NUMERACY FOCUS AREAS

MENTAL COMPUTATION AND NUMERICAL REASONING
- Understanding information in texts
- Estimating and problem solving
- Addition, subtraction, multiplication and division
- Understanding fractions, decimals, percentages, rates and ratios
- Understanding money and finance

PATTERNS AND ALGEBRA
- Patterning, generalisations and algebraic reasoning

SPATIAL VISUALISATION, GEOMETRIC REASONING AND MAPPING
- Applying concepts of 3D objects
- Applying concepts of 2D shapes
- Applying angles and geometry
- Understanding position, maps and grids

MEASUREMENT AND TIME CALCULATIONS
- Understanding length
- Understanding area
- Understanding mass, volume and capacity
- Understanding time

STATISTICS AND PROBABILITY
- Interpreting and analysing data
- Representing data in graphs and timelines
- Interpreting chance, events and probability
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This resource contains a collection of numeracy activities and teaching sequences to enhance and improve student outcomes in numeracy. All the activities were implemented in classrooms and students showed significant improvement in numeracy outcomes. Students were pre-tested and post-tested using NAPLAN questions and extended response questions. Students were asked to explain how they solved the problems and explain thinking strategies. Student work samples were analysed and the data used to inform and guide teaching. The syllabus areas covered by the activities were areas where students performed below state average in NAPLAN and teachers identified as common problem areas.

THE TEACHING AND LEARNING CYCLE

Explicit and systematic teaching and learning will best occur when teachers follow the process articulated by the teaching and learning cycle. The teaching and learning cycle represents the four stages that occur in the design and delivery of classroom tasks that incorporate an outcomes-based approach. The cycle has no start or end point, with each step informing the next. It is the process of gathering data and reflection that indicates where in the cycle you are operating.

ASSESSMENT

Assessment is an essential component of the teaching and learning cycle. Assessment enables teachers to gather evidence and make judgements about student achievement. Assessment for learning and assessment of learning may be used individually or together and formally or informally.

The principles of assessment for learning and assessment as learning have some common elements. Assessment for learning and assessment as learning incorporate: self-assessment and peer assessment strategies for students to actively monitor and evaluate their own learning feedback, together with evidence, to help teachers and students decide whether students are ready for the next phase of learning or whether they need further learning experiences to consolidate their knowledge, skills and understanding.

Assessment for learning and assessment as learning approaches, in particular, help teachers and students to know if current understanding is a suitable basis for future learning. Teachers, using their professional judgement in a standards-referenced framework, are able to extend the process of assessment for learning into the assessment of learning.
TEACHING AND LEARNING SEQUENCE
The teaching and learning sequences of activities in this resource includes assessment of prior knowledge, explicit teaching strategies and learning activities to introduce, develop and consolidate concepts.

Assessment for/of learning
Assess students’ learning to determine their current level of knowledge and skills and provide them with purposeful feedback.

Planning
Plan a lesson or series of lessons based on assessment and clearly focus planning on what needs to be taught and how it is taught.

Instruction
Use modelled, guided and independent teaching to explicitly support students to achieve lesson goals and engage students in summative reflection on their learning.

Explicit teaching and learning strategies have been differentiated into:
- modelled
- guided
- independent

Modelled teaching is mainly teacher-regulated and involves explicit or direct instruction in new learning, the focus of which is informed by assessment information. Students can say, I have learned something new.

Guided teaching involves supporting student practice where students take increasing control of new learning. Students can say, I will have a go by myself, but I might need some help.

Independent teaching involves supporting students to consolidate, transfer and apply new learning. Students can say, I know how to do it and when, where and why to use it.

Each of the lessons may have a mixture of modelled, guided and independent activities. Some lessons are more explicit and involve mainly modelled activities, some may focus on independent activities where the teacher plays the role of a facilitator.

Learning activities and tasks have been differentiated to include introduction, development and consolidation of concepts. A process for structuring learning activities and lessons is shown in the flow chart.
PRIOR KNOWLEDGE IN MATHEMATICS
Prior knowledge is the foundation on which students build new knowledge. Diagnostic tasks are used to identify students’ prior knowledge. The resources contain opportunities to identify students’ prior knowledge and skills before the introduction of new concepts.

Students bring existing skills and knowledge to actively interpret the world. The learner engages prior knowledge, develops a deep foundation of knowledge in the context of a conceptual framework, takes control of their own learning through metacognition and self-regulation. If they do not get the concept they stop, as teachers we need to build resilience, students need to pick themselves up and try again.

Vygotsky’s definition of Zone of Proximal Development is always at the centre of effective student learning. The zone of proximal development “is the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (Vygotsky 1978). As a learner gains new skills and abilities, this zone moves progressively forward.

The activities in this resource provide opportunities for students to develop their learning, they may make mistakes, learn from their mistakes, continue to problem solve and consolidate their learning.

SYLLABUS OUTCOMES
All the syllabus outcomes and content addressed in the activities are from the NSW Syllabuses K-10 for the Australian curriculum.

Learning across the curriculum content, including cross-curriculum priorities, general capabilities and other areas identified as important learning for all students have been identified in this document using the Learning Across the Curriculum Icons from the NSW Education Standards Authority (NESA) http://syllabus.bostes.nsw.edu.au/mathematics/mathematics-k10/learning-across-the-curriculum/.

Cross-curriculum priorities

- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia’s engagement with Asia
- Sustainability

General capabilities

- Critical and creative thinking
- Ethical understanding

- Information and communication technology capability

- Intercultural understanding

- Literacy

- Numeracy

- Personal and social capability

Other learning across the curriculum areas

- Work and enterprise
PURPOSE
The purpose of this sequence of activities is so that students know that numbers can be represented in different ways as fractions, decimals and percentages. They will learn to use these different concepts in real life situations. Batlow Technology School implemented these activities with their Stage 1 students to develop the concept of a half.

SYLLABUS OUTCOMES
MA1-7NA  A student represents and models halves, quarters and eighths.
MA1-1WM  A student uses language, actions, materials, diagrams and symbols.
MA1-3WM  A student supports conclusions by explaining or demonstrating how answers were obtained.

Students
Recognise and describe one-half as one of two equal parts of a whole (ACMNA016).

- Describe two equal parts of a whole object, e.g. ‘I folded my paper into two equal parts and now I have halves.’ (Communicating)
- Recognise that halves refer to two equal parts of a whole.
- Describe parts of a whole object as ‘about a half’, ‘more than a half’ or ‘less than a half’.
- Record two equal parts of whole objects and shapes, and the relationship of the parts to the whole, using pictures and the fraction notation for half.
- Use concrete materials to model half of a collection, e.g. describe two equal parts of a collection, e.g. ‘I have halves because the two parts have the same number of seedlings.’ (Communicating)
- Record two equal parts of a collection, and the relationship of the parts to the whole, using pictures and fraction notation for half.

Recognise and describe one-half as one of two equal parts of a whole (ACMNA016).

- Use concrete materials to model half of a whole object, e.g. describe two equal parts of a whole object, e.g. ‘I folded my paper into two equal parts and now I have halves.’ (Communicating)
• Recognise that halves refer to two equal parts of a whole.
• Describe parts of a whole object as ‘about a half’, ‘more than a half’ or ‘less than a half’.
• Record two equal parts of whole objects and shapes, and the relationship of the parts to the whole, using pictures and the fraction notation for half, e.g.
• Use concrete materials to model half of a collection, e.g. describe two equal parts of a collection, e.g. ‘I have halves because the two parts have the same number of seedlings.’ (Communicating)
• Use concrete materials to model half of a collection, e.g. describe two equal parts of a collection, e.g. ‘I have halves because the two parts have the same number of seedlings.’ (Communicating)
• Record two equal parts of a collection, and the relationship of the parts to the whole, using pictures and fraction notation for half.

**PRIOR KNOWLEDGE**
Students should know what a half of something is and be able to record half of an object using drawings.

**NUMERACY LINKS**
Numeracy Skills Framework, student are working at early Stage 1 for Focus Area 1, understanding fractions, decimals, percentages, rates and ratios.

**LITERACY STRATEGIES**
Vocabulary, context, Students should be able to communicate using the following language: whole, part, equal parts, half, halves, about a half, more than a half, less than a half. Some students may hear ‘whole’ in the phrase ‘part of a whole’ and confuse it with the term ‘hole’.

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**Teaching and Learning Activities**

In Year 1 students recognise, describe and represent one-half as a one of two equal parts of whole objects, shapes and collections. They use fraction notation $\frac{1}{2}$, use concrete materials to model half of a collection and describe two equal parts of a collection.

**INTRODUCTION**
Tell students that in Year 1 we learn about halves and wholes.

Show students a large piece of newspaper and tell them that you need to cut it in half.

Ask students “How do you think I could do this?”

See what sort of responses you get.

Invite a student to come out and show how they might do this.

Ask students... “Is this what you would do? Is there anyone who might do it differently?”

**After several responses**

Ask “What do we know about a half?”

Listen to student responses.

Responses may include that you cut the paper in two.

Ask “But are they in half?”

Model the cutting below and ask which pieces are cut in half. Ask “Which shapes are cut in half and which are not?”

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Students use vocabulary: less than a half, more than a half, one half.

**Resources**
Sheets of newspaper and scissors

**Differentiation**
The content as needed for individual students.

**MODELLLED/GUIDED**
Discuss that the two parts need to be equal.

“What do I mean when I say that the two parts need to be equal?”

Students fold a coloured paper square, rectangle and circle in half. “What do we need to ensure?”

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INDEPENDENT
Students make their own fairy bread watching and following teacher instructions. When it comes to cutting the bread students decide ways of cutting in half. Students may cut bread diagonally or in half through the middle of the bread.

CONSOLIDATION
Students make a shape artwork using various paper shapes. Students cut paper shapes in half and draw in details to make artwork.

Students take turns to report back to the class about their artwork and which shapes have been made into halves and what they were used for.

ASSESSMENT OF LEARNING
Can the students cut their bread in half accurately?
Does one half match the other half?

Resources
Various kinder squares and Brenex shapes, including circles
Clag or glue sticks
Show students collections of shapes artwork on Pinterest for ideas
TEACHING SEQUENCE FOR UNDERSTANDING FRACTIONS Stage 2

STRAND AND SUBSTRAND
Number - Fractions, Decimals and Percentages - Stage 2

SYLLABUS OUTCOMES
MA2-7NA A student represents, models and compares commonly used fractions and decimals.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, understanding fractions, decimals, percentages, rates and ratios.

ACTIVITY FOCUS
Students know that numbers can be represented in different ways as fractions, decimals and percentages.
Fractions Beyond 1 Activity

Represent fractions on number lines, including number lines that extend beyond 1.

1. Teacher has at least 15 number lines labelled around the room. The number lines should be consecutive: 1-2, 3-4, 5-6, 7-8, 9-10, 11-12 and so on.

2. Teacher models on one of the number lines.

E.g. 15 ____________ 16

Question: 'If I put a mark in the middle of 15 and 16 what number am I representing?'

Student: ‘15 and a half’

3. In partners students mark their own number lines to make even intervals and then record the number it represents on the number line.

4. Can I make any other marks on the number line? (Teacher shows marks on a number line for \( \frac{1}{4} \) and \( \frac{3}{4} \)).

Problem solving

On the number line 3-6, what is the number halfway between these two numbers?

Problem solving strategy: Guess and check

Students make a mark anywhere on the number line 3-6 and students have to estimate that number.

Representing Fractions Activity

Represent fractions with denominators of 2, 3, 4, 5 and 8.

Modelled

Teacher models the language of fractions and explains numerator and denominator.

Teacher demonstrates to students that the denominator is the bottom number showing how many pieces make up the whole and the numerator is the top number showing how many pieces that are taken from the whole.

Students show understanding by manipulation of objects on the board or in group work on the floor.

Guided

Students use paper to represent fractions either by folding, cutting or gluing of paper. Students label each part of their paper (\( \frac{1}{4}, \frac{1}{8} \) or \( \frac{1}{6} \)).

Verbal questioning

Adding fractions together e.g. \( \frac{1}{4} + \frac{1}{4} \).

Problem solving

a) Mum bought 2 pizzas for dinner. Both pizzas were cut into quarters. How many pieces of pizza altogether?

b) How many pieces are left if Mum ate 2 pieces on the way home?

Problem solving strategy

Draw a diagram or use concrete materials or act it out.

Sharing Collections Activity

Equally share collections into \( \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5} \) and \( \frac{1}{8} \).

Example

There are four apples on the board. Sue gets \( \frac{1}{4} \) of the apples. How many apples left over? How many apples did Sue get?

Problem solving

Lisa, Mark and Gary share a bag of oranges. Lisa and Mark each get \( \frac{1}{5} \) of the oranges in the bag. What fraction of the bag of oranges is left for Gary?

Problem solving strategy

Draw a diagram or use concrete materials or act it out.
TEACHING SEQUENCE FRACTIONS
Stage 2 - Related Fractions

PURPOSE
The purpose of this sequence of activities is so that students know that numbers can be represented in different ways as fractions and decimals. They will learn to use these different concepts in real life situations that they will experience in their daily lives. Batlow Technology School implemented this sequence with Stage 2 students.

SYLLABUS OUTCOMES
MA2-7NA A student represents, models and compares commonly used fractions and decimals.
MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.
MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

Students
Model and represent unit fractions, including \( \frac{1}{2}, \frac{1}{4}, \frac{1}{3}, \frac{1}{5} \) and their multiples, to a complete whole (ACMNA058).

• Model fractions with denominators of 2, 3, 4, 5 and 8 of whole objects, shapes and collections using concrete materials and diagrams, e.g.

- Recognise that as the number of parts that a whole is divided into becomes larger, the size of each part becomes smaller. (Reasoning)
- Recognise that fractions are used to describe one or more parts of a whole where the parts are equal. (Communicating and Reasoning)
- Interpret the denominator as the number of equal parts a whole has been divided into.
- Interpret the numerator as the number of equal fractional parts, e.g. \( \frac{3}{8} \) means 3 equal parts of 8.
Use the terms ‘fraction’, ‘denominator’ and ‘numerator’ appropriately when referring to fractions.

Compare unit fractions using diagrams and number lines and by referring to the denominator, e.g. is less than.

Recognise and explain the relationship between the value of a unit fraction and its denominator. (Communicating, Reasoning)

Count by quarters, halves and thirds, including with mixed numerals; locate and represent these fractions on a number line (ACMNA078).

Identify and describe ‘mixed numerals’ as having a whole-number part and a fractional part.

Rename $\frac{2}{2}, \frac{3}{3}, \frac{4}{4}, \frac{5}{5}, \frac{8}{8}$ as 1.

Count by halves, thirds and quarters, e.g.

$0, \frac{1}{3}, \frac{2}{3}, 1, \frac{1}{3}, \frac{2}{3}, 2, \frac{1}{3}$

Place halves, quarters, eighths and thirds on number lines between 0 and 1, e.g.

PRIOR KNOWLEDGE

Students will recognise, describe and represent halves, quarters and eighths of whole objects, shape and collections and be able to use the notation $\frac{1}{4}$ and $\frac{1}{8}$.

NUMERACY LINKS

Numeracy Skills Framework, students are working at early Stage 2 for Focus Area 1, understanding fractions, decimals, percentages, rates and ratios.

LITERACY STRATEGIES

Students should be able to communicate using the following language: whole, part, equal parts, half, quarter, eighth, third, fifth, one-third, one-fifth, fraction, denominator, numerator, mixed numeral, whole number, fractional part, number line.

When expressing fractions in English, the numerator is said first, followed by the denominator. However, in many Asian languages (e.g. Chinese, Japanese), the opposite is the case: the denominator is said before the numerator.

Teaching and Learning Activities

INTRODUCTION

Related fractions - One half, one-quarter and one-eighth.

1. Write the fractions one half ($\frac{1}{2}$), one-quarter ($\frac{1}{4}$) and one-eighth ($\frac{1}{8}$) on the board. Hold up a paper streamer approximately 100 cm long. "Using this paper streamer, how could you make one of these fractions?" Allow the students some time to think about the question. "Which of these fractions will be the easiest to make? Why?" Focus the questions on: How do you know that you have one half? (or one-quarter or one-eighth)?

2. Fold the paper streamer in half and then fold one half in half. Unfold the streamer and display it to the class. Point to each part in turn and ask "What fraction of the streamer is this part? How do you know?"

3. "If I fold one-quarter in half, what will I have?"

Fold the quarter in half and, as before, point to each part in turn and ask "What fraction of the streamer is this part? How do you know?"

4. "Which is the biggest part? Which is the smallest part? Can anyone see two fractions that would be the same as another fraction?"

5. "Show me two-eighths. Show me two-quarters. Show me two-halves."

6. "Draw the streamer and show how halves, quarters and eighths are related to each other."

Emphasise reversibility: "If I fold the quarter in half I get two-eighths and two-eighths is the same as one quarter."

Students discuss their findings.

Resources

Lengths of crepe paper cut in metre lengths
DEVELOPMENT

Lamingtons

1. Lamingtons are pieces of sponge cake covered in chocolate icing and dipped in shredded coconut. Show students a real lamington and use it to cut during the activity. I am going to start with a rectangular sponge cake.

2. Giving explicit instruction, distribute rectangular sheets of brown paper. Show by folding the piece of paper how I could make 4 lamington bars out of the rectangle of brown paper. Ask the students to fold their own piece of paper into 4. Check to see which way they have divided their paper. If they use different methods to form quarters, ask them if each person would still get the same.

"I am going to make eight smaller lamington bars." Fold the rectangle into eighths. "If I wanted to eat this much" (show three-quarters of the horizontally divided rectangle) "How many of the smaller lamington bars would this be equal to?" Have them discuss and explain their answer.

Resources
Lamington sponge cake
Sheets of rectangular brown paper

A pikelet recipe
Students use sharing diagrams to operate on continuous models of fractions.

In this activity students explore dividing wholes into equal parts and use sharing diagrams to divide by fractions.

1. Place 4 identical empty cylindrical clear plastic tumblers near each other on a table. Have your students fill the tumblers to the desired amount if possible.

Say "I want to pour half a glass of drink. Who can show me where about on the glass I would need to fill it to?" Provide the student with a thin piece of masking tape to record his or her answer. A marking pen could also be used. "Who thinks that this is the place we should fill the tumbler to get half a glass?"

Allow an opportunity for class discussion and if the student wishes, he or she can move the tape. "How can we check if we are right?"

2. Put out another transparent tumbler with vertical sides. "Can you show me where I would have to fill this glass to get one-quarter of a glass?"

Attach a small piece of thin black tape at the indicated location. "Does this look correct?" Adjust as directed.

Draw a sketch of the tumbler on the board. Ask one student to add a line to your diagram on the board to show one - quarter of a glass.

"I have 6 cups of milk. A recipe needs a cup of milk. How many times can I make the recipe before I run out of milk? Can you draw your answer?"

"I have 6 cups of milk. A recipe needs one quarter (\(\frac{1}{4}\)) of a cup of milk. How many times can I make the recipe before I run out of milk? Can you draw your answer?"

Resources
4 x clear plastic tumblers
Jug of coloured water
Coloured tape

Number line fractions
Clothes line

Distribute fraction cards e.g. \(\frac{1}{5}\), \(\frac{2}{5}\), \(\frac{3}{5}\), \(\frac{4}{5}\), \(\frac{1}{10}\), \(\frac{2}{10}\), \(\frac{3}{10}\), \(\frac{4}{10}\), \(\frac{1}{4}\) and place cards for 0 and 1. Discuss where to place \(\frac{1}{8}\), \(\frac{1}{2}\), \(\frac{1}{4}\) and have students peg cards on a string number line in the appropriate place and explain their reason why. Extend the activity with placing the other cards.

Variation - Use different combinations of fractions

Distribute fraction cards \(\frac{1}{8}\), \(\frac{2}{8}\), \(\frac{1}{4}\), \(\frac{3}{8}\), \(\frac{4}{8}\), \(\frac{1}{2}\), \(\frac{5}{8}\), \(\frac{3}{4}\), \(\frac{1}{8}\), \(\frac{1}{10}\) and place cards for 0 and 1.

Discuss where to place \(\frac{1}{5}\), \(\frac{1}{10}\) and have students peg cards on a string number line in the appropriate place and explain their reason why.

Resources
Clothes line string and pegs

Strategies
"What strategies could we use to find \(\frac{1}{2}\) of 24?"
Divide 24 in half gives 12.

"What strategies can we use to find a \(\frac{1}{3}\) of 24?"
Half 24 gives 12 and half 12 gives 6 (half 24 and half the answer).

Repeat this for \(\frac{1}{8}\)?
Half 24 gives 12 and half 12 gives 6 and half 6 gives 3 (half 24 and half the answer and half again).

Students move about in an open space in a group of 24.
The teacher asks the group to divide into halves, quarters or eighths.
Any remaining students check the groupings.
The activity should be repeated using groups of different sizes.
Comparing and ordering

Model different ways to represent the same fraction as a whole class on the board.

Students are provided with four sets of cards representing the same fractions. The first set has the fractions represented in fraction notation, the second set has the fractions represented in words, the third set has the fractions represented as shaded regions and the fourth set has the fractions represented as the shaded part of a collection. The cards are randomly distributed to students who must find other students with the same fraction represented. Students then place the sets of fraction cards in order.

Resources

Cards with various fractions as symbol, word, diagram of shaded region, and shaded part of a collection.

Counters

As a whole class demonstrate equivalent fractions using 16 counters, pose the questions.

Can you find \(\frac{1}{2}\) of 16 (8 counters)

Can you find \(\frac{1}{2}\) of 8 (4 counters)

Can you find \(\frac{1}{2}\) of 4 (2 counters)

Repeat this for \(\frac{1}{4}\)

Can you find \(\frac{1}{4}\) of 16 (4 counters)

Can you find \(\frac{1}{4}\) of 8 (2 counters)

Can you find \(\frac{1}{4}\) of 4 (1 counter)

Discuss the relationship between \(\frac{2}{4}\) and \(\frac{1}{2}\).

Variation - This activity can be used with 15 counters to show thirds and fifths.

Is it possible?

Students are given 16 counters and need to determine whether it is possible to find the following:

Can you find \(\frac{1}{2}\) of 16 (8 counters)

Can you find \(\frac{1}{4}\) of 16 (4 counters)

Can you find \(\frac{1}{8}\) of 16 (2 counters)

Students record their findings. The activity should be repeated using different numbers of counters and extended to include fractions with denominators of 3 and 5.

Comparisons of fifths

Ask students “When is one fifth not one fifth?”

Answer “When it is one fifth of different wholes!”

E.g. One fifth of a strip of paper is not the same size as one fifth of an apple. It is the proportion of the whole that is important not the comparison between different wholes. This is important as students will be using different sized ‘wholes’ to look at fractions.

Provide students with three equal rectangular strips 60 cm in length. Ask students to make strips of \(\frac{2}{5}\), \(\frac{3}{5}\) and \(\frac{1}{5}\).

Ask students to make additional lengths of \(\frac{2}{5}\) and \(\frac{3}{5}\) from a third piece of streamer 60 cm and use one piece of \(\frac{1}{5}\). Students make the tenths pieces of a 60 cm rectangular strip and line them up to \(\frac{2}{10}\), \(\frac{3}{10}\), \(\frac{4}{10}\).

Place pieces (\(\frac{1}{5}\), \(\frac{2}{5}\), \(\frac{3}{5}\), \(\frac{1}{10}\), \(\frac{2}{10}\), \(\frac{3}{10}\), \(\frac{4}{10}\)) into ascending order (vertically) and notice which pieces are the same.

E.g. \(\frac{1}{5}\), \(\frac{1}{5}\), \(\frac{2}{5}\), \(\frac{3}{5}\), \(\frac{4}{5}\)

Ask questions relating to the pieces, such as: “Is \(\frac{3}{10}\) bigger than \(\frac{1}{5}\)?”, “Is \(\frac{3}{5}\) smaller than \(\frac{4}{5}\)?” etc.

Now ask students to become more abstract by asking questions such as “is the fraction \(\frac{4}{5}\) bigger than or smaller than \(\frac{5}{10}\)? Why?” “Can you give me a fraction that is bigger than \(\frac{3}{5}\)? And another? And another?”

Ask students how they know that the fractions are bigger.

Resources

Strips of paper for exploring one fifth

Modifications

Variations - If the class is too small to do this activity use objects such as bean bags or individual students can use 24 counters.

Note: When there are more than 24 students they are responsible for helping the groups.

Circular fractions

Students use circular shaped coloured paper and imagine that it is the top view of a cake. They use pencils or popsticks to show where they would cut the cake to have two/four/eight equal pieces.

Resources

Circles of coloured paper
Paddle pop sticks

Cover up

Students use a collection of objects e.g. counters, blocks. One student selects a number of objects and covers up half/quarter/eighth of the objects with their hand or piece of cardboard. Their partner is then asked:

“How many counters are under my hand?”

“How many counters are there altogether?”

Investigations

The answer is \(\frac{1}{2}\). What might the question be?

Give at least 10 examples.

Is one eighth smaller or larger than one quarter?

Explain your answer with examples.

Resources

Counters, blocks, pegs, etc.
Double number line fractions (halves, fifths and tenths)
Each double number line is photocopied onto cardboard, cut out and folded along the middle line. A paper clip is used to estimate the position of a nominated fraction and the number line is flipped over to check the estimation. The activity can be an individual, paired or group activity. The side without the additional intervals is displayed and the paper clip used to indicate the nominated position on the scale. Once the estimation is made it can be checked on the other side with the paper clip acting as a marker for both sides. Discussion of strategies will enable students to improve their understanding and estimation.

Resources
Double number line stencils or laminated sheets
Paper clips

CONSOLIDATION
1. Games
Colour the fraction (halves, quarters, fifths, eighths and tenths)
Each student takes it in turns to roll the die and colour in the equivalent fraction on the gameboard.
Record each roll of the die throughout the game.
• Each row in the gameboard is equal to one whole.
• The first student to colour the entire gameboard is the winner.
• At the completion of the game, add the fractions recorded below, to ensure they equal to at least five.

Resources
Dice
Gameboard
Programming mathematics support
Fraction track 2
A gameboard task that replicates the computer task. Play with partners or groups of 3 or 4.

Resources
Sets of fraction cards
Gameboard
Programming mathematics support

Fraction card games
Students work in groups of three or four with fraction cards playing games like Old Maid, Snap, Concentration (Memory) or Fish.

Resources
Sets of fraction cards

2. Computer learning objects
Scootle resources

Wishball
The Wishball series of learning objects encourages thinking about place value. It also provides opportunities for mental addition and subtraction. Students try to reach a target number by adding or subtracting in fewer than 20 moves. The spinner randomly serves up a digit. Before students add or subtract they first choose a place value to assign to the digit. So, if 2 is the digit served up, students can make it 2.0, 0.2, 0.02 or 0.002.

Fraction track
The object of the activity is to move all the red sliders across the track in the smallest number of moves. The students click on the playing card to identify the fraction and move one slider by the amount on the card, or move more than one slider as long as it equals and doesn’t exceed the value of the fraction.

Pikelet Cutter - Sharing whole pikelets among different numbers of people.

Ribbon fractions
The Ribbon Fractions is an interactive tool that can be used in strengthening students’ sense of the size of fractions.
Colour the fraction

Resources

- A six sided die labelled $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{2}{4}$, $\frac{2}{8}$, $\frac{1}{8}$ (use plastic cubes with dot stickers to write the fraction)
- One gameboard per student.

Rules

- Each student takes it in turns to roll the die and colour in the equivalent fraction on the gameboard.
- Record each roll of the die throughout the game.
- Each row in the gameboard is equal to one whole.
- The first student to colour the entire gameboard is the winner.
- At the completion of the game, add the fractions recorded below, to ensure they equal to at least three.

Record your fractions here
Fraction track 2

0  \( \frac{1}{10} \)  \( \frac{2}{10} \)  \( \frac{3}{10} \)  \( \frac{4}{10} \)  \( \frac{5}{10} \)  \( \frac{6}{10} \)  \( \frac{7}{10} \)  \( \frac{8}{10} \)  \( \frac{9}{10} \)  1

0  \( \frac{1}{8} \)  \( \frac{2}{8} \)  \( \frac{3}{8} \)  \( \frac{4}{8} \)  \( \frac{5}{8} \)  \( \frac{6}{8} \)  \( \frac{7}{8} \)  1

0  \( \frac{1}{5} \)  \( \frac{2}{5} \)  \( \frac{3}{5} \)  \( \frac{4}{5} \)  1

0  \( \frac{1}{4} \)  \( \frac{2}{4} \)  \( \frac{3}{4} \)  1

0  1

NSW Department of Education 2017 | Numeracy Activities and Lesson Sequences K-10
**Fractions and Decimals Diagnostic Task**

**PART 1**

**Task 1**

Draw a line to cut these four shapes into halves.

\[
\begin{array}{cccc}
\text{Circle the shapes that are cut in half.} \\
\end{array}
\]

**Task 2**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

**Pre-assessment**

Using 8 connected unifix cubes can you split it into halves, quarters and eighths.

'How many different ways can you show the fraction \( \frac{2}{4}, \frac{1}{4}, \frac{3}{4} \)?'

This assessment allows the students to show their understanding of fractions in a variety of ways.

**Pikelet sharing problem**

'How would we share 5 pikelets between 4 people? Can you draw your answer?'

"Draw what will happen if I have 6 cups of milk and a recipe needs three-quarters of a cup of milk. How many times can I make the recipe before I run out of milk? 43"

**What fractions can you see?**

Students design rectangular flags according to certain features.

- The flag must have eight equal parts
- \( \frac{3}{8} \) of the flag is red
- \( \frac{1}{2} \) of the flag is blue
- \( \frac{1}{8} \) of the flag is green
PART 2
Task 3
Decorate each cake to match the label. Answer the quick quiz questions.

Half a cake

A quarter of a cake

Complete each sentence:
There are ___ quarters in a half. There are ___ halves in two cakes. There are ___ quarters in two cakes.

Task 4
Draw a line to show half of the objects. Circle a quarter of the objects.
Task 5
Colour red the shapes that are cut into “about a half.”
Colour blue the shapes that are cut into “less than a half.”
Colour green the shapes that are cut into “more than a half.”

Task 6
Cut the following shapes into quarters.

Task 7
Cut the following shapes into eighths.
**Task 8**
Divide the following group into quarters. Draw a circle around each quarter.

![Star symbols divided into quarters](image)

**Task 9**
Divide the following group into eighths. Draw a circle around the eighths.

![Heart symbols divided into eighths](image)

**PART 3**
**Task 10**
How could you share 9 pizzas between 5 people? Use the space below to show how you worked it out.
Task 11
Shade the shapes to match the fraction.

a) Shade $\frac{3}{4}$ of the rectangle

b) Shade $\frac{3}{5}$ of the circle

c) Shade $\frac{7}{8}$ of the rectangle

Task 12
Design a rectangular flag with the following features:

- It must have 8 equal parts
- $\frac{1}{2}$ of the flag is green
- $\frac{1}{4}$ of the flag is red
- $\frac{1}{8}$ of the flag is blue
- The remaining $\frac{1}{8}$ is yellow
Task 13
Place the missing fractions and equivalent fractions on the number lines.

\[
\begin{array}{ccccccccccc}
\frac{3}{8} & \frac{4}{8} & & & & & & & & 1
\end{array}
\]

Task 14
Place the missing decimals on the number lines.

\[
\begin{array}{ccccccccccc}
0.3 & 0.4 & & & & & & & & 6.7 & 6.8 & 7.1
\end{array}
\]

Task 15
Complete the table.

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Equivalent decimal</th>
<th>Diagram that represents the fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{3}{10}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\frac{5}{10}$</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>$\frac{1}{2}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\frac{3}{4}$</td>
<td>0.25</td>
<td></td>
</tr>
</tbody>
</table>
Task 16
Order these fractions from smallest to largest.
\[
\frac{1}{4} \quad \frac{3}{4} \quad \frac{1}{2} \quad \frac{15}{8} \quad \frac{3}{8} \quad 1
\]

Task 17
Order these decimals from smallest to largest.
\[
0.3 \quad 0.52 \quad 1.45 \quad 0.34 \quad 2.67 \quad 1.54
\]

Task 18
Circle the mixed numbers.
\[
5 \quad \frac{1}{2} \quad \frac{4}{5} \quad \frac{23}{4} \quad 7 \quad \frac{3}{10} \quad \frac{58}{10}
\]

Task 19
Circle the improper fractions.
\[
\frac{1}{2} \quad \frac{4}{3} \quad \frac{3}{4} \quad \frac{5}{4} \quad \frac{5}{10} \quad \frac{10}{5}
\]

Task 20
Circle the denominator in these fractions.
\[
\frac{1}{3} \quad \frac{3}{4} \quad \frac{1}{2} \quad \frac{5}{8}
\]

Task 21
Circle the numerator in these fractions.
\[
\frac{2}{3} \quad \frac{3}{4} \quad \frac{1}{2} \quad \frac{5}{8}
\]

Task 22
Place the missing decimals on the number lines.

- [ ] 1.45 1.46 1.47 1.5 1.51
- [ ] 5.11 5.12
PART 4

Task 23

Put these decimals in order from smallest to largest (Remember to add a zero at the end of the decimal to make sure each number has the same number of decimal places before comparing).

1) 53.94   54.62   53.90

2) 2.395   2.456   2.195

3) 45.234  45.19   44.89

Task 24

Is the fraction or the decimal smaller? Circle the smaller number.

1) \(\frac{1}{4}\) or 0.35

2) \(\frac{1}{2}\) or 0.89

3) \(\frac{3}{10}\) or 0.23

4) \(\frac{3}{5}\) or 0.55

5) \(\frac{4}{10}\) or 1.23

6) \(\frac{93}{100}\) or 0.91

Task 25

Add the following fractions.

1) \(\frac{2}{8} + \frac{4}{8}\) =

2) \(\frac{3}{5} + \frac{1}{5}\) =

3) \(\frac{5}{10} + \frac{4}{10}\) =

4) \(\frac{3}{7} + \frac{2}{7}\) =

5) \(\frac{3}{4} + \frac{1}{2}\) =

6) \(\frac{4}{5} + \frac{3}{10}\) =

7) \(\frac{3}{5} + \frac{2}{3}\) =

8) \(\frac{1}{2} + \frac{2}{5}\) =
Task 26
Subtract the following fractions.

1) \( \frac{3}{4} - \frac{1}{4} = \)

2) \( \frac{4}{2} - \frac{3}{2} = \)

3) \( \frac{9}{10} - \frac{4}{10} = \)

4) \( \frac{4}{3} - \frac{1}{3} = \)

5) \( \frac{4}{5} - \frac{2}{10} = \)

6) \( \frac{3}{2} - \frac{1}{4} = \)

7) \( \frac{3}{5} - \frac{1}{3} = \)

8) \( \frac{5}{8} - \frac{1}{4} = \)

Task 27
Change these improper fractions into mixed fractions.

\( \frac{7}{2} \)

\( \frac{9}{4} \)

\( \frac{7}{3} \)

Task 28
Change these mixed fractions into improper fractions.

\( 2 \frac{1}{2} \)

\( 3 \frac{1}{3} \)

\( 1 \frac{2}{5} \)
Task 29
Complete these sums.

1) $3.21 + $2.45 =

2) $5.56 + $3.45 =

3) $5.47 - $3.23 =

4) $7.56 - $3.78 =

Task 30
Find the equivalent fraction.

1) $\frac{1}{2} = \frac{6}{12}$

2) $\frac{3}{4} = \frac{12}{16}$

3) $\frac{2}{5} = \frac{10}{15}$

4) $\frac{2}{3} = \frac{6}{9}$

5) 1.4 = \frac{8}{5}

6) \frac{7}{8} = \frac{10}{16}$
Task 31
Find these percentages.

1) 10% of $1.00 =

2) 50% of $2.50 =

3) 25% of $2.00 =

4) 30% of 60 =

5) 40% of 120 =

6) 20% of 100 =

Task 32
Find the following quantities.

1) Find \( \frac{1}{2} \) of 80 =

2) Find \( \frac{1}{5} \) of 100 =

3) Find \( \frac{1}{10} \) of 150 =

4) Find \( \frac{1}{8} \) of 64 =

5) Find \( \frac{3}{4} \) of 120 =

6) Find \( \frac{2}{5} \) of 36 =

Task 33
Place the following decimals and percentages on the number line.

| 0.4 | 25% | \( \frac{1}{8} \) | 0.2 | \( \frac{2}{3} \) | 75% | 0.55 | 60% | \( \frac{9}{10} \) | 0.5 |

0 | | | | | | | | | 1
TEACHING SEQUENCE FOR FRACTIONS, DECIMALS AND PERCENTAGES Stage 3 and 4 - Adding, Subtracting and Comparing Fractions

PURPOSE
Students are able to convert numbers between fractions, decimals and percentages and apply this knowledge to multi-step written problems. This learning and teaching sequence was developed by Tottenham Central School.

SYLLABUS OUTCOMES
MA3-7NA A student compares, orders and calculates with fractions, decimals and percentage.
MA4-5NA A student operates with fractions, decimals and percentages.
MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.
MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.
MA3-3WM A student gives a valid reason for supporting one possible solution over another.

Content
Investigate strategies to solve problems involving addition and subtraction of fractions with the same denominator (ACMNA103).
• Students solve word problems that involve addition and subtraction of fractions with the same denominator, e.g. ‘I eat of a block of chocolate and you eat of the same block. How much of the block of chocolate has been eaten?’
• Identify and describe ‘improper fractions’ as fractions in which the numerator is greater than the denominator.
• Use estimation to verify that an answer is reasonable. (Problem Solving, Reasoning)
Solve problems involving fractions with the same or related denominators (ACMNA126).
• Add and subtract fractions including mixed numerals where one denominator is the same as or a multiple of, the other e.g. \( \frac{2}{3} + \frac{4}{5} \)
• Find a simple fraction of a quantity where the result is a whole number, with and without the use of digital technologies. (ACMNA127)
Solve a word problem involving a fraction of a collection/quantity.

PRIOR KNOWLEDGE
Students have a basic understanding of decimals (mainly in relation to money to two decimal places), percentages and fractions. They have some knowledge of technical language. Compare and order common unit fractions and locate and represent them on a number line (ACMNA102).

NUMERACY LINKS
Numeracy Skills Framework, student are working at end of Stage 2 for Focus Area 1, understanding fractions, decimals, percentages, rates and ratios.

- Compares and orders fractions with denominators of 2, 3, 4, 5, 6, 8, 10, 12 and 100.
- Expresses mixed numerals as improper fractions and vice versa.
- Models strategies to add and subtract fractions with the same denominator.
- Applies the place value system to represent thousandths as a decimal.
- Compares, orders and represents decimals of up to three decimal places.

LITERACY STRATEGIES
Vocabulary - Students should be able to communicate using the following language: whole, equal parts, half, quarter, eighth, third, sixth, twelfth, fifth, tenth, hundredth, thousandth, one-thousandth, fraction, numerator, denominator, mixed numeral, whole number, number line, proper fraction, improper fraction, decimal, decimal point, digit, place value, decimal places.

The decimal 1.12 is read as ‘one point one two’ and not ‘one point twelve’.

Teaching and Learning Activities

PRE-ASSESSMENT
Students tested on NAPLAN questions relating to fractions and decimals as well as word problems.

INTRODUCTION
1. Read the Lion’s Share by Matthew McElligott.
2. Brainstorm vocabulary relating to fractions, decimals and percentage. Display this as a poster in the classroom.
3. Make mind map using Popplet and share.

Word problems
1. Introduce addition and subtraction of fractions that add up to one whole. E.g. $\frac{1}{2} + \frac{2}{4}$. Students work in pairs and create a word problem. Share with class.
2. Select one question and write a word problem in learning journals.
3. Using sample NAPLAN questions decode question as whole group. Using a similarly worded question have students work in pairs, and then individually.

Differentiation and modification
High achieving students can work on creating a lemonade stand. Students must create a recipe using fractions and percentages, create price list and profit/loss statement etc.

Assessment
- Using 24 M&Ms students create as many word problems as possible in limited time using fractions/decimals or percentages achieving correct vocabulary and answers.
- Students share questions to challenge other students.
- Students tested on NAPLAN questions relating to fractions and decimals as well as word problems.

Resources
Lion’s Share by Matthew McElligott
Popplet
Round fraction pieces
Fraction/decimal/percentage wall cut up
Dominos
Dominos sheet
NAPLAN test papers
Lemonade stand
Packets of M&Ms
Adding and Subtracting Fractions

STRAND AND SUBSTRAND
Number - Fractions, Decimals and Percentages

SYLLABUS OUTCOMES
MA4-5NA A student operates with fractions, decimals and percentages.
MA3-7NA A student compares, orders and calculates with fractions, decimals and percentage.
MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.
MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

MA3-3WM A student gives a valid reason for supporting one possible solution over another.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagram and symbols.

NUMERACY LINKS
Numeracy Skills Framework, student are working at early Stage 3 for Focus Area 1, understanding fractions, decimals, percentages, rates and ratios.

ACTIVITY FOCUS
Adding and subtracting fractions.

LEARNING INTENTIONS
Students understand the role of the denominator.

SUCCESS CRITERIA
Students demonstrate an understanding of adding and subtracting fractions with same and different denominators and record their mathematical thinking in learning journals.

1. Use the wall to introduce the addition and subtraction of different denominators.

2. Students draw a wall chart of a whole, halves, quarters and eighths.

3. Using eighths, halves and quarters, have students randomly select a fraction. They need to use the wall to add fractions together: e.g. \( \frac{2}{8} + \frac{1}{2} = \frac{3}{4} \)

4. Use learning journals explain their answer.

5. Repeat the process with subtraction.

EXTENSION
Repeat with percentages and decimals.

<table>
<thead>
<tr>
<th>1.00</th>
<th>1 whole</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>( \frac{1}{2} )</td>
<td>50%</td>
</tr>
<tr>
<td>0.33</td>
<td>( \frac{1}{3} )</td>
<td>33.3%</td>
</tr>
<tr>
<td>0.25</td>
<td>( \frac{1}{4} )</td>
<td>25%</td>
</tr>
<tr>
<td>0.30</td>
<td>( \frac{1}{5} )</td>
<td>30%</td>
</tr>
<tr>
<td>0.16</td>
<td>( \frac{1}{6} )</td>
<td>16.6%</td>
</tr>
<tr>
<td>0.125</td>
<td>( \frac{1}{10} )</td>
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<td>0.083</td>
<td>( \frac{1}{12} )</td>
<td>8.3%</td>
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<tr>
<td>0.083</td>
<td>( \frac{1}{12} )</td>
<td>8.3%</td>
</tr>
</tbody>
</table>
Comparing Fractions, Decimals and Percentages

**LEARNING INTENTIONS**
Students understand the role of the denominator.

**SUCCESS CRITERIA**
Students demonstrate an understanding of comparing fractions, decimals and percentages.

<table>
<thead>
<tr>
<th>1.00</th>
<th>1 whole</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>$\frac{1}{2}$</td>
<td>50%</td>
</tr>
<tr>
<td>0.33</td>
<td>$\frac{1}{3}$</td>
<td>33.3%</td>
</tr>
<tr>
<td>0.25</td>
<td>$\frac{1}{4}$</td>
<td>25%</td>
</tr>
<tr>
<td>0.30</td>
<td>$\frac{1}{5}$</td>
<td>30%</td>
</tr>
<tr>
<td>0.16</td>
<td>$\frac{1}{6}$</td>
<td>16.6%</td>
</tr>
<tr>
<td>0.125</td>
<td>$\frac{1}{8}$</td>
<td>12.5%</td>
</tr>
<tr>
<td>0.083</td>
<td>$\frac{1}{12}$</td>
<td>8.3%</td>
</tr>
</tbody>
</table>

1. Using a divided-up fraction/percentage/decimal wall, give each student one section e.g. $\frac{1}{8}$, $\frac{1}{3}$ or 50%. Students work as a team to rebuild the wall. Each student writes about their specific section in their learning journal.

2. Referring to the class fraction/percentage/decimal wall, students devise a word problem (collect answers to use as ongoing assessment) e.g. Johnny had $\frac{1}{4}$ of an apple and Jenny had 50% of an apple. How much do they have altogether?
Adding Fractions with Same and Different Denominators Activity 3

LEARNING INTENTIONS
Students understand the role of the denominator.

SUCCESS CRITERIA
Students demonstrate an understanding of adding fractions with different denominators and recording in their learning journals.

INSTRUCTIONS
In pairs the students are given a collection of 20 M&M’s.

1. Students write the fraction represented by each colour and find the relevant information for drawing a pie chart (application and extension).

<table>
<thead>
<tr>
<th>M&amp;Ms Colour</th>
<th>Number of M&amp;Ms</th>
<th>Each colour represents a fraction out of 20. What fraction of the M&amp;Ms are red, blue ...?</th>
<th>What angle does this fraction represent out of 360°? We need this information to create the pie chart.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td></td>
<td>E.g. $\frac{5}{20}$ of the M&amp;Ms are red which is equivalent to $\frac{1}{4}$</td>
<td>$\frac{5}{20} \times 360^\circ = \frac{1}{4} \times 360^\circ = 90^\circ$</td>
</tr>
<tr>
<td>Orange</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Brown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Students create a pie graph of the different coloured M&M’s.
3. Discuss which colour represents the biggest or smallest fraction in the pair.
4. Which colour represents a fraction less than a $\frac{1}{2}$? Which colour represents a fraction more than a third?
5. Have students discuss if they can add or subtract their fractions (refer to the fraction wall).
6. Students write number sentences showing fraction additions e.g. $\frac{5}{20}$ red + $\frac{5}{20}$ blue = $\frac{10}{20}$ red and blue.
   Students write a sentence to explain what they found e.g. half of the packet of M&Ms are red and blue in colour.
7. Select students to demonstrate their thinking and knowledge on the SMARTboard.
8. Students write about their thought process in their learning journal.
TEACHING SEQUENCE FOR NUMBER MATHEMATICAL PROBLEM SOLVING Stage 2 - Mathematical Problem Solving Strategies

PURPOSE
This teaching and learning sequence of activities provides students with a scaffold to solve numeracy problems. The activities aim to improve the student’s ability to reason, communicate and problem solve through a greater understanding of mathematical language. East Maitland Public School developed the unit and implemented the unit for two weeks. Students were pre-tested and post-tested using NAPLAN questions on the specific areas taught within the learning and teaching unit.

SYLLABUS OUTCOMES

MA2-5NA A student uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-2WM A student selects and applies appropriate mental or written strategies, technology, to solve problems.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

PRIOR KNOWLEDGE
• Students are able to describe mathematical methods using everyday language and some technical language.
• Students are familiar with addition and subtraction strategies.

NUMERACY LINKS
Numeracy Skills Framework, student are working at early Stage 2 for Focus Area 1, understanding mathematical information in texts and applying whole number concepts.

Numeracy Skills Framework, student are working at early Stage 2 for Focus Area 1, mental computation and numerical reasoning.
Teaching and Learning Activities

SESSION 1

Teaching ideas
Explicitly teach Newman’s analysis to provide students with the strategies to solve problems.

Teaching strategies
Modelled - Model how to use Newman’s analysis to solve a worded problem.
Guided - Guide students through a class worded problem by using Newman’s analysis.
Independent - Process and encoding skills of a worded problem based as whole class.

Resources
Whiteboard
Paper
Individual whiteboards
Problem solving questions
Newman’s analysis bookmarks for prompting

Differentiation
Support: Explicit teaching and modelling with support through problem solving activity.
Extension: Provide additional problems for students to solve in small group situations.

LEARNING ACTIVITIES

Introduction
• Revise language associated with addition - add plus, sum, altogether, collect, addition, equals.

Explicit teaching
Newman’s analysis
• Reading - Read the question to yourself and let me know if you need any help with words you do not understand.
• Comprehension - As a class highlight key words, numbers. Tell me what the question is asking you to find out. Read the question a partner.
• Transformation - What type of maths do we have to do? Is there more than one step?

Activities
• All students complete whole class worded problem using the explicit modelling of Newman’s analysis: Jye collected 58 cans. Terry collected 106 cans. How many cans did Jye and Terry collect altogether?

Assessment
• Assessment of learning - Understanding of problem solving ability to use appropriate written strategies.

SESSION 2

Teaching ideas
Explicitly model Newman’s analysis to solve word problems.

Teaching strategies
Modelled - Model a systematic way of solving worded problems by using Newman’s analysis.
Guided - Guide students through word problems using Newman’s analysis bookmark as a prompt.
Independent - Individually create a word problem in the range of 1-300 and share with a partner to solve.

Resources
Language cards
Whiteboard
Paper
Newman’s analysis bookmarks for prompting
12 word vocab activity

Differentiation
Support: Explicit modelling with group support to solve. Focus on smaller numbers in problem solving question and use of concrete materials to assist with addition/subtraction.


LEARNING ACTIVITIES

Introduction
• In small groups, students match their language cards with the correct operation (addition & subtraction) (plus, add, addition, minus, difference between, subtract, subtraction, total, altogether, sum, more, more than, gets more, takeaway, decrease, less than).

Explicit teaching
• Show word problem on the board. Lily and Max have 71 cards altogether. Lily has 58 cards. How many does Max have? Discuss various ways of attempting to answer the question and solve using Newman’s analysis.

Activities
• In pairs highlight the mathematical language. Draw the correct symbols/operations for this problem.
• 12 word vocab activity using addition and subtraction words.

**Assessment**

• Assessment of Learning - Recap whole class word problem. Discuss ways of solving the problem.

**SESSION 3**

**Teaching ideas**

Using knowledge gained from previous lessons, students solve word problems in differentiated group situations.

**Teaching strategies**

Modelled - Model how to solve a word problem using Newman’s analysis.

Guided - Using concrete materials and scaffolding, students will use Newman’s analysis to complete word problems in groups.

Independent - Students.

**LEARNING ACTIVITIES**

**Introduction**

• In groups, give students cards with 1, 2, 3, 4, 5, 6 and four operations (+ – ÷ ×).

• Pose the question, how many ways can you make 4 using these cards. You can use the cards as many times as you like. Students write down their answers.

**Explicit teaching**

• Whole class word problem. Laura buys a cap and a bag. The total cost is $25. The bag cost $5 more than the cap. What is the cost of the cap? Use Newman’s prompts to solve it.

• Read the problem
• What does it mean?
• How do I solve it?
• Do the Maths
• Write the answer

**Resources**

Whiteboard

Paper
Cards with numbers 1-6 and four operations (+ – ÷ ×)
Concrete materials counters, paddle pop sticks etc.
Newman’s analysis prompt cards
Scaffold sheet for problem solving

**Differentiation**

**Support** - Explicit modelling with group support to solve. Focus on smaller numbers in problem solving question. Use of concrete materials to assist with problem solving.


**Group activities**

1. Using concrete materials and scaffolding through teacher support, students will use Newman’s analysis to complete the following question:

   *There are 60 boxes in a van. There are 6 shops. How many boxes does each shop receive?*

2. Using Newman’s analysis prompt scaffold with concrete materials, students answer the following question:

   *There are 42 biscuits at a party. Each child gets 7. How many children are at the party?*

3. Using Newman’s analysis bookmark prompts, students answer the following question:

   *There are 60 boxes in a van. There are 6 shops. 7 boxes are delivered to each shop. How many boxes are left in the van after shop 6?*

4. Extension: Independent problem solving using Newman’s analysis. Students answer the following question:

   *During the holidays, your brother earns extra money mowing lawns. He mows 6 an hour and has 21 more to mow. How long will it take him?*

**Assessment**

What concrete materials are needed for the student to solve?

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**Newman’s Analysis**

**STRAND AND SUBSTRAND**

Number and Algebra - Addition and Subtraction 1 - Stage 2

**SYLLABUS OUTCOMES**

**MA2-5NA** A student uses mental and written strategies for addition and subtraction involving two-, three-, four-, and five-digit numbers.

**MA2-1WM** A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

**MA2-2WM** A student selects and applies appropriate mental or written strategies or technology to solve problems.

**MA2-3WM** A student checks the accuracy of a statement and explains the reasoning used.

**NUMERACY LINKS**

Numeracy Skills Framework, students are working at end of Stage 2, Focus Area 1, estimating and problem solving and applying addition, subtraction, multiplication and division.

**ACTIVITY FOCUS**

Explicitly teach 5 significant prompts (Newman’s Analysis) to provide students with the strategies to solve problems.
Problem Solving Activity 1

IGNITION ACTIVITY
Display Newman’s poster to students. Hand out bookmarks and introduction of poster. Discuss 5 steps.

EXPLICIT TEACHING
Write the question on the board:
Jye collected 58 cans. Terry collected 106 cans. How many cans did Jye and Terry collect altogether?

1. Reading
• Read the question quietly to yourself and let me know if you want help with any word. Students read question to themselves. Teacher then asks student to read the question. Use the following prompts:
  • Please read the question to me. If you don’t know a word, leave it out.
  • Read the question out loud. Are there any words you don’t understand? What word do you think it could be?
  • Is there another word you know?

2. Comprehension
Teacher chooses student to highlight key words, numbers. Discussion will take place of the mathematical language/terms used in the question.
• Tell me what the question is asking you to find out?
• What do you think it means?
• What do you think you should do?

3. Transformation
• What type of Maths do we have to do?
• Is there more than one step?
• Tell me how you are going to find the answer.
• What do you know that could help you to answer the question?

WHOLE CLASS ACTIVITY - INDEPENDENT
4. Process skills
Use the following prompts:
• What are the steps to your solution?
• How do you record these steps so that it is understood by others not just you?
• Show me what to do to get the answer. Talk aloud as you do it so that I can understand how you are thinking.

Students use the following sequential strategies to solve the problem as whole class.
1. Act it out using student’s fingers (Teacher support).
2. Draw a picture.
3. MAB blocks (Concrete materials).
4. Write a number sentence.

5. Encoding
• Write the answer to your question.
• Re-read the question carefully and check that you answered it correctly.
• Check that your answer makes sense.
• Is it a sensible answer?
• Is your answer in the right format?

REFLECTION
Students justify their answers (Mathematical thinking) by sharing drawings and number sentences. This will lead to a whole class discussion of the use of different strategies to solve the problem.

Mathematical Language in Problems

STRAND AND SUBSTRAND
Number and Algebra - Addition and Subtraction 1 - Stage 2

SYLLABUS OUTCOMES
MA2-5NA A student uses mental and written strategies for addition and subtraction involving two-, three-, four-, and five-digit numbers.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-2WM A student selects and applies appropriate mental or written strategies or technology to solve problems.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

NUMERACY LINKS
Numeracy Skills Framework, student are working at end of Stage 2 for Focus Area 1, estimating and problem solving.
Numeracy Skills Framework, student are working at end of Stage 2 for Focus Area 1, applying addition, subtraction, multiplication and division.

ACTIVITY FOCUS
Explicitly teach 5 significant prompts (Newman’s Analysis) to provide students with the strategies to solve problems.
Problem Solving Activity 2

IGNITION ACTIVITY
In small groups, students match their language cards with the correct operation: (Addition and subtraction) - (plus, add, addition, minus, difference between, subtract, subtraction, total, altogether, sum, more, more than, gets more, takeaway, decrease, less than).

EXPLICIT TEACHING
Expose question on board
Tanya borrowed 8 library books and Bryce borrowed 5 library books. Which number sentence shows the number of books they borrowed altogether?

- a) 8 – 5 = 3
- b) 8 + 5 = 13
- c) 8 + 1 = 9
- d) 5 – 8 = 3

As a class use the poster to guide students in solving the problem (whole class activity).

WHOLE CLASS ACTIVITY - INDEPENDENT
Students receive question on paper. In partners students will complete the following activity:
Lilly and Max have 71 cards altogether. Lilly has 58 cards. How many does Max have?

- 1. Read the problem to yourself. Visualize the situation in your head. Retell the problem to your partner.
- 2. In pairs, highlight the mathematical language found in the question.
- 3. Draw the correct symbols/operations for this problem. In pairs students draw a diagram, use concrete materials (representing the problem).
- 4. Show the steps to the solution. Write the number sentence to solve the problem (maths method/process).
- 5. Write the answer. Pair, share, discuss by swapping partners; justify working out.

REFLECTION
To complete a 12-word vocab activity with their partner using addition and subtraction words.

Group Problem Solving

STRAND AND SUBSTRAND
Number and Algebra - Addition and Subtraction 1 - Stage 2

SYLLABUS OUTCOMES
MA2-5NA A student uses mental and written strategies for addition and subtraction involving two-, three-, four-, and five-digit numbers.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-2WM A student selects and applies appropriate mental or written strategies or technology to solve problems.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

NUMERACY LINKS
Numeracy Skills Framework, student are working at end of Stage 2 for Focus Area 1, applying addition, subtraction, multiplication and division.

ACTIVITY FOCUS
Explicitly teach 5 significant prompts (Newman’s Analysis) to provide students with the strategies to solve problems.
Group Problem Solving Activity 3

IGNITION ACTIVITY
In groups, give students cards with 1, 2, 3, 4, 5, 6 and the four operations (+, −, ÷, ×). Pose the question: How many ways can you make 4 using these cards? You can use the cards as many times as you like. Students write their answers down.

Focus question

WHOLE CLASS ACTIVITY - INDEPENDENT

Question
Laura buys a cap and a bag. The total cost is $25. The bag cost $5 more than the cap. What is the cost of the cap?

Newman’s Analysis
Read the problem.
• What does it mean?
• How do I solve it?
• Write down the mathematical method/process.
• Write the answer. Does it make sense?

GROUP ACTIVITIES - DIFFERENTIATED GROUPS

1. Using concrete materials and scaffolding through teacher support, students will use Newman’s analysis to complete the following question:
   There are 60 boxes in a van. There are 6 shops. How many boxes does each shop receive?

2. Using Newman’s analysis prompt scaffold with concrete materials, students answer the following question:
   There are 42 biscuits at a party. Each child gets 7. How many children are at the party?

3. Using Newman’s analysis bookmark prompts, students answer the following question:
   There are 60 boxes in a van. There are 6 shops. 7 boxes are delivered to each shop. How many boxes are left in the van after shop 6?

4. Extension: Independent problem solving using Newman’s analysis. Students answer the following question:
   During the holidays, your brother earns extra money mowing lawns. He mows 6 an hour and has 21 more to mow. How long will it take him?

REFLECTION
Student self-reflection – Pose the following questions:
Overall: I would rate this work as (1-10)

My biggest challenge was:

I overcame the challenge by:

I had the most fun when:

Next time I will...
PURPOSE
The purpose of this sequence of activities is for students to effectively use problem solving strategies to select the correct operation in word problems. This unit was developed and implemented by Narranga Public School.

SYLLABUS OUTCOMES
MA2-2WM Selects and uses appropriate mental or written strategies, or technology, to solve problems.

MA2-5NA Uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.

MA2-6NA Uses mental and informal written strategies for multiplication and division.

Students recall addition facts for single-digit numbers and related subtraction facts to develop increasingly efficient mental strategies for computation (ACMNA055).

- The jump strategy on an empty number line, e.g. 823 + 56 : 823 + 50 = 873, 873 + 6 = 879
- The split strategy e.g. 23 + 35 : 20 + 30 + 3 + 5 = 58
- The compensation strategy, e.g. 63 + 29 : 63 + 30 = 93, subtract 1 to obtain 92
- Using patterns to extend number facts e.g. 500 – 200 : 5 – 2 = 3, so 500 – 200 = 300
- Bridging the decades e.g. 34 + 26 : 34 + 6 = 40, 40 + 20 = 60
- Changing the order of addends to form multiples of 10, e.g. 16 + 8 + 4 : add 16 to 4 first
- Using place value to partition numbers, e.g. 2500 + 670 : 2500 + 600 + 70 = 3170
- Partitioning numbers in non-standard forms, e.g. 500 + 670 : 670 = 500 + 170, so 500 + 670 = 500 + 500 + 170, which is 1000 + 170 = 1170
- Choose and apply efficient strategies for addition and subtraction. (Problem Solving)
- Discuss and compare different methods of addition and subtraction. (Communicating)
- Use concrete materials to model the addition and subtraction of two or more numbers, with and without trading, and record the method used.
Select, use and record a variety of mental strategies to solve addition and subtraction problems, including word problems, with numbers of up to four-digits.

Give a reasonable estimate for a problem, explain how the estimate was obtained, and check the solution. (Communicating, Reasoning)

Use the equals sign to record equivalent number sentences involving addition and subtraction and so to mean ‘is the same as’, rather than to mean to perform an operation e.g. $32 - 13 = 30 - 11$

**Represent and solve problems involving multiplication using efficient mental and written strategies and appropriate digital technologies (ACMNA057).**

Use mental strategies to multiply a one-digit number by a multiple of 10, including:

- Repeated addition, e.g. $3 \times 20 : 20 + 20 + 20 = 60$
- Using place value concepts, e.g. $3 \times 20 : 3 \times 2 \times 10 = 6 \times 10 = 60$
- Factorising the multiple of 10, e.g. $3 \times 20 : 3 \times 2 \times 10 = 6 \times 10 = 60$
- Apply the inverse relationship of multiplication and division to justify answers e.g. $12 \div 3 = 4$ because $4 \times 3 = 12$ (Reasoning)
- Select, use and record a variety of mental strategies, and appropriate digital technologies, to solve simple multiplication problems.
- Pose multiplication problems and apply appropriate strategies to solve them. (Communicating, Problem Solving)

- Explain how an answer was obtained and compare their own method of solution with the methods of other students. (Communicating, Reasoning)
- Explain problem solving strategies using language, actions, materials and drawings. (Communicating, Problem Solving)
- Describe methods used in solving multiplication problems. (Communicating)

**LITERACY STRATEGIES**

Students should be able to communicate using the following language: group, row, column, horizontal, vertical, array, multiply, multiplied by, multiplication, multiplication facts, double, shared between, divide, divided by, division, equals, strategy, digit, number chart.

When beginning to build and read multiplication facts aloud, it is best to use a language pattern of words that relates back to concrete materials such as arrays. As students become more confident with recalling multiplication facts, they may use less language.

For example, ‘five rows (or groups) of three’ becomes ‘five threes’ with the ‘rows of’ or ‘groups of’ implied.

This then leads to ‘one three is three’, ‘two threes are six’, ‘three threes are nine’, and so on.

**PRIOR KNOWLEDGE**

An inverse operation is an operation that reverses the effect of the original operation. Addition and subtraction are inverse operations; multiplication and division are inverse operations.

In Stage 2, it is important that students apply and extend their repertoire of mental strategies for addition and subtraction. The use of concrete materials to model the addition and subtraction of two or more numbers, with and without trading, is intended to provide a foundation for the introduction of the formal algorithm in Addition and Subtraction 2.

One-cent and two-cent coins were withdrawn by the Australian Government in 1990. Prices can still be expressed in one-cent increments, but the final bill is rounded to the nearest five cents (except for electronic transactions), e.g.

- $5.36, $5.37 round to $5.35
- $5.38, $5.39, $5.41, $5.42 round to $5.40
- $5.43, $5.44 round to $5.45

An inverse operation is an operation that reverses the effect of the original operation.

Students could extend their recall of number facts beyond the multiplication facts to $10 \times 10$ by also memorising multiples of numbers such as $11, 12, 15, 20$ and $25$.
Teaching and Learning Activities

ASSESSMENT OF PRIOR LEARNING
Students are given a word problem and asked to show their steps and explanation for how they have solved it including justifying why they choose the operation they used. Grouping for tasks will be based on this initial assessment (opportunities for support and extension).

INTRODUCTION
Lesson intention
For students to develop a thorough understanding of Newman’s prompts for solving word problems.

Warm-up
Counting games such as loop cards, Buzz using the multiple of ten, Kahoot.com - maths questions.

Modelled teaching
Explicit teaching of problem solving using word problems. Present students with a problem e.g. Ben works on a pear farm. He collects one pear on the first day, two on the second, four on the third and eight on the fourth. How many will he have picked on the 10th day?

Use the Newman’s Prompts as a whole class to model how to start thinking about solving the problem.

Guided teaching
In groups of three, students are given a specific role – a “reader”, a “recorder” and “reporter”. Each group is given a word problem and a copy of Newman’s prompts. Students solve the problem using the Newman’s prompts and record the strategies they used to solve the problem.

Reflection
Have groups take turns to share with the class the strategies that they used to solve the problem.

Resources
Notebook
Newman’s Prompts Poster
Newman’s Prompts bookmark for maths books

Step 1: Read the question.
Step 2: What is the question asking you to do?
Step 3: Think about how you are going to find the answer.
Step 4: Record working out. Draw a picture.
Step 5: Work out and highlight your answer.
Step 6: Does your answer make sense? Explain to a friend.

Differentiation and modification
Grouping for tasks will be based on this initial assessment (opportunities for support and extension).

Support for students through the use of SLSO time, LAST in class support, individual copies of Newman’s prompts, hundreds charts, MAB Place Value blocks and concrete materials.

DEVELOPMENT
Lesson intention
For students to solve an authentic word problem.

Warm-up
Have students solve an authentic word problem in pairs, “There are ____ (fill in the number) students in this classroom. I need to distribute four blank cards per student. How many blank cards do I need?”

Have a student volunteer come to the board to write the mathematical equation that he or she used to determine the answer to the problem. Then, above that equation, write the original word problem and ask students which specific word/s in the problem let them know which operations to use to solve the problem (i.e. per).

Resources
Flash cards
Various word problems for group work
Activity: Using Keywords to Solve Maths Problems
Lesson Source: Thinkmap visual thesaurus
https://www.visualthesaurus.com/cm/lessons/using-key-words-to-unlock-math-word-problems/

Differentiation and modification
Grouping for tasks will be based on initial assessment (opportunities for support and extension).

Support for students through the use of SLSO time, LAST in class support, individual copies of Newman’s prompts, hundreds charts, MAB Place Value blocks and concrete materials.

Modelled teaching
Brainstorming key words that indicate mathematical operations. Explain to the class that whether they notice it or not, they are constantly interpreting key words in word problems in order to determine which mathematical operations to use in solving the problems. Refer students to step 1/2 of Newman’s Analysis to show the importance of reading the question twice and asking yourself what is the question asking you to find out?

Draw a four-quadrant table on the board and write a different mathematical operation title in each quadrant: addition, subtraction, multiplication, and division. Write the word “per” under the title “multiplication” and have students brainstorm additional key words that belong under each of the four mathematical operation categories.

If students get stuck in this brainstorming process, you could suggest different key words (within the context of simple word problems) and have students direct you where to write the words in the table. At the end of this brainstorming session, make sure you have at least the following words and phrases listed in your table:
Mathematical operations and key words

<table>
<thead>
<tr>
<th>Addition</th>
<th>Subtraction</th>
<th>Multiplication</th>
<th>Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>add(ed) to</td>
<td>decreased by</td>
<td>a</td>
<td>divided</td>
</tr>
<tr>
<td>all together</td>
<td>difference</td>
<td>area</td>
<td>half</td>
</tr>
<tr>
<td>both</td>
<td>fewer than</td>
<td>multiplied by</td>
<td>how many each</td>
</tr>
<tr>
<td>combined</td>
<td>how many more</td>
<td>of</td>
<td>out of</td>
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<tr>
<td>in all</td>
<td>left</td>
<td>product of</td>
<td>percent</td>
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<tr>
<td>increase by</td>
<td>less</td>
<td>rate</td>
<td>quarter</td>
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<td>more than</td>
<td>less than</td>
<td>times</td>
<td>quotient of</td>
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<tr>
<td>perimeter</td>
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<td>triple</td>
<td>percent</td>
</tr>
<tr>
<td>plus</td>
<td>take away</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Creating key word flash cards

Have a student count out the number of index cards that the class determined in the warm up problem and distribute four cards to each student.

Direct students to create four flash cards – one for each of the four mathematical operations. On the blank side of each card, they should boldly write an operation and its symbol (+ – × ÷), and on the reverse, lined sign they should list the key words associated with that operation. (Students should base these flash cards on the table you created on the front board)

Guided teaching

Organise the class into small groups of no more than three to four students in each group, and explain that they will be using their new flash cards as visual aids in mathematics coaching!

Distribute a sheet with various word problems to a student in each group and explain that the student with the sheet will act as the reader and recorder during the first round. The reader and recorder’s job is to read a word problem aloud and to allow his fellow “math coaches” to advise him on which mathematical operation to follow in solving the problem.

Advise the mathematics coaches in the class to listen to the word problem closely, to advise the reader and recorder to underline any key words in the problem that they detect, and to follow the flash card mathematical operation that they decide to “flash.”

Direct groups to complete the sheet with various word problems, alternating the role of reader and recorder so that each student has at least one or two turns in that role.

Reflection

Sharing word problem answers and strategies. Invite students to the front of the classroom to explain their group’s word problem strategies and how key words led to determining which mathematical operations to use in each problem.

DEVELOPMENT

Lesson intention

Develop students’ knowledge of the metalanguage associated with mathematical problem solving.

Warm-up

Each student is given a synonym card (4 students are given an operation card (+ – × ÷) and when the teacher says go students need to find other students with corresponding cards.

Resources

Synonym cards
Operation cards (+ – × ÷)

Activity: Matching words to operations

Differentiation and modification

Grouping for tasks will be based on initial assessment (opportunities for support and extension).

Support for students through the use of SLSEO time, LAST in class support, individual copies of Newman’s prompts, hundreds charts, MAB Place Value blocks and concrete materials.

Modelled teaching

As a whole group, classify words into correct mathematical operation group using Smart Notebook.

Using four different word problems that focus on addition, subtraction, multiplication and division, e.g. Sam has 40 animals on his farm. There are 12 sheep and 14 pigs, the rest of the animals are cows. How many cows does Sam have? Identify the language linked to each operation.

Guided teaching

In groups of 2 or 3, students work on a given word problem and need to identify the operations needed to solve the problem and the words that relate to the process of problem solving.

Independent

Present students with a differentiated word problem to solve independently using Newman’s prompts. Ask students to circle the language related to the operation they used to solve the problem.

Reflection

Students share their response with the whole class.

Key questions: “How did you know which operation to use?” “Was there another way that you could have solved the problem?”
CONSOLIDATION

Lesson intention
Provide students with a scaffold to solve word problems.

Resources
Activity: Gallery walk

Differentiation and modification
Grouping for tasks will be based on initial assessment (opportunities for support and extension).

Support for students through the use of SLSO time, LAST in class support, individual copies of Newman’s prompts, hundreds charts, MAB Place Value blocks and concrete materials.

Warm-up
1. Write
Write each of the four operations on a piece of chart paper. Hang or place the labelled charts in various places around the classroom to create four stations.

2. Group
Group students into teams of three to five students, depending on the size of the class. Each group should be allocated a station to start.

3. Begin
At their first station, groups will read the operation and one recorder should write as many words associated with the operation on the chart paper as they can in the allocated time. For individual student accountability, you may also have the students record their own responses on a worksheet, or put their initials below what they wrote. Having different coloured markers for each student is also an option.

4. Rotate
After one to two minutes, have the groups rotate to the next station. Students read and discuss the previous group’s response and add content of their own. Repeat until all groups have visited each station. To involve all group members, you can have groups switch recorders at each station. Note: Groups need to add a new word at each chart i.e. one that has not previously been used.

5. Monitor
As the teacher, it is important to monitor the stations while the students participate. You may also need to clarify or provide hints if students don’t understand or misinterpret what has been posted at their station.

6. Reflect
Have students go back to their first station to read all that was added to their first response. Bring the class back together to discuss what was learned and make final conclusions about what they saw and discussed.

Resources
Activity: Storyboard

Guided teaching/Independent
Photocopy a storyboard template and have students work with a partner to solve a word problem. Have pairs join other pairs to discuss each quadrant and why they included what they did.

Reflection
Have students bring their working out to share and discuss the different approaches each partnership took to solve the problem. Have students articulate why they chose a specific operation and what told them to do that?

Assessment of learning
Students are given a word problem and asked to show their steps and explanation for how they have solved it including justifying why they choose the operation they used.
INTERNET LINKS

Maths problem a day
http://resources.hwbwales.gov.uk/VTC/maths-starter/ks3/eng/ProblemOfTheDay.html

Maths problem solving activities - Teaching ideas
http://www.teachingideas.co.uk/subjects/problem-solving

Word problems - Various operations, iPad app
http://www.mathplayground.com/wordproblems.html

Problem solving games
http://www.topmarks.co.uk/maths-games/7-11-years/problem-solving

Includes outcomes, description, required resources, activity, teaching sequences, solutions, attachments
https://nzmaths.co.nz/level-1-problems

Problems to solve in primary school maths

Resource to help you develop a problem solving approach to the teaching and learning of maths
https://nrich.maths.org/10334

Maths problems for all grades
http://mathtop10.com/

Problem solving activities for all years

Maths apps and resources - Go to working mathematically and then 2

Free maths worksheets for maths problems
http://www.dadsworksheets.com/worksheets/word-problems.html

Learning games
https://getkahoot.com/

Using Key Words to Unlock Mathematics Word Problems

STRAND AND SUBSTRAND
Number - Addition and Subtraction, Multiplication and Division 1 - Stage 2

SYLLABUS OUTCOMES
MA2-5NA A student uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.

MA2-6NA A student uses mental and informal written strategies for multiplication and division.

MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

NUMERACY LINKS
Numeracy Skills Framework, student are working at early of Stage 2 for Focus Area 1, applying addition, subtraction, multiplication and division.

ACTIVITY FOCUS
The purpose of this sequence of activities is for students to use problem solving strategies to select the correct operation in word problems.
Problem Solving Activity 1

WARM-UP
Solving an authentic word problem:
• Open the class by having the students solve an authentic word problem in pairs: “There are _______ (fill in the number) students in this classroom. I need to distribute four blank cards per student. How many blank cards do I need?”
• Circulate around the room as the students are working, ensuring that students are multiplying the number of students in the classroom by four in order to determine how many blank cards are needed.
• Have a student volunteer come to the front board to write the mathematical equation that he or she used to determine the answer to the problem. Above that equation, write the original word problem and then ask students which specific word in the problem identified the correct operation to use to determine the number of cards needed for the class (e.g. per).

MODELLED TEACHING
Brainstorming key words that indicate mathematical equations:
• Explain to the class that whether they notice it or not, they are constantly interpreting key words in word problems in order to determine which mathematical operations to use in solving the problems.
• Draw a four-quadrant table on the board and write a different mathematical operation title in each quadrant: addition, subtraction, multiplication, and division. Write the word “per” under the title “multiplication” and have students brainstorm additional key words that belong under each of the four mathematical operation categories.

If students get stuck in this brainstorming process, you could suggest different key words (within the context of simple word problems) and have students direct you were to write the words in the table. At the end of this brainstorming session, make sure you have at least the following words and phrases listed in your table:

<table>
<thead>
<tr>
<th>MATHEMATICAL OPERATIONS</th>
<th>KEY WORDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addition</td>
<td>add(ed) to all together both combined in all increase by more than perimeter plus sum total</td>
</tr>
<tr>
<td>Subtraction</td>
<td>decreased by difference fewer than how many more left less than minus remaining take away</td>
</tr>
<tr>
<td>Multiplication</td>
<td>a area multiplied by of per product of rate times triple twice</td>
</tr>
<tr>
<td>Division</td>
<td>divided half how many each out of percent quarter quotient of percent</td>
</tr>
</tbody>
</table>

CREATING KEY WORD FLASH CARDS
• Have a student count out the number of index cards that the class determined in the warm up problem and distribute four cards to each student.
• Direct students to create four flash cards - one for each of the four mathematical operations. On the blank side of each card, they should boldly write an operation and its symbol (+ – × ÷), and on the reverse, lined sign they should list the key words associated with that operation (Students should base these flash cards on the table you created on the front board).

GUIDED TEACHING
• Organise the class into small groups of no more than three to four students in each group, and explain that they will be using their new flash cards as visual aids in mathematics coaching.
• Distribute a sheet with various word problems to a student in each group and explain that the student with the sheet will act as the reader and recorder during the first round. The reader and recorder’s job is to read a word problem aloud and to allow his fellow “math coaches” to advise him on which mathematical operation to follow in solving the problem.
• Advise the mathematics coaches in the class to listen to the word problem closely, to advise the reader and recorder to underline any key words in the problem that they detect, and to follow the flash card mathematical operation that they decide to “flash.”
• Direct groups to complete the sheet with various word problems, alternating the role of reader and recorder so that each student has at least one or two turns in that role.

REFLECTION
Sharing word problem solutions and strategies
• Invite students to the front of the classroom to explain their group’s word problem strategies and how key words led to determining which mathematical operations to use in each problem.

LESSON SOURCE
Think map visual thesaurus
https://www.visualthesaurus.com/cm/lessons/using-key-words-to-unlock-math-word-problems/
Maths Story Board - Think Board

STRAND AND SUBSTRAND
Number - Addition and Subtraction, Multiplication and Division 1 - Stage 2

SYLLABUS OUTCOMES
MA2-5NA A student uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.
MA2-6NA A student uses mental and informal written strategies for multiplication and division.
MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.
MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

NUMERACY LINKS
Numeracy Skills Framework, student are working at early of Stage 2 for Focus Area 1, applying addition, subtraction, multiplication and division.

ACTIVITY FOCUS
Explicitly teach 5 significant prompts (Newman's Analysis) to provide students with the strategies to solve problems.

This activity provides a scaffold to display a word problem, breaking it down in four different ways.
This activity will be introduced by modelling the scaffold - highlighting the way it can be used e.g. writing the problem in words, showing working out, identifying strategies used, etc.
The following is an example of a “think board”.

<table>
<thead>
<tr>
<th>MY THINK BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What is the problem?</strong></td>
</tr>
<tr>
<td>Write the word problem, circle keywords, numbers and operations.</td>
</tr>
<tr>
<td><strong>Is my answer correct?</strong></td>
</tr>
<tr>
<td>Check your answer by using an inverse operation or a drawing.</td>
</tr>
</tbody>
</table>
**Worked Example**

Harry planted 4 rows of carrots. He placed 7 seeds in each row. How many seeds did he plant?

---

**MY THINK BOARD**

<table>
<thead>
<tr>
<th>What is the problem?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harry planted 4 rows of carrots. He placed 7 seeds in each row.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Concrete materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>(e.g. counters)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>• $4 \times 7 = 28$</td>
</tr>
<tr>
<td>• $7 + 7 + 7 + 7 = 28$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Picture</th>
</tr>
</thead>
</table>

---

**Maths Story Board - Think Board**

**STRAND AND SUBSTRAND**
Number - Addition and Subtraction, Multiplication and Division 1 - Stage 2

**SYLLABUS OUTCOMES**

- **MA2-5NA** Uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.
- **MA2-6NA** Uses mental and informal written strategies for multiplication and division.
- **MA2-2WM** Selects and uses appropriate mental or written strategies, or technology, to solve problems.

**NUMERACY LINKS**
Numeracy Skills Framework, student are working at early of Stage 2 for Focus Area 1, applying addition, subtraction, multiplication and division.

**ACTIVITY FOCUS**
The purpose of this sequence of activities is so that students can use problem solving strategies to select the correct operation in word problems.
Problem Solving Activity 3

A gallery walk is a classroom-based active learning strategy where students are encouraged to build on their knowledge about a topic or content to promote higher order thinking, interaction and cooperative learning. The students in groups move through different stations where a question is posted for them to answer and interact and share knowledge in the process.

Francek, Mark. “What is Gallery Walk?” Starting Point-Teaching Entry Level Geoscience.

STEPS INVOLVED

1. Write
Write each of the four operations on a piece of chart paper. Hang or place the labelled charts in various places around the classroom to create four stations.

2. Group
Group students into teams of three to five students, depending on the size of the class. Each group should be allocated a station to start.

3. Begin
At their first station, groups will read the operation and one recorder should write a word associated with the operation on the chart paper. For individual student accountability, you may also have the students record their own responses on a worksheet, or put their initials below what they wrote. Having different coloured markers for each student is also an option.

4. Rotate
After two to three minutes, have the groups rotate to the next station. Students read and discuss the previous group’s response and add content of their own. Repeat until all groups have visited each station. To involve all group members, you can have groups switch recorders at each station. Note groups need to add a new word at each chart.

5. Monitor
As the teacher, it is important to monitor the stations while the students participate. You may also need to clarify or provide hints if students don’t understand or misinterpret what is posted at their station.

6. Reflect
Have students go back to their first station to read all that was added to their first response. Bring the class back together to discuss what was learned and make final conclusions about what they saw and discussed.

7. Display
Use the student responses as a display in the classroom and as new operations vocabulary is found add these to your charts.

8. Model
Model using the chart with a word problem.

STRAND AND SUBSTRAND
Number - Addition and Subtraction, Multiplication and Division 1 - Stage 2

SYLLABUS OUTCOMES
MA2-5NA A student uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.

MA2-6NA A student uses mental and informal written strategies for multiplication and division.

MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

NUMERACY LINKS
Numeracy Skills Framework, student are working at early of Stage 2 for Focus Area 1, applying addition, subtraction, multiplication and division.

ACTIVITY FOCUS
Practice reading, creating and solving word problems using the four operations to consolidate problem solving skills.
Problem Solving Activity 4

In pairs, students challenge each other, solving word problems using a scaffold in which they can input their own numerical values.

Example 1

_______ pencils have been packed evenly into ___ boxes. How many pencils are there in each box? _____
What strategies did you use to solve the problem?

Example 2

_______ trees in an orchard are planted in rows of _______. How many trees are there in each row? _______
What strategies did you use to solve the problem?
Example 3

Lilly earns ____________ each week. She saves _________%. How much does she save in a year? ______

What strategies did you use to solve the problem?

Matching Words to Operations

STRAND AND SUBSTRAND

Number - Addition and Subtraction, Multiplication and Division 1 - Stage 2

SYLLABUS OUTCOMES

MA2-5NA  A student uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.

MA2-6NA  A student uses mental and informal written strategies for multiplication and division.

MA2-2WM  A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

NUMERACY LINKS

Numeracy Skills Framework, student are working at early of Stage 2 for Focus Area 1, applying addition, subtraction, multiplication and division.

ACTIVITY FOCUS

The focus of this activity is to develop students’ understanding/vocabulary when discussing the terms: multiplication, division, addition and subtraction within maths.

Problem Solving Activity 5

Matching words to operations is a consolidating activity that requires students to work in small groups, identifying word cards that match with each operation.

Discuss each of the four operations and brainstorm as a class some synonyms that may be used e.g. division groups of, divided, how many each etc.

With students in groups of four, each group receives a ‘pack’ of synonym cards and four operation cards.

Each child is given an operation card. With the synonym cards piled in the central location, have one student begin by selecting the top card. If this synonym matches their operation, they keep the card and choose again. If it doesn’t match the card is placed face-up so other players can see it and the next player has a turn. Players may choose a face-up card that links to their operation. The winner is declared when they have found all seven synonym cards.

Note: This activity can be modified to play snap or go fish.
Online Toy Shopping Activity 6

STRAND AND SUBSTRAND
Number - Addition and Subtraction, Multiplication and Division - Stage 2

SYLLABUS OUTCOMES
MA2-5NA A student uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.
MA2-6NA A student uses mental and informal written strategies for multiplication and division.

Working mathematically outcomes
MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

NUMERACY LINKS
Numeracy Skills Framework, student are working at early of Stage 2 for Focus Area 1, applying addition, subtraction, multiplication and division.

ACTIVITY FOCUS
The purpose of this sequence of activities is for students to use problem solving strategies to select the correct operation in word problems.

ACTIVITY
1. Each student has a “budget” of $100 (or other amount) to spend online on toys.
2. In groups, students need to research the prices of toys online and prepare a digital proposal. (Note: Explicit teaching of rounding .99 to the nearest dollar will probably be needed.)
3. Students need to be able to present their proposal to the class and explain the mathematics strategies and operations that they have used and why.

The task can be modified to bring in all the operations, by changing the problem; e.g.
• You must buy 5 of the same toy and still spend under $100.
• Purchase any two items and find the difference between each item.
• Purchase two items so that the difference is $2, then $3, then $4 and so on.
• Do the same activity with 3 items and see how far you get.
• Purchase 5 items so that the sum total is even.
• Do the same so that the total is odd.

Photograph Maths Word Problem

STRAND AND SUBSTRAND
Number - Addition and Subtraction, Multiplication and Division - Stage 2

SYLLABUS OUTCOMES
MA2-5NA A student uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.
MA2-6NA A student uses mental and informal written strategies for multiplication and division.
MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

NUMERACY LINKS
Numeracy Skills Framework, student are working at early of Stage 2 for Focus Area 1, applying addition, subtraction, multiplication and division.

ACTIVITY FOCUS
The purpose of this sequence of activities is for students to use problem solving strategies to select the correct operation in word problems.
Photograph Maths Word Problem Activity 7

**ACTIVITY**

Word problems come to life when kids write their own problems and stage photos that illustrate them

Bring word problems to life by challenging students to work together in pairs or small groups to stage photographs of real-life settings that involve mathematics and to write word problems to go with the photographs.

This activity can help students who are visual learners grasp a mathematical skill that is grounded in reading.

Prior to letting students go off on their own to write word problems, spend a couple of class sessions allowing students to practice reading and solving such problems as a class, in small-groups, and independently. Then spend another day writing word problems as a class and in small groups.

After students have had some focused practice with word problems, introduce this lesson, in which they work in pairs to think about where they encounter mathematics in their lives. Begin by brainstorming a list of places in which they find mathematics (provide a few of the ideas that follow to get them started). Then encourage students to be creative as they find mathematics in unusual places, dress themselves up, and stage photos ...

**Part A**

Use an iPad to take the photos, and then enlarge the photos to create vivid images. You might use student-written word problems as the focus of a Word Problems of the Week learning centre in your classroom.

Some ideas for “Photograph Math” Photo Opportunities.

1. Students might take a photo of a sign inside/outside the canteen. Depending on their grade and skill levels, they could write problems that involve figuring the cost of different meals, change they would receive from a $10 bill, what they might buy if they only had $2 in their pockets, and so on.

2. A couple of kids might pose by a sign that announces how many metres it is to another classroom and then create word problems to accompany the photo. Word problems could involve calculating distances between two points, how long it will take to get from place to place if they travel 35 kilometres per hour, and so on.

3. Kids might stand in mannequin-like poses as they model clothing with big price tags attached. Word problems challenge students to figure the cost of the outfits in different combinations, how much change they would get if they paid for a shirt with a $20 note, and so on.

4. Students might strategically locate large items - such as a bin, a bicycle, and a chair - on the playground outside their classroom and then take a photo, enlarge it, and attach a scale that indicates (for example) that every centimetre on the photo equals 5 metres. The problem could ask students to figure out the distance between the bin and the bicycle, whether the bin is closer to the bicycle or the chair, how much closer one item is to another, and so on.

5. Students might dress up as characters from a book, TV show, or popular movie, pose themselves in a funny scene, and write problems that relate to the characters, the book, or the show.

The possibilities are limited only by the students’ (unlimited) imagination!

**Part B**

After pairs/groups have created their photos and word problems, encourage them to meet with another pair/group to critique each other’s efforts, test the word problems, and offer editing advice. Then the work will be ready for prime time! Create a class book of word problems or set up a Word Problems of the Week learning centre!

**ASSESSMENT**

Students will write in their journals what they learned from this activity; journal entries should include what they might do differently next time to improve on this first effort. Then, students might repeat the activity during the following term, creating a whole new batch of “photograph mathematics” word problems - even better than their first efforts!

**This lesson plan source - Educationworld.com**
Visualising and Drawing to Solve Word Problems

STRAND AND SUBSTRAND
Number - Addition and Subtraction, Multiplication and Division - Stage 2

SYLLABUS OUTCOMES
MA2-5NA  A student uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.
MA2-6NA  A student uses mental and informal written strategies for multiplication and division.
MA2-2WM  A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

NUMERACY LINKS
Numeracy Skills Framework, students are working at early of Stage 2 for Focus Area 1, applying addition, subtraction, multiplication and division.

FOCUS AREA
The purpose of this sequence of activities is for students to use problem solving strategies to select the correct operation in word problems. In particular, this activity is about using visualising and drawing to help solve word problems.

MODELLED TEACHING
Students watch a short video relating to a real life mathematical problem. Students discuss with a partner what they noticed about the video and what they wondered about the video. Then as a whole class record all the mathematical questions that relate to the video. Decide upon a specific question and ask students what information we need to solve the problem. Show students more information on video.

GUIDED TEACHING
Students work with a partner to solve the problem. They have to show all their working through drawing and writing the mathematical equation.

REFLECTION
Students share and explain the strategy they used to solve the problem. Teacher highlights to students how the problem was solved using different strategies.

REFERENCES
A good example of this lesson can be seen on the following link:
https://www.teachingchannel.org/videos/teaching-subtraction-problems-nsf
Identifying Properties of 3D Objects

STRAND AND SUBSTRAND
Measurement - 3D Space - Stage 3

SYLLABUS OUTCOME
MA3-14MG A student identifies three-dimensional objects, including prisms and pyramids, on the basis of their properties, and visualises, sketches and constructs them given drawings of different views.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-3WM A student gives a valid reason for supporting one possible solution over another.

NUMERACY LINKS
Numeracy Skills Framework, student are working at end of Stage 3 for Focus Area 3, applying concepts of 3D objects.

ACTIVITY FOCUS
Identifying 3D objects and their properties.

Identifying Properties of 3D Objects Activity 1

ACTIVITY
3D shape taboo

INSTRUCTIONS

<table>
<thead>
<tr>
<th>SHAPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cube</td>
<td>3D, has 8 vertices, 12 edges, 6 faces, net of 6 Identical squares, is a solid</td>
</tr>
<tr>
<td>Triangular prism</td>
<td></td>
</tr>
<tr>
<td>Triangular pyramid</td>
<td></td>
</tr>
<tr>
<td>Rectangular prism</td>
<td></td>
</tr>
<tr>
<td>Rectangular pyramid</td>
<td></td>
</tr>
<tr>
<td>Sphere</td>
<td></td>
</tr>
<tr>
<td>Cone</td>
<td></td>
</tr>
<tr>
<td>Square based pyramid</td>
<td></td>
</tr>
<tr>
<td>Hexagonal prism</td>
<td></td>
</tr>
<tr>
<td>Cylinder</td>
<td></td>
</tr>
</tbody>
</table>

Step 1: Give a description for the following shapes:

Step 2: Write the name of the objects above on small squares of paper or cardboard to re-use.

Step 3: Students form groups of 5. Each student is given a shape but must not show the shape they have.

Step 4: Students take turns and need to remember the description of the shape they have to describe to their group. The group must then hold up the shape they think it is.
Shape and Net Match

STRAND AND SUBSTRAND
Measurement - 3D Space - Stage 3

SYLLABUS OUTCOME
MA3-14MG A student identifies three-dimensional objects, including prisms and pyramids, on the basis of their properties, and visualises, sketches and constructs them given drawings of different views.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-3WM A student gives a valid reason for supporting one possible solution over another.

NUMERACY LINKS
Numeracy Skills Framework, student are working at end of Stage 3 for Focus Area 3, applying concepts of 3D objects.

ACTIVITY FOCUS
Identifying 3D shapes and their properties.

Shape and Net Match Activity 2

ACTIVITY
Matching nets

INSTRUCTIONS
Step 1: Each student is given 2 nets (students must have two different shapes), one they create and put together and the other one they leave on their table.

Step 2: Without talking, the students must then find their net and shape partners around the room, trading one for another until they have a matching net for their 3D object or 3D object for their net.

Example of nets

Obtain nets from the following link
Nets and 3D Shapes Bingo

STRAND AND SUBSTRAND
Measurement - 3D Space - Stage 3

SYLLABUS OUTCOME
MA3-14MG A student identifies three-dimensional objects, including prisms and pyramids, on the basis of their properties, and visualises, sketches and constructs them given drawings of different views.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-3WM A student gives a valid reason for supporting one possible solution over another.

NUMERACY LINKS
Numeracy Skills Framework, student are working at end of Stage 3 for Focus Area 3, applying concepts of 3D objects.

ACTIVITY FOCUS
Identifying 3D shapes and their properties.

Nets and 3D Shapes Bingo Activity 3

ACTIVITY
Nets and 3D shapes bingo

INSTRUCTIONS
Step 1: Students are given a blank bingo proforma to fill in with their own choices of 3D shapes. They may choose to write the name of the shape or draw it. They can write the same shape more than once. Example: sphere, cone, pentagonal pyramid, rectangular prism, cylinder etc.

Nets and 3D Objects Bingo

Step 2: Teacher to read out questions/clues about each object. Questions ranging across 3D object properties, net properties and or cross sections of objects. (See below)
Construct and Draw 3D Objects

STRAND AND SUBSTRAND
Measurement - 3D Space - Stage 3

SYLLABUS OUTCOME
MA3-14MG A student identifies three-dimensional objects, including prisms and pyramids, on the basis of their properties, and visualises, sketches and constructs them given drawings of different views.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-3WM A student gives a valid reason for supporting one possible solution over another.

NUMERACY LINKS
Numeracy Skills Framework, student are working at end of Stage 3 for Focus Area 3, applying concepts of 3D objects.

ACTIVITY FOCUS
Identifying 3D objects and their properties.
Construct and Draw 3D Objects Activity 4

ACTIVITY
Construct and draw 3D objects

INSTRUCTIONS
Step 1: Students choose 4 3D objects and write their properties (faces, vertices and edges).

Step 2: Using toothpicks and marshmallows/blu-tack/small foam balls, students create the 3D objects they have selected following the properties that they listed as a guide.

Step 3: Using their constructed 3D objects, students now complete the table below. Drawing the different viewpoints of the shapes.

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>BOTTOM VIEW</th>
<th>TOP VIEW</th>
<th>SIDE VIEW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

EXTENSION ACTIVITY
Students to work in pairs. Students pick a 3D object, ask them not to show their partner. They then need to describe the shape to the partner so that their partner can reproduce the shape using the match sticks and blu-tack. Students can only use the correct terminology when giving their description/instruction and that they cannot name the shape.
String Measurement

INSTRUCTIONS
1. In pairs, students are given 5 different coloured pieces of string/wool (make them about 1 m long).
2. Students write the name of a selected object found in the classroom on some masking tape and tape this over one end of the wool. Using the wool/string, students measure the perimeter of the selected object and mark this using another piece of masking tape on the opposite end to where they started.
3. Students repeat this for the other 4 pieces of wool/string for objects found.
4. Students then use a ruler to identify the total length or perimeter of the objects (record this on one of the masking tape pieces).

String Measurement with Toothpicks Activity 2

INSTRUCTIONS
1. Working in the same pairs, use the wool/strings from the previous activity.
2. Locate the perimeter of one of the strings (recorded on masking tape previously).
3. Using the toothpicks and blu-tack, students work together to construct a 2D shape that will measure the same perimeter as the piece of string. Confirm this by measuring with the string.
4. Students record this shape in their books or on grid paper.
5. Repeat the process for the other pieces of string.
Grid Creations

INSTRUCTIONS
1. Provide students with a copy of the following grid.
2. Students measure the perimeter of the given shapes.
3. Students then create a different regular shape with the same perimeter and an irregular shape with the same perimeter on the grid paper (making sure they label the perimeter).

STRAND AND SUBSTRAND
Measurement and Geometry - Length - Stage 3

SYLLABUS OUTCOME
MA3-9MG A student selects and uses the appropriate unit and device to measure lengths and distances, calculates perimeters, and converts between units of length.
MA3-3WM A student gives a valid reason for supporting one possible solution over another.
MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

NUMERACY LINKS
Numeracy Skills Framework, student are working at end of Stage 3 for Focus Area 4, understanding and applying length, solves problems involving length and perimeter of squares, rectangles and triangles, records lengths and distances using the abbreviations km, m, cm and mm, finds perimeters of common 2D shapes.

ACTIVITY FOCUS
Finds the perimeter of given objects by measuring the length of the sides using a variety of equipment.

Grid Creation Activity 3
Shape Building

INSTRUCTIONS
1. In groups of 3, students first construct a shape with a perimeter of 8 cm using 1 cm cubes (shapes can be regular or irregular).
2. Students measure/count the length of one side of the cube and trace the outside of the shape onto the grid paper.
3. Repeat for each given perimeter: 10 cm, 18 cm, 14 cm and 20 cm.

NUMERACY LINKS
Numeracy Skills Framework, student are working at early of Stage 3 for Focus Area 4, understanding and applying length, solves problems involving length and perimeter of squares, rectangles and triangles, records lengths and distances using the abbreviations km, m, cm and mm, finds perimeters of common 2D shapes.

ACTIVITY FOCUS
Finds the perimeter of given shapes by measuring the length of the sides using a variety of equipment.

Shape Building Activity 4

INSTRUCTIONS
1. In groups of 3, students first construct a shape with a perimeter of 8 cm using 1 cm cubes (shapes can be regular or irregular).
2. Students measure/count the length of one side of the cube and trace the outside of the shape onto the grid paper.
3. Repeat for each given perimeter: 10 cm, 18 cm, 14 cm and 20 cm.

1 cm grid
12-Hour and 24-Hour clock

INSTRUCTIONS
Students given normal clock with a ring around the outside. Students to then discuss what the clock would look like if it showed 24-hour time. Students to then complete (See below).

12-Hour and 24-Hour Clock Activity 1

INSTRUCTIONS
Students given normal clock with a ring around the outside. Students to then discuss what the clock would look like if it showed 24-hour time. Students to then complete (See below).
Ordering Time

STRAND AND SUBSTRAND
Measurement and Geometry - Time - Stage 3

SYLLABUS OUTCOME
MA3-13MG A student uses 24-hour time and am and pm notation in real-life situations, and constructs timelines.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

Ordering Time Activity 2

ACTIVITY 2
Ordering time

ORDERING CARDS
Students placed into two groups. One 24-hour time group and one 12-hour time group (Use the cards the students made as well as the activity times to ensure they have a time each hour). Both groups race to put their times in correct order. First group to finish wins.

NUMERACY LINKS
Numeracy Skills Framework, student are working at end of Stage 3 for Focus Area 4, understanding time and time zones.

ACTIVITY FOCUS
Understands and uses 12-hour and 24-hour time to solve problems.
<table>
<thead>
<tr>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000HRS</td>
<td>MIDNIGHT</td>
</tr>
<tr>
<td>0100HRS</td>
<td>1AM</td>
</tr>
<tr>
<td>0200HRS</td>
<td>2AM</td>
</tr>
<tr>
<td>0300HRS</td>
<td>3AM</td>
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<tr>
<td>0400HRS</td>
<td>4AM</td>
</tr>
<tr>
<td>0500HRS</td>
<td>5AM</td>
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<tr>
<td>0600HRS</td>
<td>6AM</td>
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<tr>
<td>0700HRS</td>
<td>7AM</td>
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<td>0800HRS</td>
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<td>0900HRS</td>
<td>9AM</td>
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<tr>
<td>1000HRS</td>
<td>10AM</td>
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<tr>
<td>1100HRS</td>
<td>11AM</td>
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<tr>
<td>1200HRS</td>
<td>12AM</td>
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<tr>
<td>1300HRS</td>
<td>1PM</td>
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<tr>
<td>1400HRS</td>
<td>2PM</td>
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<tr>
<td>1500HRS</td>
<td>3PM</td>
</tr>
<tr>
<td>1600HRS</td>
<td>4PM</td>
</tr>
<tr>
<td>1700HRS</td>
<td>5PM</td>
</tr>
<tr>
<td>1800HRS</td>
<td>6PM</td>
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<tr>
<td>1900HRS</td>
<td>7PM</td>
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<tr>
<td>2000HRS</td>
<td>8PM</td>
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<tr>
<td>2100HRS</td>
<td>9PM</td>
</tr>
<tr>
<td>2200HRS</td>
<td>10PM</td>
</tr>
<tr>
<td>2300HRS</td>
<td>11PM</td>
</tr>
<tr>
<td>0000HRS</td>
<td>MIDNIGHT</td>
</tr>
</tbody>
</table>
Planning a Trip

STRAND AND SUBSTRAND
Measurement and Geometry - Time - Stage 3

SYLLABUS OUTCOME
MA3-13MG A student uses 24-hour time and am and pm notation in real-life situations, and constructs timelines.
MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.
MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

NUMERACY LINKS
Numeracy Skills Framework, student are working at end of Stage 3 for Focus Area 4, understanding time and time zones.

FOCUS AREA
Understands and uses 12-hour and 24-hour time to solve problems. Uses and reads timetables.

Planning a Trip Activity 3

INSTRUCTIONS
Your job is to plan your travel itinerary.

1. You plan to buy a return train ticket to Circular Quay. You must work out what time train you are going to catch and from which station.
2. From Circular Quay, you decide to buy a return ferry ticket. You must choose where you want to go and which ferry you have to take.
3. What time will you arrive home?

Use the following link to search for your transport timetable
https://transportnsw.info/timetables#/ 

<table>
<thead>
<tr>
<th>TRAVEL ITINERARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Train into Circular Quay</td>
</tr>
<tr>
<td>(Time and Station)</td>
</tr>
<tr>
<td>Ferry trip across</td>
</tr>
<tr>
<td>(Time and Wharf)</td>
</tr>
<tr>
<td>Ferry Trip back</td>
</tr>
<tr>
<td>(Time and Wharf)</td>
</tr>
<tr>
<td>Train home from Circular Quay</td>
</tr>
<tr>
<td>(Time and Station)</td>
</tr>
</tbody>
</table>

4. Extended Activity - Whilst in the city you also decide to buy a return bus ticket to a certain destination.
TEACHING SEQUENCE FOR APPLYING ADDITION AND SUBTRACTION Stage 2

PURPOSE
The purpose of this sequence of activities is for students to develop an understanding of solving problems involving addition and subtraction of numbers up to five-digits. They will learn how to use different mental and written strategies to solve various problems and also how to use Newman’s Analysis Prompts for worded problems. Riverstone Public School implemented these activities with their Stage 2.

Place Value

STRAND AND SUBSTRAND
Number - Addition and Subtraction - Stage 2

SYLLABUS OUTCOME
MA2-5NA A student uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

NUMERACY LINKS
Numeracy Skills Framework, Aspects of Numeracy, Focus Area 1, estimating and problem solving, Stage 2.

ACTIVITY FOCUS
Solves problems using addition and subtraction, utilising Newman’s Analysis Prompts.
Place Value Activity

PRE-ASSESSMENT
How many pairs of numbers can you find that add up to 50?

Students write their responses on paper. Take note of which students create patterns. E.g. 40 + 10, 41 + 9, 42 + 8, 43 + 7.

ACTIVITY
Learning intention
Develop fluency with adding numbers and recalls related subtraction facts to develop effective mental strategies for computation.

Whole class modelled activity
Draw a table like this on the board:

<table>
<thead>
<tr>
<th>HUNDREDS</th>
<th>TENS</th>
<th>ONES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

Write the numbers 425 and 214 in the empty boxes. Ask students to estimate the answer to this addition. Model each number with base ten blocks (remind students that a block = 1000, a flat = 100, a long = 10, a mini = 1) and add them, exchanging where necessary. Repeat activity with more numbers.

Ask students to discuss which blocks they found most useful to show addition.

EARLY STAGE 2 GROUP ACTIVITIES
Place value game
Task
Students receive a place value chart.
Roll a dice two times and create a number.
Make the number using base 10 materials.
When students have made 2 two-digit numbers they add them together using the base 10 materials.

LATER STAGE 2 GROUP ACTIVITIES
Teeny tiny ten-frames
Task
Provide the students with a set of teeny tiny ten-frames.
Nominate a two-digit number and ask the students to represent the number using the ten-frames.
Have the students share how they made the number.
Ask the students to make a second two-digit number. Repeat the questioning.
Have the students find the total of the two numbers using the ten-frames.
Discuss how they solved the addition.

PROBLEM OF THE DAY
(USING NEWMAN’S ANALYSIS PROMPTS)
I added two numbers together, each with two-digits. The solution was 94, what might the numbers be?

REFLECTION/JOURNAL ENTRY
• Students have a one minute conversation with a peer on their learning that took place during the lesson.
• Students draw or write a reflection on the learning that took place during the lesson (5 minutes).
Strategies on a Number Line Activity

PRE-ASSESSMENT
Students work out addition/subtraction equations using as many different strategies as they can e.g. Jump, split, compensation, bridging, extending number facts, changing order of addends \((14 + 16 + 7 = 14 + 7 + 16)\).

ACTIVITY

Warm up
Two- and three-digit addition and subtraction.
- Provide the students with a blank piece of paper.
- Write two addition and two subtraction problems, e.g. \(79 + 36, 348 + 179, 94 - 46\) and \(900 - 242\).
- Ask the students to solve each problem and record and justify recording the strategy they used.

Learning intention
To use mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.

Whole class modelled activity
a) Revisit strategies for addition and subtraction using two-, three- and four-digit numbers, including:
- The jump strategy e.g. \(23 + 35; 23 + 30 = 53, 53 + 5 = 58\)
- The split strategy e.g. \(23 + 35; 20 + 3 + 5 = 58\)
- The compensation strategy e.g. \(63 + 29; 63 + 30 = 93\), subtract 1, to obtain 92
- Using patterns to extend number facts e.g. \(5 - 2 = 3\), so \(500 - 200 = 300\)
- Bridging the decades e.g. \(34 + 17; 34 + 10 = 44, 44 + 7 = 51\)
b) Revisit recording strategies.
c) Recording mental strategies.
- e.g. \(169 + 32\); I added 30 to 169 to get 199, then I added 2 more to get 201. Or show the working on an empty number line.
d) Explain 3 different ways to solve \(227 + ? = 735\).
e) Show how you would use an empty number line to solve \(63 - 27\) and \(103 - 47\).
f) Explain where you think this student made errors. Display questions where common misconceptions and errors are evident.

EARLY STAGE 2 GROUP ACTIVITIES

Differences on number lines
In pairs, students draw an empty number line.
- Student A chooses two three-digit numbers and places them on the number line.
- Student B uses the number line to work out and record the difference between the two numbers.
- Students explain the mental strategies they used to find the answer.
- They reflect on their method, considering whether it can be improved.

Investigation
How many different ways can you add \(5798 + 3565\) in your head? Write number sentences to explain your mental strategies.

Which way is best?
Students are asked to solve problems in three different ways: using a mental strategy, a formal written algorithm, and a calculator e.g. ‘Our class has 356 points and another class has 567 points. How many points do we need to catch up?’
- Students compare the strategies used and discuss the advantages and disadvantages of each method.
- If students come up with different answers, they are asked to show which answer is correct.

Variation
Students write their own problems and swap with others. Students could use four- or five-digit numbers.

PROBLEM OF THE DAY
(USING NEWMAN’S ANALYSIS PROMPTS)
I added two numbers together, each with three-digits. The solution was 496, what might the numbers be?

REFLECTION/JOURNAL ENTRY
- Students have a one minute conversation with a peer on their learning that took place during the lesson.
- Students draw or write a reflection on the learning that took place during the lesson (5 minutes).
### Jump Strategy

#### Using the jump strategy on a hundred chart

**46 + 33 = 79**

![Hundred Chart](image)

- **Could be done...**
  - \[46 + 10 + 10 + 1 + 1 + 1 = 79\]

#### Using the jump strategy on an empty number line

**46 + 33 = 79**

- **Could be done...** \[46 + 10 + 10 + 1 + 1 + 1 = 79\]

![Number Line](image)

### Compensation Strategy

The compensation strategy for addition is useful when one of the numbers ends in 8 or 9. One number is rounded up to the next 10, the addition is carried out and then answer is adjusted to compensate for the original change.

For example: \(52 + 39\)

Think \(52 + 40 = 92\)

But because I added 1 to 39 to round up to 40
I need to subtract 1 from my answer.

Therefore: \(52 + (40 - 1) = 91\)

This can also be shown on the empty number line like this:

![Number Line](image)

This is a type of jump strategy.
TEACHING SEQUENCE FOR APPLYING ADDITION AND SUBTRACTION WHEN PROBLEM SOLVING
Stage 2

PURPOSE
The purpose of this sequence of activities is to develop students’ understanding of different mathematical strategies for multiplying, dividing, adding, subtracting and problem solving. They will learn how to solve multi-step problems, find missing values in an equation, understand multiples and inverse operations and mark fractions on a number line. Wirreanda Public School implemented these activities with their Stage 2 students.

STRAND AND SUBSTRAND
Number - Addition and Subtraction - Stage 2

SYLLABUS OUTCOMES
MA2-5NA A student uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, applying addition, subtraction, multiplication and division.

ACTIVITY FOCUS
Understanding the relationship between addition and subtraction and use of the equals sign.
Solving multi-step addition and subtraction problems.
Inverse Operations Activity

Understand the relationship between addition and subtraction.

Inverse operations
Teacher models a variety of equations where there is a missing value. Using a SMARTboard file (Year 3 Inverse Operations – Numeracy Project folder) allow students time to manipulate the pictures alternating the objects to find as many number sentences as possible.

Students use addition facts and subtraction sentences. i.e. 13 – 6 = 7, therefore 13 – 7 = 6, therefore 7 + 6 = 13

Determine the value of a missing number by using inverse operations.

Example:

\(? + 7 = 13\\ 13 - ? = 8\\ 7 + 6 = ?\\

Students continue with a number of examples at various levels.

Understand that equations either side of the = sign must be the same value.

True or false wall
Teachers provide a number of equation cards with addition and subtraction on either side of the equals sign:

\[ 39 - 12 = 15 + 12 \]
\[ 45 + 11 = 62 - 12 \]

Students must say whether or not the operations are true or false and discuss how they got their answer.

Place the true equations on the true wall, and false equations on the false wall.

With a partner, students make up their own cards.

Exchange cards with another partner set and complete the equations, placing them on the wall in the correct position.

Teacher provides students with a variety of equation cards with a missing value.

Students work in pairs or groups to solve the problems.

Example: 35 – ? = 24 + 3

Multi-Step Problem Solving - Addition and Subtraction Activity

ACTIVITY

Solve multi-step problems for addition and subtraction.

Students are given problems at various levels as below.

Teacher to model how to answer the question by putting a Level 1 question on the board.

1. Read the question through.
2. Read the question again, underline key information.
3. What does each part of the question require us to do? Focus on just one step at a time until you get the final answer.
4. Use the problem solving sheet to help solve the problem.

Questions can be changed for students to continue to practise using the problem solving sheet and different multi-step problems. This sheet can be used for any problem solving question and links well to multiplication and division.
Level 1

Question 1
Shane and Lucy both bought a T-shirt and hat. They each spent the same amount of money.
Shane's T-shirt cost $12 and his hat cost $8.
Lucy's T-shirt cost $14.
How much did Lucy's hat cost?

Question 2
James and Sally were both collecting cars and trains. They each had the same amount of toys.
James had 17 cars and 13 trains.
Sally had 16 cars.
How many trains did Sally have?

Level 2

Question 3
Lucas and Sharon both bought a book and a DVD. They each spent the same amount of money.
Lucas' book cost $27.00 and his DVD cost $33.00.
Sharon's book cost $31.00.
How much did Sharon's DVD cost?
Question 4
Matthew and Brooke both collected stamps and erasers. They both had the same amount of items in their collection.
Matthew had 54 stamps and 42 erasers.
Brooke had 37 stamps.
How many erasers did Brooke have?

Level 3

Question 5
David and Sarah both bought a T-shirt and hat. They each spent the same amount of money.
David's T-shirt cost $28.90 and his hat cost $21.10.
Sarah's T-shirt cost $30.95.
How much did Sarah's hat cost?

Question 6
Ben and Ella read two books each. They each read the same amount of pages.
Ben's first book had 347 pages and his second book had 452 pages.
Ella's first book had 426 pages.
How many pages did Ella's second book have?
TEACHING SEQUENCE FOR APPLYING MULTIPLICATION AND DIVISION Stage 2

STRAND AND SUBSTRAND
Number – Multiplication and Division – Stage 2

SYLLABUS OUTCOMES
MA2-6NA A student uses mental and informal written strategies for multiplication and division.
MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.
MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.
MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, applying addition, subtraction, multiplication and division, early in Stage 2.

ACTIVITY FOCUS
Linking multiplication and division to solve problems.
Uses repeated addition to solve multiplication problems.
Work out multiples of numbers and link to multiplication.
Linking Multiplication and Division Activity

Link multiplication and division.

Groups of students
Secretly give an equal number of coins to each student e.g. 6 students get 7 coins each and put them in the bag. The rest of the class count the coins and have to work out how many coins each student put in.

Problem solving

<table>
<thead>
<tr>
<th>CUBES PROBLEM SOLVING</th>
</tr>
</thead>
<tbody>
<tr>
<td>C  Circle numbers</td>
</tr>
<tr>
<td>U  Underline the question - what is the question asking?</td>
</tr>
<tr>
<td>B  Box - draw a box around the key words</td>
</tr>
<tr>
<td>E  Evaluate - evaluate the steps you should take OR Eliminate - cross out any unnecessary information</td>
</tr>
<tr>
<td>S  Solve - solve the problem and check your answer</td>
</tr>
</tbody>
</table>

Students use problem solving strategies, such as CUBES or Newman’s Analysis prompts to solve the following problems:

**ANIMALS ON A FARM**
Multi-step multiplication and division involving different animals and paddocks.

**Division/Fractions**
1. The farmer has 24 goats, 12 sheep and 32 cows. How many animals altogether?
2. The farmer has 24 goats, 12 sheep and 32 cows. If he was to count all the legs, how many would there be?
3. The farmer has 24 goats, 12 sheep and 32 cows. He must put an equal amount of animals in a paddock. How many different combinations of animals in each paddock can he have for the goats, sheep and cows?
4. The farmer has 24 goats, 12 sheep and 32 cows. He sold half the goats, one quarter of the sheep and three quarters of the cows. How many of each animal does he have now? How many animals altogether?
5. The farmer has 24 goats, 12 sheep and 32 cows. Over a period of drought, flood and famine he lost \( \frac{3}{4} \) of the goats, \( \frac{1}{2} \) of the sheep and \( \frac{1}{4} \) of the cows. How many of each animal does he now have left?

**Multiples Activity**

**ACTIVITY**
Work out multiples of numbers and link to multiplication.

**Multiples**
Using their knowledge of simple multiples (e.g. 2’s, 5’s, 10’s), students use knowledge of players in sporting teams to work out multiples of numbers, e.g. Netball and Rugby League.

**Netball**
Each team has 7 players; therefore, two teams have 14 players, three teams 21 players etc. The multiples of 7 are 7, 14, 21, 28, 35...

**Rugby League**
Each team has 13 players; therefore, two teams have 26 players, three teams 39 players etc. The multiples of 13 are 13, 26, 39, 52, 65...

Students think of other examples of multiples. E.g. fingers on hands = multiples of 5, octopus’ tentacles = multiples of 8
Repeated Addition to Multiply Activity

Use repeated addition to solve multiplication problems.

**Job activity**

Students have a list of jobs for their household and what they will receive if they complete them.

In pairs, students work out which jobs they will do and how much total pocket money they will earn each week.

Parents have put a limit of $20 per child per week.

Students are paid pocket money for 12 weeks.

Students work out how much they will earn in 12 weeks.

Show the teacher how much they have earned after 12 weeks.

Students talk about how much money was earned.

Who earned the most? How was this worked out?

Students do a gallery walk.

### Job Money Earned Table

<table>
<thead>
<tr>
<th>JOB</th>
<th>MONEY EARNED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dusting 1 x p/wk</td>
<td>$6</td>
</tr>
<tr>
<td>Make beds 7 days</td>
<td>$4</td>
</tr>
<tr>
<td>Tidy Toy Room 7 days</td>
<td>$6</td>
</tr>
<tr>
<td>Help with dishes 7 days</td>
<td>$5</td>
</tr>
<tr>
<td>Clean room 1 x p/wk</td>
<td>$4</td>
</tr>
<tr>
<td>Feed the dog 7 days</td>
<td>$3</td>
</tr>
<tr>
<td>Vacuum 1 x p/wk</td>
<td>$5</td>
</tr>
</tbody>
</table>

### Job Money Earned Table

<table>
<thead>
<tr>
<th>WEEKS</th>
<th>WHICH JOBS WILL YOU DO?</th>
<th>HOW MUCH POCKET MONEY WILL YOU EARN EACH WEEK?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>2</td>
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<td>11</td>
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</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Money Earned in 12 Weeks**
TEACHING SEQUENCE FOR APPLYING
ADDITION, SUBTRACTION, MULTIPLICATION
AND DIVISION Stage 2

STRAND AND SUBSTRAND
Number - Multiplication and Division - Stage 2

SYLLABUS OUTCOMES
MA2-6NA A student uses mental and informal written strategies for multiplication and division.

MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

MA2-5NA A student uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, multiplication and division.

ACTIVITY FOCUS
Recalls multiplication facts up to $10 \times 10$ fluently and applies the commutative property for multiplication.

Solves problems using addition and subtraction.

Solves problems using doubling and addition.
Calculating Multiplication Facts Activity

Counter game

Materials
Ten counters
Two dice (with numbers 1-10)
A hundred-chart game board to share

Instructions
Students take turns to roll two dice and multiply the upper faces.

Students place a counter on the hundreds chart for the solution they have obtained.
The winner is the first student with four counters in a row, column or diagonal. The student who must shout out 'four in a row', 'four in a column' or 'four on the diagonal' to win when they see it (or they don't win!). Support students with a calculator to check.

Cross Over Activity

In pairs, students choose a number between 1 and 1000 and write in on paper.
The student with the larger number always subtracts a number from their chosen number.
The student with the smaller number always adds a number to their chosen number.
The student who is adding must always have a number less than their partner’s answer.

The student who is subtracting must always have a number more than their partner’s answer.

Play continues until one student is forced to ‘cross over’ their partner’s number.
The student who crosses over their partner’s number loses the game.

<table>
<thead>
<tr>
<th>PLAYER A</th>
<th>PLAYER B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Number 250</td>
<td>Start Number 900</td>
</tr>
<tr>
<td>250 + 300 = 550</td>
<td>900 − 100 = 800</td>
</tr>
<tr>
<td>550 + 150 = 700</td>
<td>800 − 99 = 701</td>
</tr>
<tr>
<td>700 + 1 = 701</td>
<td>Player B wins</td>
</tr>
</tbody>
</table>

First to 100 Activity

One child rolls the dice for the whole class.
Students have ten/ones chart ruled up.

Each child decides whether to put the number in the tens or ones column and find progressive total.
First child to make it to 100 wins.

Make One Dollar Activity

Materials
Large collection of silver coins (To use if necessary)

Instructions
Students form groups of three.
Students write as many different number sentences as possible (using coins 5c, 10c, 20c, 50c) that give a total of $1.00 in 5 minutes. Discuss answers.
When time limit is reached the group with the most combinations wins the game.
Repeat the activity using different target amounts and different money values, e.g. $2 coin or $10 notes.
TEACHING SEQUENCE FOR FRACTIONS
Stage 2 and 3 - Fractions and Decimals

PURPOSE
Figtree Public School implemented the sequence of activities for Stage 2 and 3 students to develop understanding of fractions and decimal representation.

STRAND AND SUBSTRAND
Number - Fractions and Decimals - Stage 2 and 3

SYLLABUS OUTCOMES
MA2-7NA A student represents, models and compares commonly used fractions and decimals.
MA3-7NA A student compares, orders and calculates with fractions, decimals and percentages.
MA3-4NA A student orders, reads and represents integers of any size and describes properties of whole numbers.
MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.
MA2-2WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

NUMERACY LINKS
Numeracy Skills Framework, Aspects of Numeracy, Focus Area 1, understanding fractions, decimals, percentages, rates, ratios, Stage 2 and 3.

ACTIVITY FOCUS
Applies the place value system to represent tenths, one hundredths as decimals.
Makes connections between fraction and decimal notation.
Models, compares and represents decimals of one and two decimal places.
Fractions and Decimals Activity

PRE-ASSESSMENT

<table>
<thead>
<tr>
<th>WHAT DO I KNOW ABOUT FRACTIONS AND DECIMALS?</th>
<th>WHAT AM I UNSURE OF?</th>
<th>WHAT DO I NEED HELP WITH?</th>
</tr>
</thead>
</table>

- Ask students to fill in the proforma to gauge their understanding of fractions and decimals.
- They may use pictures, diagrams or text to explain what they know (approx. 10 minutes). Students pair share what they have written.
- Provide students with a picture of the 100s, 10s and 1s MAB blocks. Give students 5 minutes to write down the names of these blocks. Students discuss their answers with partners.

MODELLED/GUIDED

- Using a prepared SMART notebook, teacher revises the value of each MAB base-10 block. e.g. hundreds, tens, ones etc.
- Introduce the decimal point and revise the value of MAB blocks to the right of the decimal point. e.g. tenths, hundredths etc.
Fraction/Decimal Mat Game

Every child has a laminated mat with a picture of a MAB hundred block (to scale).

- Teacher will call out an amount, for e.g. ‘15 hundredths’.
- Students use concrete MAB materials to place the correct amount on their mat.
- With teacher guidance, students will discuss whether they have a whole number or a fraction.
- Students will write the fraction amount and record the decimal amount.
- Once students become familiar with recording fractions and decimals, they turn their mat over and repeat the same lesson with mixed numerals (fractions and decimals beyond the whole/greater than one).

**Lesson add-ons:** Teacher can ask how many more hundredths are required to make a whole/tenths if need be.
Fractions and Decimals

STRAND AND SUBSTRAND
Number - Fractions and Decimals - Stage 3

SYLLABUS OUTCOMES
MA3-7NA A student compares, orders and calculates with fractions, decimals and percentages.
MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.
MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.
MA3-3WM A student gives a valid reason for supporting one possible solution over another.

NUMERACY LINKS
Numeracy Skills Framework, student are working at end of Stage 3, Focus Area 1, understanding money and finance.

ACTIVITY FOCUS
The purpose of this activity is to continue to build students understanding of decimals and money. They will apply this knowledge to solve multi-step word problems involving money.

Fractions and Decimals Activity 3

LESSON 3 - WORD PROBLEM
Josh went to the Easter Show.
He started the day with $150 in his wallet. His return train ticket cost $8.90, entry into the Easter show cost him $56.00. He went on 5 rides, each ride cost $8. Josh ate a Dagwood Dog, which cost $3.50 and bought a bottle of water for $2.00. Josh went wild in the Show Bag Hall and bought 4 shows bags. Each bag cost $7.00. Josh did not spend any more money that day and caught the train home.

How much money did Josh have left in his wallet at the end of the day?
TEACHING SEQUENCE FOR NUMBER Stage 2 and 3 - Mathematical Problem Solving Reading

PURPOSE
Concord Public School focused on reading and understanding mathematical problems in Stage 3. A major focus was placed on vocabulary and mathematical language, the meanings of words within the problems and in various contexts.

Reading Mathematical Questions

STRAND AND SUBSTRAND
Working Mathematically - Stage 3

SYLLABUS OUTCOMES
MA3-6NA A student selects and applies appropriate strategies for multiplication and division, and applies the order of operations to calculations involving more than one operation.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3, Focus Area 1, estimating and problem solving.

FOCUS ACTIVITY
How to read mathematical questions (focusing on mathematical terminology).
How to Read Mathematical Questions

INTRODUCTION
Explain the learning intention - We are learning about keywords in Mathematics. This is because knowing the language will help us understand and answer questions.

Success Criteria - I can highlight the important words in mathematical problems.

MODELLED/EXPLICIT TEACHING
• Teacher introduces NAPLAN question.
• Teacher reads the questions aloud twice. Upon second reading, teacher highlights/circles important information and underlines key Mathematical terminology.
• Repeat process with three new questions.

Example
A lizard is 11 cm long. A snake is 6 times as long as a lizard. The difference between the length of the snake and the lizard is about:

a) 5 cm    b) 17 cm    c) 66 cm    d) 55 cm

GUIDED/DEVELOPMENT
In small groups, students deconstruct mathematical word problems highlighting important information and underlining key terminology.

ASSESSMENT
Observation of guided activity.
• Can students highlight important information?
• Can students identify key terminology?
• Are students using mathematical language?

RESOURCES
Mathematical language document (Created by colleague, Pascarl El-Hage, used with permission)
NAPLAN past papers
Multi-step worded problems

DIFFERENTIATION
EALD/Special Needs - Explicit definition of mathematical terminology.
Gifted and Talented - Differentiated questions which involve more than two steps.

Newman's Analysis to Problem Solving

TICK OFF NEWMAN’S PROMPTS BELOW AS YOU SOLVE MATHEMATICAL PROBLEMS
☐ Reading: Please read the question to me. Underline key words.
☐ Comprehension: Tell me what the question is asking you to do.
☐ Transformation: Tell me how you are going to find the answer.
☐ Processing skills: Show me what to do to get the answer.
☐ Encoding: Now, write down your answer.
Multi-Step Worded Problems

1. David bought three bags of chocolate with 75 pieces in each one. He plans to divide all the chocolates evenly among seven friends. How many chocolates will David have left for himself?

3. Mustafa wishes to buy 3 gifts that cost 15 dollars, 9 dollars, and 12 dollars. He has \( \frac{1}{4} \) of the money he needs. How much more money must he earn in order to buy the gifts?

5. A cookie factory can bake 62 trays of cookies in the morning and 53 trays of cookies in the afternoon. If each tray holds 12 cookies, how many cookies can be baked in 2 days?

7. The school library has 286 books. If the school librarian buys 12 books each month for five months, how many books will the library have in total?

9. 18 eggs are needed to make an omelette for 6 people, how many eggs are needed to make an omelette for 4 people?

11. The school hall has 8 round tables and 16 rectangular tables. Each round table has 4 chairs, and each rectangular table has 9 chairs. How many chairs are there in total?

13. A comic book store orders 362 copies of the new Marvel comic book for $9.20 per copy. How much money would the store make if they sold half of their copies in the first week?

15. Burwood Bike Shop is having a sale. Racing bikes cost $489. Mountain bikes cost $275. You get a discount of $145 if you buy both bicycles. How much will it cost to buy both bikes?

Problems with Irrelevant Information

1. Erica and her friends had a pizza party. They ordered 8 pizzas. \( \frac{1}{2} \) of the pizzas were large combo pizzas, \( \frac{1}{4} \) of the pizzas were medium specialty pizzas, and \( \frac{1}{4} \) were medium pepperoni pizzas. They also ordered five 2-litre soft drink bottles for $3.50 each. How many medium pepperoni pizzas did Erica and her friends order?

2. Jess earned $3 an hour baby-sitting, and $4 an hour working in the garden. Last week she did baby-sitting for 5 hours and garden work for 3 hours. How much more money does she need to buy a game that costs $35?
<table>
<thead>
<tr>
<th>MATHEMATICAL LANGUAGE - NUMBER &amp; ALGEBRA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EARLY STAGE 1</strong></td>
</tr>
<tr>
<td>K</td>
</tr>
<tr>
<td><strong>Whole Number</strong></td>
</tr>
<tr>
<td><strong>Addition &amp; Subtraction</strong></td>
</tr>
<tr>
<td><strong>Multiplication &amp; Division</strong></td>
</tr>
<tr>
<td>MATHEMATICAL LANGUAGE - MEASUREMENT &amp; GEOMETRY</td>
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<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td><strong>EARLY STAGE 1</strong></td>
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<td><strong>Length</strong></td>
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<tr>
<td><strong>Area</strong></td>
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<tr>
<td><strong>Volume and Capacity</strong></td>
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<tr>
<td><strong>Mass</strong></td>
</tr>
<tr>
<td><strong>Time</strong></td>
</tr>
<tr>
<td>MATHEMATICAL LANGUAGE - STATISTICS &amp; PROBABILITY</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td><strong>EARLY STAGE 1</strong></td>
</tr>
<tr>
<td><strong>STAGE 1</strong></td>
</tr>
<tr>
<td><strong>STAGE 2</strong></td>
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<tr>
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<tr>
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<tr>
<td><strong>Y6</strong></td>
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<table>
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</tr>
<tr>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Chance</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>will happen, might happen, won't happen, probably</td>
</tr>
<tr>
<td>chance, certain, uncertain, possible, impossible, likely, unlikely</td>
</tr>
<tr>
<td>chance, experiment, outcome, random, trials, tally, expected results, actual results</td>
</tr>
<tr>
<td>chance, event, possible, impossible, likely, unlikely, less likely, more likely, most likely, least likely, equally likely, experiment, outcome</td>
</tr>
<tr>
<td>chance, event, likelihood, certain, possible, likely, unlikely, impossible, experiment, outcome, probability</td>
</tr>
<tr>
<td>chance, event, equally likely, experiment, outcome, expected outcomes, random, fair, trials, probability, expected probability, observed probability, frequency, expected frequency, observed frequency</td>
</tr>
</tbody>
</table>
TEACHING SEQUENCE FOR NUMBER Stage 2 and 3 - Multiplication and Division Problems

PURPOSE
Cooma Public School developed the activities below to develop Stage 2 and 3 problem solving strategies in the number strand.

Ordering Numbers and Problem Solving Problems

STRAND AND SUBSTRAND
Number and Algebra - Addition and Subtraction, Whole Numbers - Stage 2

SYLLABUS OUTCOMES
MA2-4NA A student applies place value to order, read and represent numbers up to five-digits.

MA2-5NA A student Uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.

Working mathematically outcomes
MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3, Focus Area 1, applying whole number concepts and applying addition, subtraction, multiplication and division.

FOCUS ACTIVITY
Solving worded problems with Newman's Analysis and complete activities for whole numbers, addition and subtraction.
Newman's Analysis to Problem Solving

TICK OFF NEWMAN'S PROMPTS BELOW AS YOU SOLVE MATHEMATICAL PROBLEMS

☐ Reading: Please read the question to me. Underline key words.
☐ Comprehension: Tell me what the question is asking you to do.
☐ Transformation: Tell me how you are going to find the answer.
☐ Processing Skills: Show me what to do to get the answer.
☐ Encoding: Now, write down your answer.

Example - Tick off Newman’s Prompts to solve the following
The solution to a problem is 50. Write down as many questions that this problem could be? **Give a time limit of 15-20 minutes to get the most questions.** Questions can be numerical involving operations (+ – × ÷) or worded problems.

Three-, Four- or Five-Digit number

**WHAT YOU NEED**
Pack of number cards (0-9)

**INSTRUCTIONS**
1. Students take turns at turning over the first three, four or five cards. They write this number down that has been formed.
2. After writing 5 numbers down, they arrange the numbers in ascending or descending order.
3. Students can also pose the following questions:
   • What is the place value of each number turned?
   • Can you read the number aloud?
   • What number comes next or before?
   • Can you round off the number to the nearest hundredth, thousandth etc.?
   • Can you write the number down in words?

**Extended activity 1**
How many different ways can you write this number?

**Extended activity 2**
What is the highest number?

• Students work in pairs and take turns to turn over the cards.
• Each card they turn over needs to be placed in position and cannot be changed. For example, if they turn over 1 and they put it at the beginning, they cannot change it when they turn over the next number.
• They need to arrange the cards in a way to get the highest number.
• The student with the highest number wins.

You can also work this to obtain the lowest number.

**Extended activity 3**
Subtraction or Addition

Students work in pairs and turn over two- (three-, four- or five-) digit numbers. They can add them together or subtract them. If they are subtracting, make sure they put the higher number on top.

**Example**

```
<table>
<thead>
<tr>
<th>1245</th>
<th>4567</th>
</tr>
</thead>
<tbody>
<tr>
<td>4567</td>
<td>1245</td>
</tr>
</tbody>
</table>
```

**Other examples**

```
134 + 235  2459 + 138  568 – 322  1352 + 168  37049 – 9285
```

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Ordering Numbers and Problem Solving Problems

STRAND AND SUBSTRAND
Number and Algebra - Whole Number - Multiplication and Division - Stage 3

SYLLABUS OUTCOMES
MA3-6NA A student selects and applies appropriate strategies for multiplication and division, and applies the order of operations to calculations involving more than one operation.

Working mathematically outcomes
MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3, Focus Area 1, applying whole number concepts and applying addition, subtraction, multiplication and division.

FOCUS ACTIVITY
Select and apply appropriate mental, written and calculator strategies to solve multiplication and division questions.

Multiplication and Division Strategies

Students need to be aware that there are a number of strategies that they can use to solve multiplication and division questions. More competent students would know that they can use multiplication to solve a problem and division to double check that same question.

Some activities for developing mental computation in multiplication and division are detailed below.

ACTIVITY 1 - DEVELOPING MENTAL COMPUTATION
Dice tables

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<tbody>
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<td>24</td>
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<tr>
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<td>36</td>
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<td>18</td>
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<td>2</td>
<td>30</td>
<td>10</td>
<td>20</td>
<td>3</td>
</tr>
</tbody>
</table>

Instructions
Students in pairs can play a game of Dice Tables.

• The two students need three 1 to 6 dot dice, 2 sets of coloured counters and a Dice tables board.

• The first player rolls the dice and chooses two of the three numbers to multiply to match a number on their Dice tables board, e.g. if the student rolls 4, 5 and 3 they could make $4 \times 5 = 20$ or $4 \times 3 = 12$ or $5 \times 3 = 15$.

• They place a counter on the chosen multiple. Students alternate turns.

• The aim is to be the first to get 4 counters in a row, column, diagonal or square.

DICE TO 100
Students in pairs can play a game of Dice to 100.

• Two students need two 1 to 6 dot dice.

• The students take turns to roll two dice and multiply the numbers. The total for each round is added onto the previous round. The first person to 100 is the winner.

• Variation: Use a 10- or 12-sided dice and a larger target number.
ACTIVITY 2 - HALVING AND DOUBLING

Introduce halving and doubling as strategies that can be used to solve multiplication and division problems involving three-digit numbers.

<table>
<thead>
<tr>
<th>HALVING</th>
<th>DOUBLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>• is a division strategy</td>
<td>• is a multiplication strategy</td>
</tr>
<tr>
<td>• can be used to when you have to divide by 2, 4, 8 etc.</td>
<td>• can be used to when you have to multiply by 2, 4, 8 etc.</td>
</tr>
</tbody>
</table>

Work through examples to demonstrate the strategy

To divide an even three-digit number by 4, students could find half of the number and halve again.

Example: To find the answer to 324 divided by 4.

Ask
- Can you use the halving or doubling strategy to find the answer?
- How would you use this strategy?
- What is half of 324? (162) Is this the answer to the question?
- What is half of 162?

To divide a number by 5, students could divide by 10 and double the answer.

Example: To find the answer to $4 divided by 5

$4 is shared equally among 5 girls.

How much does each girl get?

Ask
- 1. Can you use the halving or doubling strategy to find the answer?
- 2. How would you use this strategy?
  (divide by 10 then double)
- 3. What is $4/$4.00 divided by 10? (40c)
- 4. What is double 40?

ACTIVITY 3 - SOLVING WORD PROBLEMS

Pose this problem for the students to solve

On the way to school four children found a $50 note. They handed it to the school principal. They will each get an equal share of the money if no one claims it.

Investigate the strategies used by asking these questions

- How much would each child get?
- What strategy did you use to find each share?
- Can you use doubling or halving?
- Which operation would you use to check if your answer is correct?
- How much would each child get if $5 was found?
- How much would each child get if 50c was found?

Repeat using other division problems, each time discussing the strategies the students used. Emphasise that students should use multiplication to check their answers to division problems.

Pose this problem for the students to solve in pairs

It takes four oranges to fill a small juice bottle with juice. If I bought a box containing 93 oranges, how many bottles could be filled? How many oranges left over?

- Students in pairs, discuss how they would solve this problem.
- They determine two different strategies that could be used.
- Each pair explains the two strategies they would use.

Students are then presented with a variety of multiplication and division problems involving three- and four-digit numbers. Students first estimate their answer before solving, to compare mental and written strategies.

Students discuss the strategies they used and determine which strategy is the most efficient.

Discuss
- How accurate was your estimation?
- How did your estimation help?
- Which operation did you use?
- Can you describe your strategy?
- Is your strategy efficient?
- How did you check whether your answer is correct?

Students can write other word problems for their partner to solve. Check their answers with a calculator.
PURPOSE
Banora Point implemented the activities to develop Stage 3 students' problem solving skills.
Problem Solving Strategies
- Draw a Diagram or Picture

STRAND AND SUBSTRAND
Number - Single and Multi-Step Problem Solving - Stage 3

SYLLABUS OUTCOMES
Working mathematically outcomes
MA3-5NA A student selects and applies appropriate strategies for addition and subtraction with counting numbers of any size.
MA3-6NA A student selects and applies appropriate strategies for multiplication and division, and applies the order of operations to calculations involving more than one operation.
MA3-8NA A student analyses and creates geometric and number patterns, constructs and completes number sentences, and locates points on the Cartesian plane.
MA3-3WM A student gives a valid reason for supporting one possible solution over another.
MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3, Focus area 1 estimating and problem solving.
Numeracy Skills Framework, Focus Area 2, patterns and algebraic reasoning, Stage 3.
Numeracy Skills Framework, Focus Area 3, measurement and time calculations, Stage 3.
Numeracy Skills Framework, Focus Area 5, graphical representation and data analysis, Stage 3.

FOCUS ACTIVITY
Solves problems by using problem solving strategies, whilst following Newman’s Prompts (Resource 1) and also by looking at other strategies (Resource 2).

Drawing a diagram to solve a problem helps students visualise the problem at different stages of the question. It can make the question clearer to understand and solve.

Ask students to discuss what they think drawing a diagram means? When is it appropriate to draw a diagram?

Draw a diagram to solve a problem

1. Read and understand the problem
2. Underline key words
3. Determine a solution
4. Check that your answer makes sense
ACTIVITY

Are the problems below suitable for a diagram? Allow students some think time to come up with their answer (think, pair, share). Get them to explain their reasoning.

<table>
<thead>
<tr>
<th><strong>PROBLEM</strong></th>
<th><strong>SOLUTION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>How many markers would be needed for a 100 metre race if you placed two markers at every ten-metre point?</td>
<td></td>
</tr>
<tr>
<td>There are 25 people on a train. At the next stop 10 people get off the train and 4 people get on. How many people are now on the train?</td>
<td></td>
</tr>
</tbody>
</table>

Look at number tile question below - Go through Newman’s Prompts (Resource 1) to solve it.

**Number tile problem**

The number tiles below need to be arranged into a 3-tile sided square so that each side of the square adds up to a total of 11.

![Number tiles]

**Development/Group work**

Place students in small groups and support them in using the draw a diagram or picture strategy while following Newman’s Prompts to solve a variety of problems.

**Problem Solving Strategies - Guess and Check**

The guess and check strategy to solve a problem is used to guess an answer and then the students check to see whether it gives a correct solution. Ask students to discuss what they think Guess and Check means? When is it appropriate to use Guess and Check?

**Guess and check/trial and error to solve a problem**

1. **Read and understand the problem**
2. **Underline key words**
3. **Guess/trial an answer**
4. **Check the solution**
5. **Does your answer make sense?**
**ACTIVITY**
How can you solve the problem below by working backwards? Allow students some think time to come up with their answer (think, pair, share). Get them time to explain their reasoning.

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A number multiplied by 3 is subtracted from 20 to give you a solution of 2. What is the number?</td>
<td>We take a number and add 7, multiply 7, take away 7 and finally divide by 7 and the result is 7. What was the original number?</td>
</tr>
</tbody>
</table>

**Problem Solving Strategies - Working Backwards**

The working backwards strategy is usually used when we know the final solution but need to work out where we initially started. Ask students to discuss what they think Working Backwards means? When is it appropriate to use Working Backwards?

**Working backwards to solve a problem**

1. **Read and understand the problem**
2. **Underline key words**
3. **Work out an answer**
4. **Check the solution by substitution**
5. **Does your answer make sense?**

**ACTIVITY**
How can you solve the problems below by working backwards? Allow students some think time to come up with their answer (think, pair, share). Get them time to explain their reasoning.

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A number multiplied by 3 is subtracted from 20 to give you a solution of 2. What is the number?</td>
<td>We take a number and add 7, multiply 7, take away 7 and finally divide by 7 and the result is 7. What was the original number?</td>
</tr>
<tr>
<td>Lisa boarded a train. At the next station, another 3 people got on and 5 got off. There are now 3 people on the train. How many were initially on when Lisa boarded?</td>
<td>We take a number and add 7, multiply 7, take away 7 and finally divide by 7 and the result is 7. What was the original number?</td>
</tr>
</tbody>
</table>
**Problem Solving Strategies - Use a Table**

Creating a table to solve a problem helps students analyse the information given to them in a more organised format. Ask students to discuss what they think using a table means? When is it appropriate to use a table?

**ACTIVITY**

How can you solve the problem below by using a table? Allow students some think time to come up with their answer (think, pair, share). Get them time to explain their reasoning.

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 students in a class were asked how they travel to school. 5 students said that they caught the bus. Twice as many students said they walked. A third of the class rode a bike and the rest said they travelled by car. How many travelled by car?</td>
<td><strong>TRAVEL TO SCHOOL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bus</td>
</tr>
<tr>
<td></td>
<td>Walk</td>
</tr>
<tr>
<td></td>
<td>Bike</td>
</tr>
<tr>
<td></td>
<td>Car</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Use a table to solve a problem**

- Read and understand the problem
- Underline key words
- Create a table and organise information
- Answer the question
- Does your answer make sense?
Newman's Error Analysis Resource 1

Name: ____________________  
Class: ____________________

Students use the following Newman’s Prompts to answer mathematical problems.

<table>
<thead>
<tr>
<th>NEWMAN’S PROMPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reading</strong></td>
</tr>
<tr>
<td>Please read the question to me. Underline key words.</td>
</tr>
<tr>
<td><strong>Comprehension</strong></td>
</tr>
<tr>
<td>Tell me what the question is asking you to do.</td>
</tr>
<tr>
<td><strong>Transformation</strong></td>
</tr>
<tr>
<td>Tell me how you are going to find the answer.</td>
</tr>
<tr>
<td><strong>Processing Skills</strong></td>
</tr>
<tr>
<td>Show me what to do to get the answer.</td>
</tr>
<tr>
<td><strong>Encoding</strong></td>
</tr>
<tr>
<td>Now, write down your answer.</td>
</tr>
</tbody>
</table>
Problem Solving Math Strategies Resource 2

MATH STRATEGIES

1. Draw a graph
2. Guess and check
3. Brainstorm ideas and record
4. Use objects or act it out
5. Write a number sentence
6. Look for a pattern
7. Create a list
8. Simplify the problem
9. Use logical reasoning
10. Work backwards
TEACHING SEQUENCE FOR APPLYING WHOLE NUMBER CONCEPTS AND UNDERSTANDING MONEY Stage 2

PURPOSE
The purpose of this sequence of activities is to develop students’ understanding of how to use money, convert different measurements and problem solve using Newman’s prompts. Quakers Hill East Public School implemented these activities with their Stage 2 students.

STRAND AND SUBSTRAND
Number - Fractions and Decimals - Whole Number - Stage 2

SYLLABUS OUTCOMES

MA2-7NA A student represents, models and compares commonly used fractions and decimals.

MA2-5NA A student uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, mental computation and numerical reasoning, applying whole number concepts and understanding money and finance.

ACTIVITY FOCUS
Whole number and place value.
Introduction

LESSON 1
Reviewing whole number place value.

Explain that numbers before the decimal represent whole numbers and numbers after the decimal point represent part of a whole.

Explain that numbers after the decimal when using money represents tenths (cents) and hundredths (hundredths of a cent).

Using individual whiteboards, instruct the students to represent coins in decimal format e.g. 20c = $0.20.

Explore why we do not write the ‘c’ at the end of the decimal notation.

Differentiation
Explore mixed dollars and cents e.g. $4.25

Pose the question
How many cents are there in e.g. $4.25

Cents and dollars matching activity.
Students match dollar value with equivalent cent value.

Cents and Dollars Matching Activity
Cut out and match the dollar value to the cents value.

<table>
<thead>
<tr>
<th>$4.25</th>
<th>425c</th>
</tr>
</thead>
<tbody>
<tr>
<td>$7.35</td>
<td>3540c</td>
</tr>
<tr>
<td>$10.28</td>
<td>15274c</td>
</tr>
<tr>
<td>$35.40</td>
<td>735c</td>
</tr>
<tr>
<td>$5.24</td>
<td>524c</td>
</tr>
<tr>
<td>$33.85</td>
<td>3385c</td>
</tr>
<tr>
<td>$152.74</td>
<td>1028c</td>
</tr>
<tr>
<td>$85.50</td>
<td>8550c</td>
</tr>
<tr>
<td>$15.45</td>
<td>1545c</td>
</tr>
<tr>
<td>$528.50</td>
<td>52850c</td>
</tr>
</tbody>
</table>
### Shopping Task

**TASK**
You have been asked by your parents to go to the shop and purchase at least 3 items to have for your lunch. What is the total cost for your lunch?

<table>
<thead>
<tr>
<th>Items (Glue pictures of items with their prices in the boxes below)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

What is the total sum of your purchase? Use the space below to show your working out.

Total

---

*NSW Department of Education 2017 | Numeracy Activities and Lesson Sequences K-10*
Consolidation Activity

LESSON 2

Guided

a) Show pictures of 3 objects with price tags.

Pose the questions

• If I wanted to purchase these items, what calculation would I need to do?
• How would I write it as an algorithm?
• What steps do I need to do to find the answer?

b) Using individual whiteboards, students write the algorithm and calculate the total.
c) Repeat with other examples.

Example 1

Strategy box: My thinking

Example 2

Strategy box: My thinking
TEACHING SEQUENCE FOR APPLYING WHOLE NUMBERS AND UNDERSTANDING PLACE VALUE Stage 2

PURPOSE
The purpose of this sequence of activities is to develop students’ understanding of whole numbers and place value. They will manipulate the MAB blocks to model three-, four- and five-digit numbers. McCallums Hill Public School implemented these activities with their Stage 2 students.

STRAND AND SUBSTRAND
Number - Whole Number - Place Value - Stage 2

SYLLABUS OUTCOMES
MA2-4NA A student applies place value to order, read and represent numbers up to five-digits.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, applying whole number concepts, Stage 2.

ACTIVITY FOCUS
Recognise and model numbers to at least ten thousand. Model understanding of numbers using flash cards and MAB blocks.
Number Flashcards

**TASK**
Students have a variety of three-, four- and five-digit number cards (according to ability). The number is on one side of the card and the written form on the other. One student looks at a digit and reads it out loud, the other student checks the number by looking at the written form on the back of the card.

Making Numbers

**TASK**
Students can be grouped in pairs or groups of 3-5 students.

Each group has a place value chart (up to five-digits) and a deck of cards or a set of numeral cards.

Each student chooses 3 cards and lays them on the place value chart to represent the number.

Each student in the group attempts to model this number using MAB blocks.

Students check with each other to see if they agree on a model. If models differ, students should discuss variations until they come to an agreed model.

**Variations**
- Easier - Make numbers that are 2-3 digits.
- Harder - Make numbers that are five-digits and beyond.

Recognising Numbers

**ACTIVITY**
Use the following link to complete the interactive activity. Students create three-digit numbers using digital MAB blocks.

**Website link**

Students work through the game in small groups with the IWB or iPads.

Type how many hundreds, tens, and ones. Then type the number and click check.
Number Sliders

<table>
<thead>
<tr>
<th></th>
<th>HUNDREDS</th>
<th>TENS</th>
<th>ONES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cut top and bottom slit</td>
<td>Cut top and bottom slit</td>
<td>Cut top and bottom slit</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4</td>
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<td></td>
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<tr>
<td>5</td>
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<td></td>
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<tr>
<td>6</td>
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<td>7</td>
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<td></td>
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<tr>
<td>8</td>
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<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TEACHING SEQUENCE FOR UNDERSTANDING PLACE VALUE Stage 3

PURPOSE

The purpose of this sequence of activities is for students to develop an understanding of place value and whole numbers. Students will learn how to read, write and order numbers up to five-digits. They will learn to understand the place value system. Springdale Heights Public School implemented these activities with their Stage 3 students.

STRAND AND SUBSTRAND

Number - Whole Number - Stage 3

SYLLABUS OUTCOME

MA3-4NA A student orders, reads and represents integers of any size and describes properties of whole numbers.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

NUMERACY LINKS

Numeracy Skills Framework, Aspects of Numeracy, Focus Area 1, applying whole number concepts, Stage 2.

ACTIVITY FOCUS

Reads, orders and represents numbers up to five-digits.
Rolling Numbers Activity

**TASK**
Step 1: Roll 5 dice and record the numbers.
Step 2: Rearrange these numbers to make 10 different numbers in the place value table.
Step 3: Order these numbers in ascending order.
Step 4: Represent your largest and smallest numbers with pictures and words.

**Recording sheet**

<table>
<thead>
<tr>
<th>PLACE VALUE TABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tens of thousands</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ORDERED NUMBERS - IN ASCENDING ORDER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
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<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td>SMALLEST NUMBER</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Picture</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Words</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LARGEST NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Words</th>
</tr>
</thead>
</table>

Sorting Number Words Activity

**TASK**
Students each receive a pile of words (written numbers 0-9, tens, hundreds, thousands, written multiples of ten). The teacher holds up a number and students must make this number with their pile of words.

* e.g. 4523

<table>
<thead>
<tr>
<th>four</th>
<th>thousands</th>
<th>five</th>
<th>hundreds</th>
<th>two</th>
<th>tens</th>
<th>three</th>
<th>ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>zero</td>
<td>zero</td>
<td>zero</td>
<td>zero</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>one</td>
<td>one</td>
<td>one</td>
<td>one</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>two</td>
<td>two</td>
<td>two</td>
<td>two</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>three</td>
<td>three</td>
<td>three</td>
<td>three</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>four</td>
<td>four</td>
<td>four</td>
<td>four</td>
<td></td>
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<td>five</td>
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<td>six</td>
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<td>six</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>seven</td>
<td>seven</td>
<td>seven</td>
<td>seven</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eight</td>
<td>eight</td>
<td>eight</td>
<td>eight</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nine</td>
<td>nine</td>
<td>nine</td>
<td>nine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>units</td>
<td>units</td>
<td>units</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tens</td>
<td>tens</td>
<td>tens</td>
<td>tens</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hundreds</td>
<td>hundreds</td>
<td>hundreds</td>
<td>hundreds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>thousands</td>
<td>thousands</td>
<td>thousands</td>
<td>thousands</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Brookvale Public School implemented these activities to improve student understanding of place value and problem solving using the four operations across Stage 3.

**Place Value Introduction**

**STRAND AND SUBSTRAND**

Number - Whole Number - Stage 3

**SYLLABUS OUTCOME**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA3-4NA</td>
<td>A student orders, reads and represents integers of any size and describes properties of whole numbers.</td>
</tr>
<tr>
<td>MA2-1WM</td>
<td>A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.</td>
</tr>
<tr>
<td>MA2-2WM</td>
<td>A student selects and uses appropriate mental or written strategies, or technology, to solve problems.</td>
</tr>
<tr>
<td>MA2-3WM</td>
<td>A student checks the accuracy of a statement and explains the reasoning used.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA3-1WM</td>
<td>A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.</td>
</tr>
<tr>
<td>MA3-2WM</td>
<td>A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.</td>
</tr>
</tbody>
</table>

**NUMERACY LINKS**

Numeracy Skills Framework, student are working at Stage 3, Focus Area 1, applying whole number concepts.

**FOCUS ACTIVITY**

Introducing and re-capping place value.
Place Value Activity

1. Revise language associated with place value e.g. digit, numerals, number, place value columns, less than, more than, units, ones, tens, hundreds, thousands, ten thousand, hundred thousand, millions, tenths, hundredths, thousandths, decimals, decimal point.

2. Focus on practising expanded notation and partitioning of numbers. Differentiate numbers used for various groups.

   Example:

<table>
<thead>
<tr>
<th>EXPANDED NOTATION</th>
<th>PARTITIONING</th>
</tr>
</thead>
<tbody>
<tr>
<td>153 480 = 100 000 + 50 000 + 3000 + 400 + 80</td>
<td>153 480 could be partitioned as 150 000 + 3 480</td>
</tr>
</tbody>
</table>

3. Students create facts about a certain number. Example:

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>FACTS</th>
</tr>
</thead>
</table>
   | 98     | • 9 tens  
   |        | • 8 units  
   |        | • Less than 100  
   |        | • More than 97  
   |        | • 2 less than 100  
   |        | • 8 more than 90 |

4. Progress to larger numbers involving numbers with millions and decimals if appropriate.

5. Discuss how in America they often say numbers in different ways than we do. e.g. 1200 is said as 'twelve hundred'. Discuss and practise other examples such as 900 = 90 tens. For less able students, focus on smaller numbers and using concrete BASE blocks to assist with understanding.

6. Practise converting between place values e.g. 100 ones = ? tens, 30 hundreds = ? thousands.

Place Value Guess Who?

STRAND AND SUBSTRAND
Number - Whole Number - Stage 3

SYLLABUS OUTCOME
MA3-4NA  A student orders, reads and represents integers of any size and describes properties of whole numbers.

MA2-1WM  A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-2WM  A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

MA2-3WM  A student checks the accuracy of a statement and explains the reasoning used.

MA3-1WM  A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-2WM  A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3, Focus Area 1, applying whole number concepts.

FOCUS ACTIVITY
Solves word problems involving place value.
### Place Value Guess Who?

**INSTRUCTIONS**

1. Working in pairs, students to think of a number and describe it to their partner using clues about its place value. Other partner to guess their number.

2. Place Value Guess Who? - Students to be given differentiated task cards containing clues about a number. Students need to collaborate to work out answers (Examples below).

3. Focus on associated language, highlighting important information about the problem.

4. Demonstrate the importance of trial by error and recording in a systematic way (Working out sheet below).

5. Create your own riddle/Guess who questions (Template below).

### Guess Who? Examples

#### Example 1

<table>
<thead>
<tr>
<th>1. I am a two-digit number. I have a 4 in the tens column. I have a 3 in the units place. What number am I?</th>
<th>2. I am a two-digit number. I have a 5 in the tens column and a 7 in the ones place. What number am I?</th>
<th>3. I am a number that is greater than 46 but less than 49. I am an odd number. What number am I?</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. I am greater than 12. I am less than 25. I have a 7 in the ones column. What number am I?</td>
<td>5. I am less than 36. I am greater than 23. I have an 8 in the units column. What number am I?</td>
<td>6. I am less than 99. I am greater than 23. I have an 8 in the units column. What number am I?</td>
</tr>
<tr>
<td>7. I am a three-digit number with a 5 in the tens place. I am less than 200. I have a 3 in the ones column. What number am I?</td>
<td>8. I am a three-digit number that is between 200 and 285. The digit in the units column is the same as in the hundreds column. The number in the tens place is 6. What number am I?</td>
<td>9. I am less than 46 but more than 39. I have no units. What number am I?</td>
</tr>
</tbody>
</table>

#### Example 2

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Convert Between Place Values 45 000 = ? thousands</td>
<td>8. Convert Between Place Values 87 000 = ? thousands</td>
<td>9. Convert Between Place Values 91 000 = ? thousands</td>
</tr>
</tbody>
</table>
### Example 3

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I am a four-digit number. All my digits are the same. I am a multiple of 5. What number am I?</td>
</tr>
<tr>
<td>2.</td>
<td>I am a three-digit number. My tens and units digit are the same. They are the sum of 2 + 2. My hundred digit is 7. What number am I?</td>
</tr>
<tr>
<td>3.</td>
<td>I am less than 485 but more than 476. My units and tens are the same. What number am I?</td>
</tr>
<tr>
<td>4.</td>
<td>I am a number that is less than 1000. I have 80 tens. The digit in the units is that same as the digit in the tens. What number am I?</td>
</tr>
<tr>
<td>5.</td>
<td>I have thirteen hundreds, no tens and just one unit. What number am I?</td>
</tr>
<tr>
<td>6.</td>
<td>I am an even number. I am divisible by 4. In the tens place I have a 3. The digit in the units starts with the letter 'T'. What number am I?</td>
</tr>
<tr>
<td>7.</td>
<td>I am a multiple of 7. I am a number between 69 and 57. What number am I?</td>
</tr>
<tr>
<td>8.</td>
<td>I am a multiple of both 2 and 10. I am a number between 11 and 28. What number am I?</td>
</tr>
<tr>
<td>9.</td>
<td>I have no hundreds. The digit in the tens place is the same as the hundreds. The digits in the thousands and units are the same as well. This digit is divisible by 7. What number am I?</td>
</tr>
</tbody>
</table>

### Example 4

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I have two decimal places. The digit in the tens, units and tenths column is the same. The hundredths is different. If I added 2 more hundredths, I would be a whole number. What number am I?</td>
</tr>
<tr>
<td>2.</td>
<td>I am a multiple of five. I'm not a multiple of ten. My tens digit is half of my thousands digit. What number am I?</td>
</tr>
<tr>
<td>3.</td>
<td>I am less than 5000. I am not an odd number. My hundreds digit is not zero. The sum of the thousands and hundreds digit is 3. What number am I?</td>
</tr>
<tr>
<td>4.</td>
<td>I am a seven-digit number. All my digits are the same. The sum of all the digits is 21. What number am I?</td>
</tr>
<tr>
<td>5.</td>
<td>I have no tens and no units. The sum of my tenths and hundredths digits is 8. Both of these digits are the same. What number am I?</td>
</tr>
<tr>
<td>6.</td>
<td>I am a number with millions. The millions digit is 1. Each digit increases by 1 in each place value column. My ones are 7. What number am I?</td>
</tr>
<tr>
<td>7.</td>
<td>I am a prime number. My hundred and unit digits are the same. I am less than 107. What number am I?</td>
</tr>
<tr>
<td>8.</td>
<td>I have 70 tens. My tens digit and my units digit are the same. That number is one more than four. What number am I?</td>
</tr>
<tr>
<td>9.</td>
<td>I am a four-digit number. I am an odd number. I am also a multiple of 5. I have 3645 ones. What number am I?</td>
</tr>
</tbody>
</table>
### Example 5

1. I am a number that contains tenths, hundredths and thousandths with no units. The sum of these digits is 14. What number am I?

2. I am a three-digit number that also has two decimal places. One more hundredth would equal 297. What number am I?

3. I have 94 hundreds. The digit in the units column is three less than the digit in the tens column. The tens digit is 9. What number am I?

4. All of my digits are divisible by 9. I am a six-digit number. What number am I?

5. I am a six-digit number with no hundreds, tens or thousands. The other digits are multiples of 7. What number am I?

6. I am a three-digit palindromic number. The sum of all the digits is 7. What number am I?

7. I am a five-digit palindromic number. My middle digit is 6. The tens and units digits total 17. What number am I?

8. I have 46 hundreds. The digit in the ones place is the same as in the thousands. I have no tens. What number am I?

9. I am a seven-digit number. My thousands digit is 7. My ones digit is 2. I am a palindromic number. What number am I?

### Example 6

1. What is the greatest three-digit number whose digits total 15? What number am I? Justify your answer

2. What is the greatest three-digit number whose digits total 19? What number am I? Justify your answer

3. What is the greatest four-digit number whose digits total 16? What number am I? Justify your answer

4. What is the greatest four-digit number whose digits total 21? What number am I? Justify your answer

5. The product of two whole numbers is 72 and their sum is less than 30. What are the possibilities for the two numbers? What number am I? Justify your answer

6. What is the smallest three-digit number whose digits total 13? What number am I? Justify your answer

7. What is the smallest three-digit number whose digits total 17? What number am I? Justify your answer

8. What is the smallest four-digit number whose digits total 25? What number am I? Justify your answer

9. What is the smallest five-digit number whose digits total 34? What number am I? Justify your answer
Guess Who? Template

Create your own Guess Who and Riddles Questions.

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</table>
## Place Value Guess Who? Working Out Sheet

<table>
<thead>
<tr>
<th>QUESTION NUMBER</th>
<th>WORKING OUT</th>
<th>ANSWERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Remember to show all of your thinking. How did you work out the answer?</td>
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</table>
Multi-Step Word Problems Involving Addition and Subtraction with Money

STRAND AND SUBSTRAND
Number - Addition and Subtraction - Stage 2 and 3

SYLLABUS OUTCOMES
MA2-5NA A student uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.
MA3-5NA A student selects and applies appropriate strategies for addition and subtraction with counting numbers of any size.
MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3, Focus Area 1, applying addition, subtraction, multiplication and division.

FOCUS ACTIVITY
Solves multi-step word problems involving addition and subtraction with money.

INTRODUCTION
1. Revise vocabulary and concepts associated with addition, subtraction, money and purchasing goods or services. E.g. gives, purchases, buys, change, items, addition, subtracts, shop owner, dollars, cents, cost, EFTPOS, price tag, sale items, total.
2. Review the various addition and subtraction strategies e.g. vertical, split and jump and discuss where and when they are useful to use as both written and mental strategies.
3. Practise adding three amounts of numbers and then three amounts of decimal numbers/money.

TEACHING ACTIVITY
1. Set up a shop with items to buy. Teacher as the shop owner with one volunteer as the shopper. (Price tag template below)

Worded Problems - Stage 2

INTRODUCTION
2. Volunteer purchases at least three items, clearly labelled with prices, some with just dollars, some with dollars and cents.
3. Pose various simple questions to the class. E.g.
   a) How much would it cost to purchase all three items?
   b) If I bought item 1, how much change would you receive from $10?
   c) Which is the cheapest item? The most expensive? What is the difference in price between the cheapest and most expensive item?
4. Progress to more complex questions. E.g.
   a) How much would all the three items cost?
   b) How much change would you get from $40 brought all three items?
   c) Your mum gives you $20 to spend, she expects $12 back, what two items could you buy?
Price Tag Template
**Worded Problems - Stage 3**

**INSTRUCTIONS**

1. Students to create their own shop in class using real items and money resources.
2. All students take turns in being the buyer and shop owner.
3. Shop owner must add items together and give correct change using subtraction methods.
4. Students to use task cards with instructions on how much money they have and what they need to buy. E.g. You have $10 to spend and you have to buy a t-shirt and a hat.

Examples below: These can be adjusted depending on items in your shop.

5. Task cards can be differentiated e.g.
   a) Lower ability - You have $10 to buy a t-shirt and $5 to buy a pen, how much have you spent?
   b) Higher ability - You have to purchase five different items with a larger amount of money, how much change would you get? Also, they have to visit different shops to get value for money.

6. Higher ability students to use mental calculations and then a calculator to check answers. Lower ability to use whiteboards to complete calculations.

7. Extension for Higher ability - Summer Sale! All items are reduced by 10%, 25% & 50% what are their new prices? Examples on Task Cards below.

---

**Shopping Task Cards**

<table>
<thead>
<tr>
<th>You must buy a hat and a t-shirt. How much have you spent?</th>
<th>You have $15 to spend. Name two items that you could afford to buy.</th>
</tr>
</thead>
<tbody>
<tr>
<td>You have $10 to spend. How much change would you get if you bought a pen?</td>
<td>You are given $20 pocket money to buy any two items that you want. You must though give your mum at least $12 change back. What two items could you buy?</td>
</tr>
<tr>
<td>You have lost your hat and need to buy a new one. You also see a t-shirt that you like. How much will that cost you?</td>
<td>You need to buy two pens, a ruler and a pencil. You only have a $20 note. How much change should you get back from the shop owner?</td>
</tr>
<tr>
<td>It was recently your birthday and you are rich! Go and buy the five most expensive items. How much money have you spent?</td>
<td>You purchase all the items in the shop. How much have you spent?</td>
</tr>
</tbody>
</table>
### THE SUMMER SALE IS ON!
All items are further reduced by 10%

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>The summer sale is on. What is the new price for a pencil?</td>
<td>You buy a jumper, a hat and a t-shirt. You give the shop owner $30.</td>
</tr>
<tr>
<td></td>
<td>How much change will you get?</td>
</tr>
<tr>
<td>You start the day with $50. On your visit to the shop, you decide to</td>
<td>You go to the shop with $10.</td>
</tr>
<tr>
<td>purchase three pencils and a hat. Later in the day you go back to the</td>
<td>You would like to buy a pencil and a ball. You must also have at least $3.40 to get the bus home later on.</td>
</tr>
<tr>
<td>shop to buy a drink and a chocolate bar. How much money do you have</td>
<td>Can you purchase both items?</td>
</tr>
<tr>
<td>left?</td>
<td></td>
</tr>
<tr>
<td>It is the end of the school year and because you like your teachers so</td>
<td>You would like to buy a ball and a ruler. You have $20 to spend.</td>
</tr>
<tr>
<td>much you want to buy them a gift with your $5 pocket money. You decide</td>
<td>Can you afford it?</td>
</tr>
<tr>
<td>to buy them a pencil. What change do you have?</td>
<td></td>
</tr>
<tr>
<td>Could you afford to buy them anything else?</td>
<td></td>
</tr>
<tr>
<td>What is the cheapest item at the shop?</td>
<td>What is the most expensive item at the shop?</td>
</tr>
</tbody>
</table>

### BOXING DAY SALE!
All items are 50% reduced in price

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much would a hat and a ball cost in the Boxing Day sale?</td>
<td>You have $10 to spend. You must buy a hat and a t-shirt.</td>
</tr>
<tr>
<td></td>
<td>How much have you spent?</td>
</tr>
<tr>
<td>You have been invited to a birthday party and you want to bring a</td>
<td>You go to the shop to ask for change for the bus.</td>
</tr>
<tr>
<td>present. What items could you afford if you have $20 to spend on one</td>
<td>You give the shopkeeper a $5 note.</td>
</tr>
<tr>
<td>present?</td>
<td>What combination of coins could they give you?</td>
</tr>
<tr>
<td>Select any two items to buy. How much change should you get from $20?</td>
<td>Select any three items to buy. How much change should you get from $30?</td>
</tr>
<tr>
<td>Select any four items to buy. How much change should you get from $30?</td>
<td>Select four items that you think you could afford with $20 to spend.</td>
</tr>
<tr>
<td></td>
<td>How much will it cost and how much can you save?</td>
</tr>
</tbody>
</table>
The Amazing Race Task

**STRAND AND SUBSTRAND**
Number - Addition and Subtraction - Stage 3

**SYLLABUS OUTCOMES**
MA3-5NA A student selects and applies appropriate strategies for addition and subtraction with counting numbers of any size.
MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.
MA2-3WN A student checks the accuracy of a statement and explains the reasoning used.

**NUMERACY LINKS**
Numeracy Skills Framework, student are working at early Stage 3, Focus Area 1, applying addition, subtraction, multiplication and division.

**FOCUS ACTIVITY**
Solves multi-step word problems involving addition and subtraction with money.

### THE AMAZING RACE TASK CARDS

Solve a variety of problems mentally, using the vertical strategy and split strategy.

<table>
<thead>
<tr>
<th><strong>SOLVE THESE PROBLEMS MENTALLY</strong></th>
<th><strong>USING THE SPLIT STRATEGY, SOLVE THIS PROBLEM</strong></th>
<th><strong>USING THE VERTICAL STRATEGY, SOLVE THESE PROBLEMS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Peter decided to buy a new hat. Hats were on sale at Target for 10% off. The hat he wanted to purchase was $29.95. After purchasing the hat, how much did he save because of the sale?</td>
<td>Mia loves swimming. She decided to buy a pair of goggles and a swimming cap. The goggles cost $17.88 and the cap cost $15.99. When she took them to the till, the goggles were half price! How much did Mia spend altogether?</td>
<td>Terry and three mates went to the football game. Terry bought four colas and 4 hotdogs for everyone. The total cost of the drinks was $16.40. The hotdogs cost $6.50 each. Two mates went back to get one more of each for themselves. How much in total was spent at the football game?</td>
</tr>
<tr>
<td>Harry had $30 and Jack had $45. At the mall, Jack spent $10 on a new DVD, $5.50 on lollies and gave away $4 to a charity. How much does he have left over?</td>
<td>Jason decided to spend $4.60 on hair products, $15.00 on a DVD, $69.95 on a new video game and also give $13.50 to a charity. How much did he spend altogether?</td>
<td>Jacob decided to purchase a new TV worth $5,687.99 at the Tech Store. He just recently purchased a new sound system for $355.98 for the TV. Jacob also decided to purchase a new entertainment unit from the Tech Store for $498.44 that was on sale. How much did Jacob spend at the tech store altogether?</td>
</tr>
<tr>
<td>Brad wants to buy a t-shirt for $5.75. He also wants to buy two pairs of socks for $2 each. One of the pairs had a hole in them and so he decides to return them. In total, how much did he spend?</td>
<td>Stephanie received $15.25 for babysitting on Friday night, $17.75 for Saturday night and $14.35 for Sunday afternoon. How much did she make in total?</td>
<td>Jessica has $25.00 to spend in the video game store. First, she returns a game that was worth $15.95. Next, she buys a used game for $15.83. How much money does she have left over?</td>
</tr>
<tr>
<td>Sol buys a candy bar for $1. He also buys some gum for 50c. How much in total will he spend?</td>
<td>Tom buys a pair of shorts for $13. He also buys a pair of socks for $2. How much change will he receive from $20?</td>
<td>Harry had $30. At the mall, he spent $10 on a new DVD, $5.50 on lollies and gave away $4 to a charity. How much does he have left over?</td>
</tr>
</tbody>
</table>
PURPOSE
This teaching sequence was developed by Blacktown North Public School for Stage 3 students. The focus is on comparing fractions and the whole class creating a fraction wall.

Fraction Wall

STRAND AND SUBSTRAND
Number - Fractions, Decimals and Percentages - Stage 3

SYLLABUS OUTCOMES
MA3-7NA  A student compares, orders and calculates with fractions, decimals and percentage.

MA3-1WM  A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-2WM  A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

MA3-3WM  A student gives a valid reason for supporting one possible solution over another.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3, Focus Area 1, understanding fractions, decimals and percentages.

ACTIVITY FOCUS
Compare the relative size of fractions drawn on the same diagram.
Fraction Wall Activity

INSTRUCTIONS
• Divide the class in groups of 3.
• Give each group a square piece of paper. One group has to keep the sheet as it is as one whole.
• The next group folds the sheet in two halves.
• The next folds it in four quarters.
• The next group folds it in 8 eighths.
• Display a blank fraction wall on the white board.
• One person from the first group comes and writes one whole (1) in the first column.
• One person from the second group comes and writes the two halves on the wall.
• It goes on till the eighths are written down.

CONSOLIDATION
1. Have a look at the wall as a class.
2. Starting from the top and also using the folded sheets, students tell how many halves are equal to one whole. How can that be written as a fraction? They write it down in their books.

\[
1 \text{ whole } = \frac{1}{2} + \frac{1}{2} = \frac{2}{2}
\]

3. Similarly display the sheet that has been folded in quarters and ask them how many quarters in one whole. Continue to compare the relative size of fractions drawn on the fraction wall.

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<tbody>
<tr>
<td>(\frac{1}{2})</td>
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<tr>
<td>(\frac{1}{4})</td>
</tr>
</tbody>
</table>

Label Equivalent Fractions

STRAND AND SUBSTRAND
Number - Fractions, Decimals and Percentages - Stage 3

SYLLABUS OUTCOMES

MA3-7NA A student compares, orders and calculates with fractions, decimals and percentage.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

MA3-3WM A student gives a valid reason for supporting one possible solution over another.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3, Focus Area 1, understanding fractions, decimals and percentages.

ACTIVITY FOCUS
Comparing equivalent fractions.
Label Equivalent Fractions Activity

1.
Label the equivalent fractions presented in the diagrams and talk about the symbols used to express when two fractions are equivalent and why the equal sign is placed between them.

\[
\frac{1}{2} = \frac{2}{4}
\]

\[
\frac{1}{3} = \frac{9}{9}
\]

\[
\frac{2}{4} = \frac{4}{8}
\]

\[
\frac{2}{5} = \frac{2}{10}
\]
2.

Colour and complete the following equivalent fractions:

\[ \frac{1}{4} = \frac{2}{8} \]

\[ \frac{2}{4} = \quad \]

---

**Equivalent Fraction Snap**

**WHAT IS AN EQUIVALENT FRACTION?**

Equivalent fractions are fractions that are the same in value but look different. You can make equivalent fractions by multiplying or dividing the numerator and denominator by the same number.

Example of equivalent fractions: \( \frac{1}{2} = \frac{2}{4} = \frac{4}{8} = \frac{4}{9} = \frac{8}{16} \)

**INSTRUCTIONS**

1. Students play this game in pairs.
2. Print, laminate and cut the following sheet to create fraction cards.
3. Player 1 deals the cards face down between the two players. Player 2 starts by placing a card in the center.
4. They take turns in turning over the top cards until they find an identical card or equivalent fraction. They call 'Snap'.
5. The winning player takes all the cards underneath. They continue to play until the pile is finished.
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</tr>
</thead>
<tbody>
<tr>
<td>2/3</td>
<td>1/2</td>
<td>1/4</td>
<td>4/8</td>
</tr>
<tr>
<td>4/6</td>
<td>2/4</td>
<td>3/12</td>
<td>4/16</td>
</tr>
<tr>
<td>9/12</td>
<td>3/4</td>
<td>2/8</td>
<td>8/12</td>
</tr>
<tr>
<td>25/100</td>
<td>10/20</td>
<td>50/100</td>
<td>12/16</td>
</tr>
<tr>
<td>Fraction</td>
<td>Fraction</td>
<td>Fraction</td>
<td>Fraction</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------</td>
<td>-------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>$\frac{75}{100}$</td>
<td>$\frac{11}{44}$</td>
<td>$\frac{4}{8}$</td>
<td>$\frac{5}{10}$</td>
</tr>
<tr>
<td>$\frac{12}{48}$</td>
<td>$\frac{6}{9}$</td>
<td>$\frac{20}{100}$</td>
<td>$\frac{2}{10}$</td>
</tr>
<tr>
<td>$\frac{1}{5}$</td>
<td>$\frac{8}{12}$</td>
<td>$\frac{2}{3}$</td>
<td>$\frac{1}{2}$</td>
</tr>
</tbody>
</table>
Identifying Fractions and Their Equivalent Decimals on a Number Line

**INSTRUCTIONS**
1. Divide the class into groups.
2. One group gets the fractions set and the other group gets the decimals set.
3. Print the cards given below in two different colours and hand out to the students in two different groups.
4. Put a string or ribbon on the floor to create a number line. Put 0 and 1 on each end.
5. Students in the first group (fraction group) have to come and stand with the card behind the number line facing the front in the right place.
6. Once all the students from that group are behind the line, give them a moment to discuss and check whether they are in the correct spot and move accordingly.
7. Then the next group with decimals has to come and find their fraction friend and stand ahead of them on the number line.

**Set A**

<table>
<thead>
<tr>
<th>0.5</th>
<th>$\frac{1}{2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>$\frac{1}{4}$</td>
</tr>
<tr>
<td>0.125</td>
<td>$\frac{1}{8}$</td>
</tr>
<tr>
<td>0.16</td>
<td>$\frac{1}{6}$</td>
</tr>
<tr>
<td>0.75</td>
<td>$\frac{3}{4}$</td>
</tr>
<tr>
<td>0.4</td>
<td>$\frac{2}{5}$</td>
</tr>
<tr>
<td>0.6</td>
<td>$\frac{3}{5}$</td>
</tr>
<tr>
<td>0.71</td>
<td>$\frac{5}{7}$</td>
</tr>
<tr>
<td>0.5</td>
<td>( \frac{5}{10} )</td>
</tr>
<tr>
<td>------</td>
<td>----------------</td>
</tr>
<tr>
<td>0.2</td>
<td>( \frac{2}{10} )</td>
</tr>
<tr>
<td>0.6</td>
<td>( \frac{6}{10} )</td>
</tr>
<tr>
<td>0.1</td>
<td>( \frac{1}{10} )</td>
</tr>
<tr>
<td>0.8</td>
<td>( \frac{8}{10} )</td>
</tr>
<tr>
<td>0.4</td>
<td>( \frac{4}{10} )</td>
</tr>
<tr>
<td>0.9</td>
<td>( \frac{9}{10} )</td>
</tr>
<tr>
<td>1</td>
<td>( \frac{10}{10} )</td>
</tr>
</tbody>
</table>
Adding Fractions Activity

**ADDING FRACTIONS WITH THE SAME DENOMINATOR**
Adding fractions with the same denominator is simple. The denominator stays the same and you just add the numerators together.

\[
\frac{1}{6} + \frac{2}{6} = \frac{1 + 2}{6} = \frac{3}{6}
\]

**ACTIVITY**

**What you need**
- 2 different coloured dice needed for each player.
- One die is a normal six-sided die and the second one has 6 on each face.

**INSTRUCTIONS**
1. In pairs, students roll the two dice. The normal sided die is the numerator and the second die is the denominator.
2. They record the fraction that they obtained in their books.
3. They roll it a second time and record that fraction also.
4. Now they add these two fractions together. Remembering that the denominators remains the same.
5. Students repeat the process 5 times.
6. Students compare questions and answers.

---

Identifying Equivalent Fractions and Placing Them on the Number Line

**ACTIVITY**

1. Make a big number line on the wall using a string, streamer or a ribbon. Display 0 and 1 on post it notes and place them on the number line.
2. Give a post it to each student with a fraction on it. Students write down as many equivalent fractions to the fraction given to them.

**INSTRUCTIONS**
3. When the teacher says time up, they go and organise the fractions on the number line and place them between 0 and 1.
4. Students take turns to put their post it in the correct place, correctly ordering the fractions.
5. Students check that all fractions are in the correct place.
TEACHING SEQUENCE FOR FRACTIONS
Stage 3 and 4 - Classifying and Finding Fractions of Quantities

PURPOSE
This sequence of activities develops students understanding of fractions through the use of concrete materials. Students create fractions from collections of everyday objects, find the fraction and classify fractions. Miller Technology High School developed these activities for Stage 4 students. Students also engage in problem solving strategies across the curriculum regularly applying various methods and reasoning while working mathematically.
Creating Fractions Stage 3

STRAND AND SUBSTRAND
Number - Fractions, Decimals and Percentages - Stage 3

SYLLABUS OUTCOMES
MA3-7NA A student compares, orders and calculates with fractions, decimals and percentage.
MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.
MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.
MA3-3WM A student gives a valid reason for supporting one possible solution over another.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3, Focus Area 1, understanding fractions, decimals and percentages.

ACTIVITY FOCUS
Creating fractions using concrete materials.

Creating Fractions Activity 1

PURPOSE
To build a better understanding of fractions by using concrete materials.

EQUIPMENT
Scale, plasticine 500 g, money coins and paper money, measuring water jug, round paper or circle parts, Mentos lollies or counters, rulers, snakes (edible), camera (if accessible), USB cables.

INSTRUCTIONS
• Money - Students are provided with $48 (whole), you need $20, $10, $5 (×3), $2, $1 to divide into fractions.
• Lollies - Provide students with 24 lollies (Mentos or Counters). One whole is 24 lollies and then students are to divide the lollies into fractions.
• Circle - Students are provided with round paper that’s one whole or a fraction circle with 12 parts.
• Measuring Jug - Students fill the jug with 900 mL of water. Pour out the water to create the other fractions.

As students create their fractions and have an accessible camera, they can take photos and upload it onto their worksheet on the computer. Alternatively, they can just complete the worksheet provided.

EXTENSION ACTIVITY
Students use snakes and a ruler, a clock, plasticine and a semi-circle to create fractions.

Note: The semi-circle is created by folding a whole circle. This semi-circle now becomes a whole. Fold the semi-circle and fold it again to obtain 8 parts. Use a paper clip to hold it together.
## Finding fractions of quantities

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>WHOLE</th>
<th>$1 \over 8$</th>
<th>$1 \over 3$</th>
<th>$1 \over 6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Money</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total: $48$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counters/Lollies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total: 24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring Jug</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total: 900 mL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 parts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Finding fractions of quantities

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>WHOLE</th>
<th>$\frac{1}{8}$</th>
<th>$\frac{3}{4}$</th>
<th>$\frac{1}{2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snakes</td>
<td>12 cm (can vary)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clock</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semi-circle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plasticine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total: 500 g</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Classifying Fractions

STRAND AND SUBSTRAND
Number - Fractions, Decimals and Percentages - Stage 3

SYLLABUS OUTCOMES
MA3-7NA A student compares, orders and calculates with fractions, decimals and percentage.
MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.
MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3 and 4, Focus Area 1, understanding fractions, decimals and percentages.

ACTIVITY FOCUS
Classifying fractions as proper, improper or mixed numeral.

Classifying Fractions Activity 2

Task
Place the following fractions into the correct column.

<table>
<thead>
<tr>
<th>PROPER</th>
<th>IMPROPER</th>
<th>MIXED</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\frac{25}{15})</td>
<td>(\frac{3}{15})</td>
<td>(\frac{12}{22})</td>
</tr>
<tr>
<td>(\frac{5}{7})</td>
<td>(\frac{9}{3})</td>
<td>(\frac{16}{10})</td>
</tr>
<tr>
<td>(2\frac{1}{4})</td>
<td>(\frac{4}{7})</td>
<td>(\frac{4}{2})</td>
</tr>
<tr>
<td>(8\frac{1}{3})</td>
<td>(1\frac{6}{8})</td>
<td>(\frac{6}{12})</td>
</tr>
<tr>
<td>(3\frac{2}{5})</td>
<td>(\frac{30}{22})</td>
<td>(5\frac{4}{9})</td>
</tr>
</tbody>
</table>
Skittles Activity 3

Name: __________________________________________
Class: __________________________________________

WHAT YOU NEED
Skittle packet or Smarties (at least 50 g)

INSTRUCTIONS
• Students need to form pairs.
• Each pair receives a skittle packet and then fills in the boxes below.
• Students then answer the questions that follow.

Red
Fraction =  

Total number of skittles =  

Orange
Fraction =  

Yellow
Fraction =  

Green
Fraction =  

Brown
Fraction =  

ANSWER THE FOLLOWING
1. How many total Skittles are there altogether? __________________________________________

2. How many Skittles are Yellow? __________________________________________

3. What fraction of Skittles are yellow? __________________________________________

4. How many Skittles are not yellow? __________________________________________

5. What fraction of Skittles are not Yellow? __________________________________________

6. Which colour Skittle occurs the most? What fraction is this of the total amount? __________________________________________

7. Which Skittle had the lowest fraction? __________________________________________
Problem Solving Strategies 1

PURPOSE
To familiarise students with a variety of problem solving strategies used by good mathematicians.

EQUIPMENT
ALARM jigsaw summarising the different problem solving strategies

LESSON PLAN
Step 1: Divide class into groups of 6.
Step 2: Each student is provided with a piece of jigsaw. They are then required to find the other 5 students who will help them complete the jigsaw for their problem solving strategy.
Step 3: Students help each other complete the summary sheet on their problem solving strategy. Step 4: Students return as experts to their home group and share their understanding of the problem solving strategy.

<table>
<thead>
<tr>
<th>IDENTIFY the strategy</th>
<th>DESCRIBE the characteristics</th>
<th>EXPLAIN the purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draw the picture/diagram</td>
<td>Model the problem in a drawing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>This includes drawing pictures and diagrams</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pictures don’t need not be too elaborate (complex or detailed)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Examples include, Venn diagrams and tree diagrams</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ANALYSE why it works</th>
<th>CRITICALLY ANALYSE the advantages/disadvantages</th>
<th>EVALUATE its effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagrams help show the relationships between the different parts of the problem</td>
<td>Ideal for visual learners</td>
<td></td>
</tr>
<tr>
<td>Helps you ‘see’ the problem</td>
<td>Helps build confidence</td>
<td></td>
</tr>
<tr>
<td>A simple but effective strategy</td>
<td>Can be used to record known information</td>
<td></td>
</tr>
</tbody>
</table>

Mak es the problem concrete

Dr aw the picture/diagram

Model the problem in a drawing

This includes drawing pictures and diagrams

Pictures don’t need not be too elaborate (complex or detailed)

Examples include, Venn diagrams and tree diagrams

Diagram s help show the relationships between the different parts of the problem

Helps you ‘see’ the problem

A simple but effective strategy

Can be used to record known information

Ideal for visual learners

Helps build confidence
### Jigsaw Strategy 1

<table>
<thead>
<tr>
<th>IDENTIFY the strategy</th>
<th>DESCRIBE the characteristics</th>
<th>EXPLAIN the purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guess and check</td>
<td>Guess and check</td>
<td>Checks the validity of an answer</td>
</tr>
</tbody>
</table>

**ANALYSE why it works**
- Encourages you to make a conjecture (an educated guess)
- Test the validity of an answer

**CRITICALLY ANALYSE the advantages/disadvantages**
- + A flexible strategy that is used as a starting point
- - Can encourage random guesses

**EVALUATE its effectiveness**
- Can be made more sophisticated by improving each guess based on the last guess
- A useful strategy when you are completely stuck

### Jigsaw Strategy 2

<table>
<thead>
<tr>
<th>IDENTIFY the strategy</th>
<th>DESCRIBE the characteristics</th>
<th>EXPLAIN the purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Break a problem into smaller parts</td>
<td>Break the problem into steps or smaller more manageable parts</td>
<td>Difficult problems are easier to manage when broken down into little steps</td>
</tr>
</tbody>
</table>

**ANALYSE why it works**
- Works from the known to the unknown
- Can be used in conjunction with tables and diagrams to keep track of work
- Completing the first step helps build confidence

**CRITICALLY ANALYSE the advantages/disadvantages**
- + Helps you gain confidence
- - Easier to focus on small steps

**EVALUATE its effectiveness**
- A useful strategy to use when solving complex problems with multiple steps
Jigsaw Strategy 3

**IDENTIFY the strategy**
Make a systematic list

**DESCRIBE the characteristics**
Includes making a table
Columns should be clearly labelled

**EXPLAIN the purpose**
Organises the problem in a systematic way

**ANALYSE why it works**
Helps bring a logical and systematic process to problem solving
Keeps your working out in order
Can help break the problem down into smaller more manageable parts

**EVALUATE its effectiveness**
This strategy provides a simple way to organise the information of a problem to help you work through the problem methodically

**CRITICALLY ANALYSE the advantages/disadvantages**
+ Helps you check your answers later
- Keeps your information organised

Jigsaw Strategy 4

**IDENTIFY the strategy**
Write a number sentence

**DESCRIBE the characteristics**
Helps you understand whether the problem is asking you to add, subtract, multiply, or divide
Write down the numbers and the operations as a number sentence
Use known equations

**EXPLAIN the purpose**
Organises the problem into a mathematical sentence that can be solved algebraically

**ANALYSE why it works**
Turns a problem into a number sentence that can be solved

**EVALUATE its effectiveness**
Turning a real-world situation into a number sentence is an important step in using mathematics in everyday life

**CRITICALLY ANALYSE the advantages/disadvantages**
+ Helps you record your working out
- Outlines the computational steps you need to follow to get an answer
### Problem Solving Strategies 2

#### R
**Read** the question carefully and circle the numbers.

- Swimming pool entry costs $2.80 per child
- How many children can enter for $10?

#### I
**Identify** the problem you need to work out.

- Swimming pool entry costs $2.80 per child
- How many children can enter for $10?

#### N
**Note** in a diagram, table or list the information you know.

<table>
<thead>
<tr>
<th>ENTRY</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Child</td>
<td>$2.80</td>
</tr>
<tr>
<td>? Children</td>
<td>$10.00</td>
</tr>
</tbody>
</table>

#### S
**Select** and apply the best problem solving strategies. Clearly show your working out.

- Numeracy strategies
  - Guess and check
  - Look for a pattern
  - Work backwards
  - Draw a picture
  - Make a systematic list
  - Write a number sentence
  - Break a problem into smaller parts

#### E
**Evaluate** and check your answer. **Ensure** your answer makes sense and is in the right units.

- 1 = $2.80
- 2 = $5.60
- 3 = $8.40
- 4 = $11.20

- Have you answered the questions? ✓
- Does your answer use the correct units? ✓
- Does your answer look reasonable? ✓
- Is there any way you can text your answer? ✓

3 children can enter for $10
PURPOSE
This teaching sequence was designed to develop students' understanding of the application of decimals, fractions and percentages.

STRAND AND SUBSTRAND
Number and Algebra - Fractions, Decimals and Percentages - Stage 4

SYLLABUS OUTCOMES
MA4-5NA A student operates with fractions, decimals and percentages.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3 and 4, Focus Area 1, understanding decimals, money and finance.

ACTIVITY FOCUS
Using concrete examples to determine effective methods for multiplying by a number less than one.
Birthday Cake Activity 1

INSTRUCTIONS

1. To understand multiplication by decimals we investigate multiplication and division by powers of ten. Example multiplication and division by 10, 100 and 1000.

For example, let’s look at the number 3:

Multiplication by powers of 10 will provide a larger answer. Students can use this fact when estimating and reasoning.

3 × 10 = three lots of ten = 10 + 10 + 10 = 30
3 × 100 = three lots of one hundred = 100 + 100 + 100 = 300
3 × 1000 = three lots of one thousand = 1000 + 1000 + 1000 = 3000

Students can use a number slide to show the result of multiplication and division by powers of 10 on a number.

Dividing by powers of 10 will give us a smaller answer.

For example:

3 divided by 10 = \(\frac{3}{10}\) = three tenths = 0.3
3 divided by 100 = \(\frac{3}{100}\) = three hundredths = 0.03
3 divided by 1000 = \(\frac{3}{1000}\) = three thousandths = 0.003

Use the correct language associated with decimals and fractions so students understand the magnitude of the numbers when using mental computation strategies to find the answer.

Use a number slide to show the result of multiplication and division by powers of 10 on a number. Students estimate if the answer will be larger or smaller. Using mental computation strategies to find the answer.

Example: For each question ask students to estimate whether the answer will be smaller or larger than 4.1 and how do they know.

Find 4.1 × 10 = 41
Find 4.1 × 100 = 410
Find 4.1 × 1000 = 4100
Find 4.1 divided by 10 = 0.41

Find 4.1 divided by 100 = 0.041
Find 4.1 divided by 1000 = 0.0041

Example: Find 3 × 0.40

(Ask students to estimate whether the answer will be larger or smaller than the decimals in the question, how do they know)

= 3 × \[\frac{30}{100}\] (three times forty hundredths)
= \[\frac{120}{100}\]
= \[\frac{12}{10}\] (this can be simplified from 120 tenths to one and two tenths)
= 1.2 (one point two or one and two tenths)

Example: Find 0.1 × 0.3

(Ask students to estimate whether the answer will be larger or smaller than the decimals in the question, how do they know)

= \[\frac{1}{10}\] × \[\frac{3}{10}\] (one tenth times three tenths)
= \[\frac{3}{100}\] (gives three hundredths)
= 0.03

Example: Find 70 × 0.10

(Ask students to estimate whether the answer will be larger or smaller than the number 70 in the question, how do they know)

= 70 × \[\frac{1}{10}\] (70 × one tenth)
= 7

2. As a class, students make estimates of what the answers will be when the whole number is multiplied by a decimal.

3. Teacher demonstrates vertical format multiplication to multiply by a number less than one.

4. Give each student a multiplication table, number slide and birthday cake worksheet.

5. Students work in pairs, to use the resources at hand to answer the questions and explain the strategies they used.
Birthday Cake Decimal Number Slide

1. Cut out at least two of these and join them together (The longer the slide, the easier it is to work with).

2. Cut out one of these. Also cut a slit along each dotted line.

3. Thread the long strip through the slits until it looks like this ...
Birthday Cake Worksheet

Name: ____________________________________________
Class: __________________________________________

THE BIRTHDAY CAKE

ITEM | QUANTITY | COST PER UNIT | COST
--- | --- | --- | ---
Small candles | 9 | $0.15
Large candles | 5 | $0.70
Box of matches | 3 | $0.40
Bag of icing sugar | 2 | $0.85
Edible decorations | 20 | $0.85
Plastic forks | 70 | $0.10
Serviettes | 100 | $0.05

TOTAL

ANSWER THE FOLLOWING QUESTIONS

1. How could I use the multiplication table to help solve these questions?

2. How could I use the number slide?

3. Explain how you found 9 x $0.15? Show your working.

4. What strategy did you use to find 100 x $0.05?

5. Explain how you found 20 x $0.85. Show your working.

6. Explain how you found 5 x $0.70? Show your working.
Decimal Game

STRAND AND SUBSTRAND
Number and Algebra - Fractions, Decimals and Percentages - Stage 4

SYLLABUS OUTCOMES
MA4-5NA  A student operates with fractions, decimals and percentages.
MA4-1WM  A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.
MA4-2WM  A student applies appropriate mathematical techniques to solve problems.
MA4-3WM  A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3 and 4, Focus Area 1, understanding decimals, money and finance.

ACTIVITY FOCUS
Use a hundredths grid as a strategy for calculating the product of two numbers with a magnitude of less than one.

Decimal Game Activity 2

INSTRUCTIONS
How to play
1. In groups of 2, students are given 1 laminated game board and 2 whiteboard markers (a different colour for each player).
2. Player 1 chooses two decimals from the top grid to multiply together. They then colour in the boxes of the hundredths grid associated with each decimal-colouring in columns for numbers on the horizontal axis and rows for numbers on the vertical axis.
3. Where the rows and columns that are coloured in overlap will indicate the number of hundredths that results as the product of the two decimals.
4. Use the language ‘groups of’ to describe multiply the two numbers. For example, “0.7 groups of 0.1 = 0.07”. The player then colours in this decimal value on the connect 4 grid.
5. Player 2 repeats the process using their coloured marker to indicate the product they have formed.
6. The first player to connect 4 (colour 4 spaces next to each other) wins.

QUESTION TO DISCUSS AFTER THE ACTIVITY
1. What do you notice about multiplying decimals together?
2. Is the number bigger or smaller than the numbers you stated with?

MISCONCEPTIONS
Students will often think that multiplying numbers will always result in a bigger product. Using the hundredths grid to show the decimal ‘groups of’ can help students visualise that multiplying by a number less that 1 will result in a smaller number.
Decimal Game Worksheet

Name: ______________________________
Class: ______________________________

CONNECT 4 DECIMAL GAME
Step 1: Choose 2 decimals to multiply together.

<table>
<thead>
<tr>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
</tr>
</thead>
</table>

×
(times/multiplied by/groups of)

<table>
<thead>
<tr>
<th>0.1</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
<th>0.9</th>
</tr>
</thead>
</table>

Step 2: Draw the multiplication on the hundredths grid.

Step 3: Colour in the product, the first person to connect 4 in a row wins!

<table>
<thead>
<tr>
<th>0.01</th>
<th>0.02</th>
<th>0.03</th>
<th>0.04</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.06</td>
<td>0.12</td>
<td>0.07</td>
<td>0.08</td>
</tr>
<tr>
<td>0.16</td>
<td>0.21</td>
<td>0.36</td>
<td>0.14</td>
</tr>
<tr>
<td>0.27</td>
<td>0.09</td>
<td>0.18</td>
<td>0.35</td>
</tr>
<tr>
<td>0.3</td>
<td>0.45</td>
<td>0.05</td>
<td>0.18</td>
</tr>
</tbody>
</table>

DISCUSSION
1. What do you notice about multiplying decimals together?
2. Is the number bigger or smaller than the numbers you stated with?

REFERENCE
Party Decorations

STRAND AND SUBSTRAND
Number and Algebra - Fractions, Decimals and Percentages - Stage 4

SYLLABUS OUTCOMES
MA4-5NA A student operates with fractions, decimals and percentages.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.
MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3 and 4, Focus Area 1, understanding decimals, money and finance.

ACTIVITY FOCUS
Use concrete materials to understand multiplying and dividing by powers of 10.

Party Decorations Activity 3

INSTRUCTIONS
1. Split class into groups of 3.
2. Give each group a number slide sheet, a pair of scissors and three ‘Party Decorations’ worksheets.
3. Model how to use a number slide to the class and how to use written methods.
4. Students use the number slide to answer the questions on the worksheet.

CLASS DISCUSSION
What are some quicker ways of solving these questions? (Get students to demonstrate written methods on the board)
**Party Decoration Worksheet**

Name: ________________________________

Class: ________________________________

**PARTY DECORATIONS**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COST PER UNIT</th>
<th>QUANTITY</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table Cloth</td>
<td>$7.35</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Bunting per cm</td>
<td>$0.32</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Confetti</td>
<td>$0.01</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Disco Lights</td>
<td>$12.50</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Party Popper</td>
<td>$0.11</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

**ITEM**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COST</th>
<th>QUANTITY</th>
<th>COST PER UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streamers</td>
<td>$50</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Balloons</td>
<td>$1.20</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Party Hats</td>
<td>$0.80</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Flowers</td>
<td>$9.90</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Glow Sticks</td>
<td>$18</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
Party Supplies

STRAND AND SUBSTRAND
Number and Algebra - Fractions, Decimals and Percentages - Stage 4

SYLLABUS OUTCOMES
MA4-5NA A student operates with fractions, decimals and percentages.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.
MA4-2WM A student applies appropriate mathematical techniques to solve problems.
MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3 and 4, Focus Area 1, understanding decimals, money and finance.

ACTIVITY FOCUS
Use problem solving strategies and concrete resources to devise effective written methods for dividing decimals.

Party Supplies Activity 4

INSTRUCTIONS
1. Three large tables are prepared - ‘Decorations’, ‘Entertainment’ and ‘Food + Drink’. Each table has number scales, butcher’s paper and calculators on them.
2. Teacher introduces the activity: students must calculate the price per unit of each of the party supplies. Each table is to devise written methods for one section of the worksheet - ‘Decorations’, ‘Entertainment’ or ‘Food + Drink’.
3. Students choose a table to work on. As students are working, the teacher walks around the classroom providing guidance.
4. When all groups have a written method to propose, they present it to the rest of the class. Other students ask questions and provide feedback on the methods devised.
5. Students move around the tables and complete all aspects of the worksheet.
6. After completing the activity, the class comes together to discuss the methods they devised.

DISCUSSION QUESTIONS
1. What prior knowledge did you use to create these written methods?
2. What was useful? What wasn’t?
3. What are the similarities between the groups’ methods? What are the differences?
4. How would you change these strategies in order to multiply the cost per unit by a quantity?
## Party Supplies Worksheet

Name: ____________________________________________
Class: ____________________________________________

### PARTY DECORATIONS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COST</th>
<th>QUANTITY</th>
<th>COST PER UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streamers</td>
<td>$50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balloons</td>
<td>$1.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Party Hats</td>
<td>$0.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flowers</td>
<td>$9.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glow Sticks</td>
<td>$18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### ENTERTAINMENT

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COST</th>
<th>TIME</th>
<th>COST PER UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clown</td>
<td>$217</td>
<td>1 hour</td>
<td></td>
</tr>
<tr>
<td>Band</td>
<td>$500</td>
<td>2 hours</td>
<td></td>
</tr>
<tr>
<td>Jumping Castle</td>
<td>$450</td>
<td>4 hours</td>
<td></td>
</tr>
</tbody>
</table>

### PARTY FOOD AND DRINKS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COST</th>
<th>QUANTITY</th>
<th>COST PER UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sushi platter</td>
<td>$58</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Mini burgers</td>
<td>$12</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Sausage rolls</td>
<td>$7.50</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Pizza</td>
<td>$32</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Donuts</td>
<td>$37</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Fruit juice</td>
<td>$4.85</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Soft drink</td>
<td>$30.25</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>
Money Activity 5

INSTRUCTIONS
1. Write out the prices from the birthday cake worksheet on the board:
   - Small candles $0.15
   - Large candles $0.70
   - Box of matches $0.40
   - Bag of icing sugar $0.85
   - Edible decorations $0.85
   - Plastic forks $0.10
   - Serviettes $0.05
2. Split class into 8 groups.
3. Each group gets a picture of a $5 note (with Snapchat filter applied for additional engagement) and a piece of butcher’s paper.

NUMERACY LINKS
Numeracy Skills Framework, student are working at Stage 3 and 4, Focus Area 1, understanding decimals, money and finance.

ACTIVITY FOCUS
Using concrete examples to determine effective methods for multiplying by a number less than one.

DISCUSSION QUESTIONS
1. What were some techniques you found interesting?
2. What mathematical skills did you use to solve this problem?
PURPOSE

The purpose of this sequence of activities is for students to be able to compare fractions and understand their size and meaning. Ambarvale High School implemented these activities with Stage 4 students to develop student’s understanding of fraction.

SYLLABUS OUTCOMES

Students

• Compare fractions using equivalence.

• Locate and represent positive fractions on a number line.

• Express improper fractions as mixed numerals and vice versa.

• Generate equivalent fractions.

PRIOR KNOWLEDGE

Stage 3 a student compares, orders and calculates with fractions, decimals and percentages.

NUMERACY LINKS

Numeracy Skills Framework, student are working at early Stage 4, Focus Area 1, understanding fractions, decimals, percentages, rates and ratios.
Comparing and Locating Fractions

INSTRUCTIONS
Number - Fractions - Stage 4

SYLLABUS OUTCOMES
MA4-5NA  A student operates with fractions, decimals and percentages.
MA4-1WM  A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

TEACHING AND LEARNING ACTIVITIES

INRODUCTION TO FRACTIONS TOPIC
Language of fractions
Numerator, denominator, proper, improper, mixes numeral, half a quarter, one fifth, two tenths ...
Identifying different ways to represent a fraction (different definitions)
As equal parts of a whole
As a part of a group
As a divisor
As a number (number line)

INTRODUCTION
Activity 1
Partitioning

DEVELOPMENT
Group activity
Building on the number line.
As a class build a number line from -3 to 3 deciding what would be an appropriate scale.
Decide where to place fractions (in picture form and number form).

CONSOLIDATION
Independent work
Create two worksheets for students to work on.
Create a worksheet involving number lines with missing fractions for students to fill in.
Have students create draw number lines and find an appropriate scale to display given fractional values on a number line.
Convert between improper fractions and mixed numbers - can be added to number line.

Teaching ideas
Using the fraction wall and number lines created in the activity and equivalent fraction rainbows.
# Activity 1 - Partitioning

**INSTRUCTIONS**
Students will then create a number line from -3 to 3 and will use this throughout their unit to place fractions, decimals and percentages on.

1. Hand out five coloured rectangles of the same size to each student. Sticky notes can also be used.

2. In their books, have students draw five number lines underneath each other that are just a bit longer than their rectangles. You may wish to demonstrate one for the class or alternatively prepare a worksheet with five blank number lines.

3. Students then need to place the number 0 and 1 on their number line. To do this, have students place a coloured rectangle directly under the number line. Students then use the two ends of the rectangle to place 0 and 1 on each number line. You may wish to differentiate this by having this step done for a student.

4. Ask students to fold their first rectangle into halves. Students are then to line up their folded rectangle under their first number line and use it to divide the number line into halves (Use the crease of the folded paper to mark the point) and place \( \frac{1}{2} \) on the number line.

5. Students then fold their second rectangle into quarters. Students use this rectangle to divide the second number line into quarters and place \( \frac{1}{4}, \frac{2}{4}, \frac{3}{4} \) on the number line.

**To help students with folding quarters**
Discussion can be held around the fact that quarters can be found by halving and then halving again. You may wish to suggest to students to use a ruler to measure each partition to see if they have successfully quartered into equal parts.

6. Repeat this process for the last three rectangles dividing them into thirds, sixths and fifths. For an extension, you may also wish students to do a sixth division of tenths.

**To help students with folding thirds**
Discuss whether one third is bigger or smaller than one half. Have students estimate one third leaving space for two more equal sized sections. Have students use a ruler to measure if their estimation is correct and adjust if necessary.

**To help students with folding sixths**
Discuss whether one sixth is bigger or smaller than one third. It is half of a third. Have students use their rectangle that was folded into thirds to fold thirds on their fourth rectangle then students can halve each third.

**To help students with folding fifths**

**Note:** To fold fifths roll a piece of paper two and half times, then fold the entire paper cylinder flat and in half.

- Join the two short ends of the A4 paper for the first roll.
- Continue to roll the paper until the ends align again this is the second roll (one end will be inside the cylinder the other outside).
- Roll a further half turn so that the paper ends are opposite.
- Now flatten the cylinder and fold in half.
- Unfold the paper and fifths will appear along the fold lines.

Discuss whether one fifth is bigger or smaller than one quarter and whether it is bigger or smaller than one sixth. Have students estimate one fifth. Then halve and halve again the remaining section to create four more equal sections. Have students measure to see how accurately they have folded fifths.

7. Students can then use a pen to clearly mark all folds on their rectangles and glue them into their book to make a fraction wall.

8. Discussion can be held around equivalent fractions using the resources the students have created in this activity.
TEACHING SEQUENCE FOR MULTI-STEP PROBLEM SOLVING Stages 2, 3, 4 - Applying the Four Operations

PURPOSE
Students are able to apply their knowledge to multi-step written problems. Current lessons incorporate 15 minute session at the beginning of each lesson to unpack multi-step problems. Tottenham Central School developed and implemented the teaching units across Stages 2, 3 and 4.

SYLLABUS OUTCOMES

MA2-5NA A student uses mental and written strategies for addition and subtraction involving two-, three-, four- and five-digit numbers.

MA2-6NA A student uses mental and informal written strategies for multiplication and division.

MA3-5NA A student selects and applies appropriate strategies for addition and subtraction with counting numbers of any size.

MA3-6NA A student selects and applies appropriate strategies for multiplication and division, and applies the order of operations to calculations involving more than one operation.

MA4-4NA A student compares, orders and calculates with integers, applying a range of strategies to aid computation.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

PRIOR KNOWLEDGE
Students are able to read the questions. Students understand how to use the operation correctly.
Teaching and Learning Activities

In stage 2 students were assessed for levels of the prior knowledge of addition and subtraction strategies and multiplication and division strategies before the whole class activity.

WHOLE CLASS ACTIVITY

Introduction
Introduce the Problem Solving Bookmark prompts. Discuss each element and what students are required to think about to successfully solve a problem.

Using a sample NAPLAN question, split class into 7 groups each group focusing on one element of the bookmark.

Students discuss and report back to the whole class about their element in relation to the question they were provided.

Each student gets a laminated copy of the bookmark to keep in their books.

Resources
Problem solving bookmark

Modelled instruction by teacher
Teacher models solving a multi-step written question using the bookmark problem solving prompts. This will continue until students are confident. Problem solving questions will range between addition, subtraction, division and multiplication.

Students in pairs, guided instruction by teacher
Provide students with sample questions to refer to bookmark to solve. This will build student confidence, persistence and focus will be on the strategies used, rather than the solution.

Repeat until students have a clear understanding of strategies for solving word problems.

Resources
Use both attached questions and past NAPLAN questions

Differentiation and modification
Problems will vary depending on student ability.

Students individually, independent instruction
Students work for 10 minutes at the beginning of each lesson working on different multi-step problems in a range of contexts, using bookmark problem solving prompts and recording thinking strategies in learning journals as they progress.
PROBLEM 1
When three boys stepped on a set of scales together it read 164 kilograms. One boy stepped off and the scale moved down to 104 kg. One more boys stepped off and the scaled showed 55 kg. What was each boy’s weight?

PROBLEM 2
Bob baked cupcakes over the weekend. Each day during the week he took three cupcakes to school to share with his friends. On Saturday when he counted there were 18 left. How many had he baked?

PROBLEM 3
Four boys each caught a fish while at the river. Tom’s was double the size of Bob’s. Bob’s fish was shorter than Jack’s by nine centimetres. Jack’s was 18 cm longer than Will’s who caught a fish 30 cm long. How long were Tom’s, Bob’s and Jack’s fish?

PROBLEM 4
Bob has 72 stamps and Sarah has 56 stamps. How many stamps should Bob give to Sarah, so they both have the same number of stamps?

PROBLEM 5
162 – 69. What could the question be?

PROBLEM 6
At Easter 5 children gave each other an Easter egg. How many Easter eggs are given altogether?

PROBLEM 7
James and Harry are making a board game. The board for their game is three squares by three squares in size. What is the total number of squares you can find on their game board? If they increased the size of the board by four squares by four squares, what would be the total number of squares on the board? What if they increased the board to five by five squares?

PROBLEM 8
How many equations can you make using the numbers 3, 2, 6, 1 and the symbols =, +, ÷? You can only use each numeral once in any equation, but you may use the signs more than once.

PROBLEM 9
80 students voted for their favourite sport. The fractions in the graph show how the students voted. How many more students voted for swimming than tennis?

PROBLEM 10
Ben has 2 identical pizzas. He cuts one pizza equally into 4 large slices. He then cuts the other pizza equally into 8 small slices. A large slice weighs 32 grams more than a small slice. What is the mass of one whole pizza?

**Bookmark problem solving prompts**

**READ** the problem carefully.

**UNDERLINE** key words and numbers.

**CHOOSE** the right operation(s).

**SOLVE** the problem.

**WRITE** out the sum and do the calculation.

**ANSWER** the question. Show your working out.

**REREAD** the questions and check your work.
Purpose
The purpose of this learning is to provide students with the skills they need to be aware of the way mathematics connects to real life situations. Students use and develop problem solving skills to make sense of the world.

Syllabus Outcomes
Mathematics
MAE-8NA A student recognises, describes and continues repeating patterns.

English
A student replicates rhythm and sound patterns in stories.

History
A student sequences events in order and identifies and sequences stages in his or her lifetime.

PDHPE
A student mirrors simple rhythmic dance patterns by using beat.

Students sort and classify familiar objects and explain the basis for these classifications (ACMNA005).

• Sort and classify a group of familiar objects into smaller groups.
• Recognise that a group of objects can be sorted and classified in different ways, explain the basis for their classification of objects. (Communicating, Reasoning)

Copy, continue and create patterns with objects and drawings.
• Recognise, copy and continue repeating patterns using sounds and/or actions.
• Recognise, copy, continue and create repeating patterns using shapes, objects or pictures, e.g. create or continue a repeating pattern using simple computer graphics. (Problem Solving)
• Recognise when an error occurs in a pattern and explain what is wrong. (Communicating, Reasoning)
• Describe a repeating pattern made from shapes by referring to its distinguishing features, e.g. ‘I have made my pattern from squares. The colours repeat. They go red, blue, red, blue, …’
PRIOR KNOWLEDGE

Students begin to recognise patterns and relationships and the connections between them. They are beginning to sort, categorise, order and compare collections and events and attributes of objects and materials, in their social and natural world.

NUMERACY LINKS

Numeracy Skills Framework, students are at prior to school for Focus Area 2, patterning, generalisations and algebraic reasoning.

Teaching and Learning Activities and Assessment Sequence

LESSON 1

Modelled
Teacher shows the class a collection of objects e.g. farm animals, counters or shapes. The teacher will then sort the objects into different groups. Teacher will then ask students to look at the groups and try and figure out what characteristic the teacher used to sort the objects e.g. colour, size and shape.

Repeat this activity several times until students show an understanding of the different ways objects can be classified and sorted.

Guided - ’Is the same as’
Students are given collections of objects to sort and count in order to find groups that have the same number of objects. Students describe and label the group using the term ‘is the same as’.

Students could use drawings or simple computer graphics, and the term ‘is the same as’ to record their findings.

Activity sourced from

Independent - ’Sorting objects’
In pairs students are provided with a collection of objects. One student has to sort the objects while the other student needs to look at the way the objects have been sorted and try to identify how the other student classified the objects. Then the student who sorted the objects needs to explain how they sorted them to clarify. Students swap rolls and repeat.

Modelled - Sound patterns
Teacher will make a ‘two’ sound pattern and students will copy e.g. clap, stomp. Teacher will then invite a student to create their own ‘two’ sound pattern for the class to follow.

Modifications
This activity could be extended by creating ‘three’ patterns.

Guided - ‘Class patterns’
Take class outside and get them to stand in a line. Select one student to be the ‘Pattern Master’. The ‘Pattern Master’ must then choose 2 or 3 shapes and model them to the class e.g. standing on one foot, stars and rocks. The Pattern Master must then walk along the line telling students what shape they need to make to create the pattern. Teacher will then record the pattern by taking a photo of it.

When class returns to classroom teacher can display the people patterns on the IWB and students can check the patterns to make sure there are no errors and describe them.

Beginning to make repeating patterns
Students are given a set of counters containing two colours and are asked to put the counters in a row. Some students may create a repeating pattern, while others may not. The intention of the activity is to distinguish between those arrangements that are repeating patterns and those that are not.

Possible questions include:
• Where do we see patterns?
• What comes next in this pattern?
• How do you know?
• Which part of the pattern is repeated?
• Tell me how to make this pattern?

The teacher models putting a small collection of counters in a row, making sure that they make a repeating pattern.

Possible questions include:
• Can you describe your row of counters?
• Can you describe my row of counters?
• Can you make a row of counters like mine?
• Can you make another row of counters that has a pattern?
Model informally recording patterns
In pairs, students make new rows of counters, describe them to each other, and record their patterns. At this early stage, it is preferable to use materials that have only one attribute (e.g. colour) before using materials with multiple attributes. The activity above was sourced from: http://nswcurriculumsupport.wikispaces.com/file/view/Patterns%20%26%20Algebra%20ES1.pdf/469911756/Patterns%20%26%20Algebra%20ES1.pdf

Describing repeating patterns using numbers
The teacher makes a repeating pattern using multilink cubes. This pattern is called a ‘two’ pattern because the pattern repeats after every second cube.

Possible questions include:
• How many cubes are in each group that repeats?
• How many groups are in your pattern?
• What is the total number of cubes in the pattern?

With teacher guidance, students record the pattern using drawings. They are encouraged to use numbers in their recording. The activity above was sourced from: http://nswcurriculumsupport.wikispaces.com/file/view/Patterns%20%26%20Algebra%20ES1.pdf/469911756/Patterns%20%26%20Algebra%20ES1.pdf

Independent - Sound and action patterns
Create repeating patterns with a sequence of different sounds or actions, such as: clap, clap, stamp, stamp, clap, stamp, stamp...

Ask students to continue the patterns and describe them in words.

Create repeating patterns from the one sound or action, such as: clap, clap, [pause] clap, clap [pause] clap, clap, clap [pause] clap, clap ...

Ask students to continue the patterns and describe them in words.

Students create their own sound or action repeating patterns
Create a sound or action pattern and insert a deliberate error. Students raise their hands when they think they hear or see the error.

For example, clap, clap, finger-tap, clap, clap, finger-tap, clap, finger-tap, clap, finger-tap ...

Students explain why they think it is an error. Note the language they use to describe the concept of repetition. Encourage them to use words to describe the pattern, rather than perform the actions. For example, they might say about the above pattern: The pattern was two claps and one finger-tap and then you started again.

Note that patterns that repeat the same number of sounds or actions can help early learners establish concepts of the twoness of two and so on. The activity above was sourced from: NSW Department of Education Patterns and Algebra http://nswcurriculumsupport.wikispaces.com/file/view/Patterns%20%26%20Algebra%20ES1.pdf/469911756/Patterns%20%26%20Algebra%20ES1.pdf

Sound and action pattern representations
Ask students to suggest how you could draw a clap (maybe representing it with a hand) and a stamp (maybe a foot). Draw on large cards sound and action patterns using claps and stamps. For example, the clap, clap, tap, tap, clap ... pattern could be drawn as follows.

[Diagram of sound and action pattern representations]

Ask students to describe the pattern. Also ask them: How do you know this is a pattern? Or: What makes this a pattern? Reinforce the words repeat, repeated and repeating.

Patterns can also be represented by written words.
For example, provide several cards with the word clap on them and several with the word tap on them. A sample pattern could be represented with the cards as follows.

[Diagram of sound and action pattern representations]

1. In pairs, students create/draw two step patterns. They then swap with their partner and continue each other’s repeating pattern. Students then record their patterns.
2. Using prepared pattern and ‘non’ pattern cards students are ask to sort into two groups, one containing pattern cards and the other containing the non-pattern cards.
3. Students record their results and explain (verbally or in writing) their choices.

The activity above was sourced from: http://nswcurriculumsupport.wikispaces.com/file/view/Patterns%20%26%20Algebra%20ES1.pdf/469911756/Patterns%20%26%20Algebra%20ES1.pdf

Modelled - What is a pattern?
What is a pattern? Show students a sheet of paper with a random arrangement of three coloured circles.

[Diagram of modelled - what is a pattern?]

Ask: Is this a pattern? Allow the students to discuss their ideas, and lead them to understand that this, by itself, is not a pattern. Next, line up five photocopies of the sheet.

[Diagram of modelled - what is a pattern?]

Ask: Is this a pattern? Allow discussion, and lead students to understand that this is a pattern because there is something that repeats.

The activity above was sourced from: http://nswcurriculumsupport.wikispaces.com/file/view/Patterns%20%26%20Algebra%20ES1.pdf/469911756/Patterns%20%26%20Algebra%20ES1.pdf
Is this a pattern
Teacher will make a pattern with an error in it. Students are then asked to identify what is wrong with the pattern. Students then explain why that is an error.

Guided - What's wrong with this pattern?
1. Students are presented with patterns where one of the elements (e.g. shapes, pictures, letters or numbers) have been misplaced.
2. Possible questions include:
   • Do you think this is a pattern?
   • Can you find what is wrong and can you correct the mistake?

Students should experience a variety of patterns with errors so that they can readily identify patterns that repeat and those that don’t.

The activity above was sourced from:

Independent - Fix my pattern
1. Students are put into pairs and are provided with a variety of resources they can use to make a pattern e.g. counters, teddies, match sticks, beads.
2. One student is to make a pattern but include an error in their pattern.
3. The other student then needs to identify the error, explain why it is an error and then correct it.
4. Change roles and repeat.
5. Pairs will then present one of their patterns to the class.
TEACHING SEQUENCE FOR PATTERNS
AND ALGEBRA Stage 1 - Understanding Patterns

PURPOSE
The purpose of this sequence of activities so that students know that numbers can be represented in different ways as fractions, decimals and percentages.

SYLLABUS OUTCOMES
Mathematics
MA1-8NA A student creates, represents and continues a variety of patterns with numbers and objects.

Creative arts
A student represent and manipulates patterns occurring in nature for students’ own works in visual arts, music, dance and drama.

Science and technology
A student describe patterns of seasonal changes in temperature.

Students
Investigate and describe number patterns formed by skip counting and patterns with objects (ACMNA018).

• Identify and describe patterns when skip counting forwards or backwards by ones, twos, fives and tens from any starting point.
• Use objects to represent counting patterns. (Communicating)
• Investigate and solve problems based on number patterns. (Problem Solving)
• Represent number patterns on number lines and number charts.
• Recognise, copy and continue given number patterns that increase or decrease, e.g. 1, 2, 3, 4, ... 20, 18, 16, 14 ...
  - Describe how number patterns are made and how they can be continued. (Communicating, Problem Solving)
• Create, record and describe number patterns that increase or decrease.
• Recognise, copy and continue patterns with objects or symbols.
• Recognise when an error occurs in a pattern and explain what is wrong. (Communicating, Problem Solving)
• Create, record and describe patterns with objects or symbols.
• Describe a repeating pattern of objects or symbols in terms of a ‘number’ pattern, e.g. make connections between repeating patterns and counting, e.g. a ‘three’ pattern and skip counting by threes. (Communicating, Reasoning)

• Model and describe ‘odd’ and ‘even’ numbers using counters paired in two rows describe the pattern created by modelling odd and even numbers. (Communicating)

PRIOR KNOWLEDGE
Students are able to sort and classify objects into groups and recognises, copies, continues, creates and describes repeating patterns of objects and drawings.

Teaching and Learning Activities and Assessment Sequence

PATTERNS AND ALGEBRA PART 1

SKIP COUNTING
Provide frequent opportunities for students to count by ones, twos, fives and tens.

Introduction
Show different groups of items such as counters, pop sticks, etc. and ask students to count how many. Observe students counting. Most students will count from 1.

Discuss with students that if we have a lot of objects it can take a long time to count and that there are more efficient ways of counting many objects.

Modelled activity
Ask students to pair counters and model to students. Ask students ‘how could we count these pairs?’ ‘Are there any students who say count by two’s?’ If not model to students the first time. Point to pairs and count 2, 4, 6, 8, 10, etc.

Resources
Counters
Tiny teddies
Pop sticks
Shells

Differentiation and modification
Adjust according to student placement on the numeracy continuum.

Assessment for Learning - Observe students as they present to the class. Note who is able and not able to count by two’s, etc.

Guided activities
Ask students to say it with you the second time. Repeat several times. Ask who thinks they can count by two’s on their own. Count many paired items.

For example, students stand with a partner - count by two’s.

Students stand or sit in a circle with their feet out in front. Students count shoes by two’s.

Students line up class chairs in two’s and count.

Independent activities
Students work in pairs.

Provide collections of objects for students to collect such as tiny teddies, shells, pop sticks, etc.

Students place the objects in two’s or pairs and count.

Consolidation
Students sit in a circle beside their partner and present to the class their collection and count it by two’s. Are there any objects left over for example one pop stick. This would be the perfect opportunity to use the term ‘odd’. Say this is an ‘odd’ pop stick because it doesn’t have a partner.
HUNDREDS CHART
Introduce the term ‘even’. Discuss what ‘even’ means. Model to students on EWB 100s chart counting by two's. Students can count by two's up to 100 with teacher leading. Identify odd and even numbers. Refer back to counters to check. Ask questions such as:
• Is 6 an even or odd number let’s check with the counters. Pair counters.
• Continue with asking students if various numbers are odd or even.
• Ask students if they notice anything special on the hundreds chart.
• Identify patterns e.g. Even numbers end in 0, 2, 4, 6, 8 odd numbers end in 1, 3, 5, 7, 9.
The above lesson sequence of learning can be used for skip counting by 5s and 10s.

Resources
EWB 100s chart found in SMART gallery

Differentiation and modification
Variation - Students can count by other multiples e.g. tens, twos.

Hundreds chart
Provide frequent opportunities for students to count by ones, twos, fives and tens from any starting point to 100.
The (1-100) chart is a very potent teaching aid. It can be used in a variety of ways to strengthen students’ concept of number.

Students use skip counting strategies to locate and identify a number from the information presented by the teacher using a 100s chart. E.g. What number is 10 less than 20? What number is 10 more than 40 etc.
Students use the 100's chart to skip count, understand multiples and notice patterns.
Count forwards and backwards on the 100s chart by ones, twos, fives and tens.

Finding the pattern (Make connections between repeating patterns and counting)
Use laminated 100s charts. Students put a counter on or colour in using a whiteboard marker. Identify odd numbers 1, 3, 5, 7 etc colour in to 100. Discuss the pattern. Identify even numbers and colour in a different colour. What do students notice?

Resources
Hundred chart

<table>
<thead>
<tr>
<th>HUNDRED CHART</th>
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<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>11</td>
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<tr>
<td>21</td>
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<tr>
<td>31</td>
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<td>41</td>
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<td>51</td>
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<td>61</td>
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<tr>
<td>71</td>
</tr>
<tr>
<td>81</td>
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<tr>
<td>91</td>
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</tbody>
</table>

Differentiation and modification
Assessment of learning: Are the students able to do the following?
• Skip count by twos, fives and tens.
• Identify odd and even numbers.
• Create, represent and continue a variety of number patterns.

Counting Patterns
Divide students into two groups and display EWB 100s chart.
The class counts by 5s to 100, referring to the 100s chart. As the students count the two groups take turns to name the next number in the sequence, 5, 10, 15, 20, 25, 30.
• What do you notice about the numbers we are saying?
• What do you notice about the numbers your group is saying?
• Look at the numbers on the 100s chart. What pattern do you notice?

Model to students a number pattern e.g. 12, 14, 16 on EWB.
Ask students to identify pattern, give clues if needed. Is it going up - ascending or is it descending - going down.
Ask the students to create their own repeating number pattern on a 100s chart. The pattern must begin from a number other than 1. Students present to class their coloured in 100s chart repeating pattern.
Encourage students to ask questions.
• “Can you tell me the numbers you coloured in?”
• “Look at the colours, can you see a pattern”
• “Who can see a pattern?”

Resources
Photocopied 100s chart
TEACHING ACTIVITY FOR PATTERNS AND ALGEBRA Stage 2 - Identifying Patterns

PURPOSE
This teaching activity was developed to promote algebraic thinking. Students are encouraged to investigate and think about the patterns presented to them with a focus on questioning to guide students to explore patterns and articulate the pattern they see through reasoning.

Thinking Aloud with Patterns

STRAND AND SUBSTRAND
Number - Patterns and Algebra - Stage 2

SYLLABUS OUTCOMES
MA2-8NA A student generalises properties of odd and even numbers, generates number patterns, and completes simple number sentences by calculating missing values.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

NUMERACY LINKS
Numeracy Skills Framework, students are working at the end of Stage 2 for Focus Area 2, patterning, generalisations, algebraic reasoning.

ACTIVITY FOCUS
Identifying a pattern for a set of numbers.
**Thinking Aloud with Patterns Activity**

**ACTIVITY**

Use a ‘think aloud’ strategy to explicitly teach students the steps to identify the next number in a pattern. This strategy focuses on the teacher explaining the thinking process while completing a task.

The teacher models the thinking process for a subtraction number pattern by talking through these steps.

**EXAMPLE**

Teacher starts by saying: ‘Look at this pattern. Can you see what has happened to get the next number in the pattern?’

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<tbody>
<tr>
<td>74</td>
<td>68</td>
<td>62</td>
<td>56</td>
</tr>
</tbody>
</table>

Teacher then poses the following questions

1. Are the numbers getting bigger? No.
2. If the numbers are getting smaller, the pattern might be to take away a number. I need to find the difference between two numbers in the pattern.
3. Two of the numbers are 62 and 56. The difference is 6.
4. Is the difference between 74 and 68, 6? Yes.

Therefore, the pattern is that the numbers are going down by 6 each time.

**Pattern B**

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<tbody>
<tr>
<td>55</td>
<td>60</td>
<td>65</td>
<td>70</td>
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</tbody>
</table>

**Pattern C**

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<tbody>
<tr>
<td>12</td>
<td>15</td>
<td>18</td>
<td>21</td>
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</tbody>
</table>

**Pattern D**

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</thead>
<tbody>
<tr>
<td>40</td>
<td>30</td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>
PURPOSE
Looking for patterns is a very important strategy for problem solving. By observing each given element, one at a time in consecutive sequence, students can decide what the next elements will be in the pattern. Predictions based on these patterns can be used to solve many different kinds of problems. The development of these skills in young students lays a foundation for later algebra work.

SYLLABUS OUTCOMES
Mathematics
MA2-8NA A student generalises properties of odd and even numbers, generates number patterns, and completes simple number sentences by calculating missing values.

Creative arts
• Uses measurement, fractions, ratios, proportions, estimation and relationships in making artworks in visual arts, music, dance and drama.

• Solves mathematical problems and thinks critically when drawing, designing, enlarging, reducing, planning and constructing in visual arts.

Science and technology
• Describes patterns and relationships in data collected from investigations.

Describe, continue and create number patterns resulting from performing addition or subtraction (ACMNA060).

• Identify and describe patterns when counting forwards or backwards by threes, fours, sixes, sevens, eights and nines from any starting point.

• Model, describe and then record number patterns using diagrams, words or symbols.

• Ask questions about how number patterns have been created and how they can be continued. (Communicating)

• Create and continue a variety of number patterns that increase or decrease, and describe them in more than one way.
Investigate the conditions required for a number to be even or odd and identify even and odd numbers (ACMNA051).

- Model even and odd numbers of up to two-digits using arrays with two rows.
  - Compare and describe the difference between models of even numbers and models of odd numbers. (Communicating)
  - Recognise the connection between even numbers and the multiplication facts for two. (Reasoning)
- Describe and generalise the conditions for a number to be even or odd.
  - Recognise the significance of the final digit of a whole number in determining whether a given number is even or odd. (Reasoning)
- Identify even or odd numbers of up to four-digits.

PRIOR KNOWLEDGE
Students are able to describe patterns with numbers and identify missing elements; and find missing numbers in number sentences involving one operation of addition or subtraction.

NUMERACY LINKS
Numeracy Skills Framework, students are at end of Stage 2 for Focus Area 2, patterning, generalisations and algebraic reasoning.

LITERACY STRATEGIES
Students should be able to communicate using the following language: pattern, term, missing number, odd, even, number sentence, is the same as, equals.

Teaching and Learning Activities and Assessment Sequence

Allow some students to create patterns for the above activity. Talk about how patterns can be described in a number of ways e.g. It increases by 2s; they are the even numbers; you add 2.

With partners and using small whiteboards and OHP pens have one student create a simple number pattern. Have the partner continue the pattern and verbalise the rule for the pattern. Allow them to do several examples each.

DEVELOPMENT

LESSON 1
Initiating activities
On a hundreds chart, students colour all the multiples of 3 in yellow, the multiples of 6 in blue and the multiples of 9 in green.

Students make a number chart using only the multiples of 3 and cut it into a jigsaw for another student to complete.

Resources
Small whiteboards
Whiteboard markers
Hundred charts
Coloured pencils

Differentiation and modification
Modifications - Select groups carefully so that the less able have more capable partners.

LESSON 2
Relating multiples sequences
Students investigate relationships among sequences of multiples, such as relationships among the multiples of two, four and eight, relationships between the multiples of three and six, and relationships among the multiples of three, four and twelve.

Resources
BLM Table (Opposite)
Paddle pop sticks

Multiples of one and nine produce the same wheel pattern, as do the multiples of two and eight, the multiples of three and seven and the multiples of four and six. Students observe that each pair with the same pattern (e.g. one and nine) adds to ten, and the patterns of the two are drawn in opposite directions.

Resources
BLM
Wheel

LESSON 3
Creating patterns on a calculator
Using the constant function on a calculator is another way to generate number sequences. An interesting sequence is the multiples of 37.

Begin by writing 37 on the board and asking students to repeatedly add 37. They do the first few mentally, discussing the calculation strategies they use. Generating number sequences provides opportunities for mental addition practice.

After generating the first nine numbers in the sequence, set students to work in pairs to continue the sequence to 999, with the help of the calculator constant function. (To use this function, key in 37 then +, then repeatedly press the = key.) If they list the first nine numbers in a row, then the next nine numbers in a second row and the following nine numbers in another row, they will find that fascinating patterns emerge. Ask students to describe the patterns that they find.

Resources
BLM Table (Opposite)
Paddle pop sticks
Making squares out of pop sticks
Ask students “Can you work out how many pop sticks you would need if you wanted to make 15 squares? What are some different ways you can work this out? Does the table help you work this out?” And: “If I used 80 pop sticks, how many squares could I make?”

<table>
<thead>
<tr>
<th>Number of squares</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of paddle pop sticks</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>24</td>
<td>28</td>
<td>32</td>
</tr>
</tbody>
</table>

Differentiation and modification
Modifications - For more capable students use different shapes such as octagons, hexagons, etc.

**LESSON 4**

**Stations**
Divide the class into groups and have the groups work on a number of problems based on Patterns and Algebra.

**Station 1: Prime numbers**
Use a hundred chart and have students follow the instructions to find the prime numbers to 100.
• Cross out 1
• Colour 2 and cross out the rest of the even numbers
• Colour 3, cross out all the multiples of 3
• Colour 5, cross out all the multiples of 5
• Colour 7, cross out all the multiples of 7
• Colour all the remaining numbers

The coloured numbers are the prime numbers. Reflect on what they have learnt.

**Resources**
Instruction for each station on a laminated sheet
Hundred charts

**Differentiation and modification**
Allow them to create their own tables.

**Station 2: Calendar patterns**
• Look closely at the dates on any calendar and you might find some unexpected patterns e.g. for any 3 horizontally adjacent dates the middle number is half the sum of the other 2 numbers.
• Does this apply to vertically or diagonally adjacent dates?
• What other patterns can you find for 3 adjacent dates?
• What patterns can you find for 5 horizontally, vertically or diagonally adjacent dates?

Challenge students to find similar patterns.

**Resources**
Copy of a calendar page

**Differentiation and modification**
Modifications - Select groups carefully so that the less able have more capable partners.

**Station 2: Calendar patterns**
• What diagonal patterns can you find going left to right? (It goes up by 8, one week plus a day)
• What diagonal patterns go right to left? (It goes up by 6 because it is one week less a day)
• Choose 3 adjacent dates in a line, horizontally, vertically or diagonally, such as 5, 6, 7. Describe the relationship between the sum of the three numbers and the centre number. Where else does this happen?
• What happens with 5 adjacent dates?
• Does this pattern work with 3 vertical dates?
• If the total of the three adjacent numbers is 51, what are the numbers?
• Draw a box around any four dates. What relationships do you notice between the numbers in the opposite corners of the box? If you add the numbers diagonally, what do you find? (4 + 12 = 16, 5 + 11 = 16). Why? Does this relationship apply for larger boxes such as 3 x 2, 3 x 3, 3 x 4 or 2 x 4?
• Draw a 3 x 3 box around nine dates. Look at the centre number in the box. What do you notice? Can students explain why this relationship holds? What happens if you take a 3 x 3 pattern of numbers and add them diagonally?

**Resources**
Concrete materials for creating visuals or paper and pen for creating visuals

**Station 3: Apple picking**
• During the holidays, Sue picked apples at the Granny Smith Orchard.
  • She was paid:
    • 10c for the first bucket of apples,
    • 20c for the second,
    • 40c for the third and
    • 80c for the fourth.
• If the pattern of payment continued, how much was she paid for the eighth bucket, the tenth bucket, etc?

**Resources**
Concrete materials for creating visuals or paper and pen for creating visuals
Station 4: Paintings
• Mrs. Holder hangs paintings on a piece of wire in the classroom.
• She uses pegs to hold them securely:
  • For one painting she needs two pegs
  • For two paintings she needs three pegs and
  • For three paintings she needs four pegs.
• How many pegs will she need for 18 paintings, for 30 paintings?

Resources
Concrete materials for creating visuals or paper and pen for creating visuals

Station 5: Mice
• Sara started with 2 mice.
• By the end of the first month she had 6 mice and by
  the end of the second month there were 14.
• The following month she had 26 mice.
• If the mice continue multiplying at the same rate, how many mice will there be in the ninth month?

Resources
Concrete materials for creating visuals or paper and pen for creating visuals

Station 6: Fibonacci
• A marine biologist is researching the structure of
  a nautilus.
• The shell’s numerical pattern follows a sequence
discovered by the mathematician Fibonacci.
• What are the next three numbers?
  0 1 1 2 3 5 8 13 ___ ___ ___
• Explain the pattern.

Resources
Concrete materials for creating visuals or paper and pen for creating visuals

Station 7: Blow flies
• Blow flies are known to breed at an amazing rate:
  • One day there are 2 flies
  • On the next day, 5
  • On the third day, 9 and
  • On the fourth day, 14
• How many blow flies will there be on the eighth day, on the 12th day etc?

Reflect on what they have learnt.
Challenge - How much will she be paid on the twentieth bucket?

Station 8: Jogging
• Sam jogs 5 blocks on the first day of training.
• Each day he increases his distance by another
  two blocks.
• On the last day of training he jogged 33 blocks.
• For how many days did he jog?

Students are asked to reflect on the activities at the end of this lesson and talk about what they discovered at each activity and on patterns in general.

Resources
Concrete materials for creating visuals or paper and pen for creating visuals

LESSON 5
Consolidation
Naplan Problems (Naplan Year 3 2012)
Lara used pattern blocks to make a pattern.
She used 1 block in her first shape, 5 blocks in her
second shape and 9 in her third shape. How many blocks are in the next shape in Lara’s pattern?

Naplan problems (Naplan Year 3 2014)
Jesse hangs 3 T-shirts on a line.
Any t-shirts next to each other share a peg. He uses
4 pegs. How many would Jesse use to hang 6 t-shirts next to each other?

Naplan problems (Naplan Year 3 2015)
Roy made a pattern by adding 3 numbers to get the
next number. Which of these could be the first four
numbers of Roy’s pattern?
3, 13, 23, 33;
4, 7, 11, 16;
6, 10, 14, 18;
8, 11, 14, 17;

Resources
Stencil
Naplan problems printed on
Concrete materials

LESSON 6
Introduction
On a hundred chart colour in every second number i.e.
the even numbers. Repeat this on a second hundred chart except start at 1 so they colour the odd numbers.
What the numbers on the first number chart called?
What do you notice the same about these numbers?
What do you notice different?
Reflection: So what do even numbers need to be an even number?
Repeat this for the odd numbers. Write the rules for even and odd numbers in their books, on the board, on a poster for the room, etc.

The final number (ones) on an even number is always 0, 2, 4, 6 or 8.

The final number (ones) on an odd number is always 1, 3, 5, 7, 9.

**Modelled**
Write a selection of numbers on the IWB and model circling the ones, looking at the rules and verbalising the placement of the numbers in the odd or even side of the board following the above rules.

**Resources**
- Hundred charts
- 2 for each child
- Printed sheet of the rule about odds and evens

**LESSON 7**

**Guided**
Write a selection of numbers on the IWB, as a class/group have students circle the ones in the numbers. Students look at the rule and determine if the number is an even or odd number and place it on the even or odd side of the board.

In pairs - Sort a selection of numbers into odd and even numbers following the above rules. Have students justify why they have put different numbers into different groups.

**Resources**
- IWB

**LESSON 8**

**Independent**
Game - Students roll a dice once, twice or three times to create a number. Write the number down created in an even or odd column.

Final digit of a number.

Students are given a number of cards up to four-digits they then are to identify even or odd numbers by using the final digit of the whole number. Students are then to describe and generalise before placing in the odd or even pile of numbers.

**Assessment**
Stencil - Circle the even number and cross the odd numbers. Write the odd and even rules.

**Resources**
- IWB
- Cards - with a selection of numbers - two-, three- and four-digit numbers
- Dice
- Assessment stencil
TEACHING SEQUENCE FOR PATTERNS AND ALGEBRA Stage 2 - Exploring Number Patterns

PURPOSE
The purpose of this sequence of activities for students to develop an understanding of know that numbers can be represented in different ways as fractions, decimals and percentages and in different patterns and relationships.

SYLLABUS OUTCOMES
Mathematics
MA2-8NA A student generalises properties of odd and even numbers, generates number patterns, and completes simple number sentences by calculating missing values.

Creative arts
A student explores patterns for creating structure, form, interest and meaning in visual arts, melodic and rhythmic ideas for singing and organising sound in music, words and movement in drama and motifs and themes of movement in dance.

Geography
A student identifies geographical patterns and the distribution of features of places.

History
A student sequences familiar people and events.
A student sequences significant events related to human occupation in Australia.

Use equivalent number sentences involving addition and subtraction to find unknown quantities (ACMNA083).

- Complete number sentences involving addition and subtraction by calculating missing numbers, e.g. find the missing numbers, use inverse operations to complete number sentences. (Problem Solving)

- Justify solutions when completing number sentences. (Communicating, Reasoning)

- Find the missing number in a number sentence involving operations of addition or subtraction on both sides of the equals sign, e.g. 8 + □ = 6 + 7

Investigate and use the properties of even and odd numbers (ACMNA071).

- Investigate and generalise the result of adding, subtracting and multiplying pairs of even numbers, pairs of odd numbers, or one even and one odd number, e.g. even + odd = odd, odd × odd = odd
- Explain why the result of a calculation is even or odd with reference to the properties of the numbers used in the calculation. (Communicating, Reasoning)
- Predict whether the answer to a calculation will be even or odd by using the properties of the numbers in the calculation. (Reasoning)

**Explore and describe number patterns resulting from performing multiplication (ACMNA081).**

- Generate number patterns using multiples of 3, 4, 6, 7, 8 and 9, e.g. 3, 6, 9, 12, ...
  - Investigate visual number patterns on a number chart. (Problem Solving)
  - Use the word ‘term’ when referring to numbers in a number pattern.
  - Describe the position of each term in a given number pattern, e.g. ‘The first term is 6.’ (Communicating)
- Find a higher term in a number pattern resulting from performing multiplication, given the first few terms, e.g. determine the next term in the pattern 4, 8, 16, 32, 64, ...
  - Describe how the next term in a number pattern is calculated, e.g. ‘Each term in the pattern is double the previous term.’ (Communicating)

**Solve word problems by using number sentences involving multiplication or division where there is no remainder (ACMNA082).**

- Complete number sentences involving multiplication and division by calculating missing numbers, e.g. find the missing numbers.
- Represent and solve multiplication and division word problems using number sentences, e.g. ‘I buy six pens and the total cost is $24. What is the cost of each pen?’ can be represented as $6 \times ? = 24$ or $24 \div 6 = ?$
  - Discuss whether it is more appropriate to represent the problem using $\times$ or $\div$ in order to calculate the solution. (Communicating, Reasoning)
  - Pose a word problem based on a given number sentence, e.g. given $4 \times \square = 28$, a problem could be: ‘I have 28 cans of drink and stack them into rows of 4. How many rows will there be?’

**PRIOR KNOWLEDGE**

Students are able to Identify, continue, create, describe and record increasing and decreasing number patterns and identify odd and even numbers of up to four-digits.

**NUMERACY LINKS**

Numeracy Skills Framework, students are at early in Stage 2 for Aspects of Numeracy, Focus Area 2, patterns, generalisations and algebraic reasoning.

**LITERACY STRATEGIES**

Students should be able to communicate using the following language: pattern, term, missing number, odd, even, number sentence, is the same as, equals.

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**Teaching and Learning Activities and Assessment Sequence**

**INTRODUCTION**

**Playground number lines**

Have each student draw their own number line on the playground 1-30 with chalk. Have them solve simple addition and subtraction stories such as $5 + \square = 19$, $19 - \square = 5$, $19 - 5 = \square$

Continue to do examples with students making links between the addition and subtraction stories. Complete the number stories on the playground with chalk. Students reflect on how they are solving the equations.

**Resources**

Chalk

**DEVELOPMENT**

**What number am I thinking of?**

Modelled - Make cards with number sentences on them and cover one number on each card with a flap.

$45 - 3 = \square$ What number is 3 less than 45?
$34 + ? = 37$ What do I add to 34 to make 37?
$? + 18 = 23$ If I add 18 to my number I get 23?

Guided - Do a number of examples and then have students write an addition or subtraction story and cover a numeral and have a friend work the number out. Have students verbalise what they need to do.

Next present the number story on board with a box to represent the covered numeral. e.g. $15 + \square = 26$ Repeat a number of times with different students verbalising. Then in pairs use sets of cards with number stories containing boxes such as the example above and have them solve the number story box.

Independent - As students master this allow them to solve the equation by themselves.

**Resources**

Incomplete number sentences on cards
Cardboard squares to cover numeral
Blu-tack
Cards with number stories and missing numeral
CONSOLIDATION

Related number stories
Write the number story \(5 + 6 = 11\) on the board. Let's play with this number story!

\[
\begin{align*}
5 + 6 &= 11 \\
6 + 5 &= 11
\end{align*}
\]

What about \(11 - 5 = ?\)
\[
\begin{align*}
11 - 5 &= 6 \\
11 - 6 &= 5
\end{align*}
\]

We can make 4 different number stories out of one - two addition and two subtractions.
Do a number of examples with class. Pair students up to do examples. Do examples independently.

What about this one \(\square + 21 = 34\)
Write the 4 number stories. Which one will help us to solve the box?

Once again guide the students through the process to solve the box using the four related number stories until they understand the process and can do it on their own.

INTRODUCTION

Problem \(12 + 14 = 26\)

"Circle the last digit in each number - Are they odd or even numbers?"

Use small whiteboards and markers - revise how to determine if a number is odd or even and do a number of examples on white boards.

Pose the question ...

"So if you add two even numbers what will the answer be odd or even?"

"How can we test this?"

Gather ideas from the students as to how they can determine this. Select the best method and use it to test the students' ideas.

Test.

Reflection - What did you find?
Do a number of examples to test what they have found ...

DEVELOPMENT

So we have found that an even number added to an even number makes an even number.

Pose another question - What does an even number added to an odd number make?

Guided - Allow students to work in pairs using the previous testing method to find the answer. Reflect on the findings with the students.

INDEPENDENT

Pose other questions for students to investigate in a similar method.

What do you get if you add an even and an odd number?
What do you get if you subtract an even from an even number?

What do you get if you subtract an odd from an odd number?
What do you get if you subtract an even from an odd number?
What do you get if you subtract an odd from an even number?

Independent - If students are able to work independently or in pairs.

Pose further questions on multiplying and dividing odd and even numbers and work out what the results are.

CONSOLIDATION

Reflect on what the students find and complete a chart on the results. Reflect on how the students can work.

Assessment
What do you get if you multiply an even number by an even number? Show me or explain to me how you found the answer.

Generating sequences by counting
Students generate multiples sequences in different ways. For example, to list the multiples of three, they could silently count two numbers and count out loud every third number as far as 30. After doing this two or three times, ask students to recall the numbers they said out aloud.

Record the numbers on the board as the multiples of three.

Discuss: Why do you think these numbers are called multiples of three?

Students work in pairs to continue the sequence and look for patterns. A hundreds chart and transparent counters are used to highlight patterns for multiples of three.

Display the multiples of three sequence. Return to it later and ask questions such as: What did we call this sequence of numbers? Why? Cover it up and ask questions such as: What is the eighth multiple of three? How did you work it out? What are some different ways you could work it out?

Repeat this sequence for other multiples.

'Talking About Patterns and Algebra' page 173

Resources

Hundred charts
Transparent counters

Generating sequences by repeated addition

Another way to generate multiples sequences is through repeated addition. For example, to generate the sequence of multiples of six, students begin with four and continue adding four.

Begin the sequence as a class activity, writing 4 on the board and asking students to add another four. Write 8 next. Continue this process. Students share their addition strategies and discuss them. The students continue the sequence individually, look for patterns and give the sequence a title. They gather together and discuss the patterns they found. Note the language they use to generalise about patterns.
Write on the board the different titles they have selected and ask students to talk about these. Giving a sequence a title can be another form of generalising it.

‘Talking About Patterns and Algebra’ page 173

**Investigating sequences of multiples**
Students generate a list of multiples and investigate patterns in the sequence. They look for patterns of odd and even numbers, the final digits pattern and patterns in the tens digits.

A useful tool for investigating multiples sequences is the 0–9 wheel on which the sequence of final digits in a list of multiples is mapped.

For example, in the list of multiples of three the final digits sequence is a repeating cycle of 3–6–9–2–5–8–1–4–7–0. Begin by drawing a line on the 0–9 wheel from 3 to 6, then continue it to 9 and so on back to 3.

**Resources**
0–9 wheel stencils

**Relating multiples sequences**
Students investigate relationships among sequences of multiples, such as relationships among the multiples of two, four and eight, relationships between the multiples of three and six, and relationships among the multiples of three, four and twelve.

Multiples of one and nine produce the same wheel pattern, as do the multiples of two and eight, the multiples of three and seven and the multiples of four and six. Students observe that each pair with the same pattern (e.g. one and nine) adds to ten, and the patterns of the two are drawn in opposite directions.

**Investigating multiplication and division facts**
Make some cards with sets of incomplete multiplication or division number sentences such as the following.

Students complete the number sentences, discuss their strategies for doing so, and discuss the patterns.

*Example of card*

4 × 5 = 20
4 × 50 = 200
4 × 500 = 2000

Repeat using many examples as modelled, guided and independent activity as the students develop their understanding of the concept.

**Resources**
Set of cards with incomplete multiplication and division number sentences

**Related multiplication and division facts**
Record some sets of numbers sentences on cards such as the following...

4 × 6 = 24, 6 × 4 = 24, 24 ÷ 6 = 4, 24 ÷ 4 = 6

Ask students: What can you tell me about these number sentences?

Students make their own cards like these, covering some of the numbers with flaps.

Show cards such as the following

4 × 13 = 52
4 × 1 = 52
52 – 4 = 52
52 – 13 = 52

Ask students if they can work out the missing numbers and explain the reasons for their answers.

Numbers of this magnitude have been chosen to make it more difficult for students to do a quick calculation. They need to look for other strategies, such as relating the facts on the card.

**Resources**
Sets of cards with the multiplication and division matching number stories

Sets of cards with missing numerals as shown

**Arrays and multiplication and division facts**
Display the card from the previous activity, with the missing numbers filled in.

Next, show a card with a 4 × 13 array of dots (without telling students the number of rows and columns) and ask them to work out how many dots they see.

Do they refer to the card on display to work out the answer?

Next, show a card with a 8 × 13 array of dots (without telling students the number of rows and columns) and ask them to work out how many dots they see.

Do they refer to the card on display and double the 52 when they realise this is a 13 x 8 array?

Set students the task of writing four related multiplication and division facts that the array shows.

**Resources**
Counters for making arrays
Cards showing arrays
TEACHING SEQUENCE FOR PATTERNS AND ALGEBRA Stage 3 - Patterns and Rules

PURPOSE
The purpose of this sequence of activities to develop students understanding that numbers can be represented in different ways as fractions, decimals and percentages and in patterns and relationships.

SYLLABUS OUTCOMES
Mathematics
MA3-8NA  A student analyses and creates geometric and number patterns, constructs and completes number sentences, and locates points on the Cartesian plane.

Creative arts
A student investigates patterns within classical architecture and works of artists, e.g. golden mean and Leonardo Da Vinci.

Geography
A student compares spatial distributions and patterns in geographical phenomena.

Describe, continue and create patterns with fractions, decimals and whole numbers resulting from addition and subtraction (ACMNA107).

• Identify, continue and create simple number patterns involving addition and subtraction.
• Describe patterns using the terms ‘increase’ and ‘decrease’, e.g. for the pattern 48, 41, 34, 27, …, ‘The terms decrease by seven.’
• Create, with materials or digital technologies, a variety of patterns using whole numbers, fractions or decimals, e.g. or 2.2, 2.0, 1.8, 1.6…
• Use a number line or other diagram to create patterns involving fractions or decimals.

Use equivalent number sentences involving multiplication and division to find unknown quantities (ACMNA121).

• Complete number sentences that involve more than one operation by calculating missing numbers, e.g.
  - Describe strategies for completing simple number sentences and justify solutions. (Communicating, Reasoning)
• Identify and use inverse operations to assist with the solution of number sentences, e.g. becomes
  - Describe how inverse operations can be used to solve a number sentence. (Communicating, Reasoning)
• Complete number sentences involving multiplication and division, including those involving simple fractions or decimals, e.g.
  - Check solutions to number sentences by substituting the solution into the original question. (Reasoning)
• Write number sentences to match word problems that require finding a missing number, e.g. ‘I am thinking of a number that when I double it and add 5, the answer is 13. What is the number?’

PRIOR KNOWLEDGE
Students are able to finds missing numbers in number sentences involving addition or subtraction on one or both sides of the equals sign; investigates and uses the properties of odd and even numbers; recognises, continues and describes number patterns resulting from performing multiplication; finds missing numbers in number sentences involving one operation of multiplication or division.

NUMERACY LINKS
Numeracy Skills Framework, students are working at early in Stage 3 for Focus Area 2, patterning, generalisations and algebraic reasoning.
Students are at early in Stage 3 for Aspects of Numeracy, Focus Area 2, patterning, generalisations and algebraic reasoning.

LITERACY STRATEGIES
Vocabulary, text complexity, context.
Students should be able to communicate using the following language: pattern, increase, decrease, missing number, number sentence, number line.

Teaching and Learning Activities and Assessment Sequence

IDENTIFYING PATTERN RULE

Introduction: Modelled
Write a simple pattern on the board that uses an addition or subtraction rule e.g. 5, 7, 9, 11, 13. Ask the students to identify the rule (+2) that is being applied to this pattern with them continuing the pattern on a further three numerals. Repeat the process with a pattern that uses subtraction e.g. 15, 12, 9, 3. Students identify the rule (-3) and continue the pattern.

Compare these two patterns displayed on the board, ask questions such as;
• What is the difference between these two patterns?
• What rule is applied to them?
• How does the rule affect the pattern?
• Are the patterns increasing or decreasing? By what?

Encourage students to use language such as increase, decrease, pattern, rule etc.

Resources
Set of Numerical Cards - Whole numbers, fractions and decimals
Pattern grid template
Number line
Whiteboard and markers

Development: Guided and independent tasks
Find my rule
Supply students with a set of numeral cards including whole number, decimals and fractions. Using the numeral cards and a simple grid template e.g.

5 9 13 17 21 25 29

They will then swap their pattern with their partner and attempt to guess their partners rule.
• What is the rule?
• Why do you think this?
• How can you prove your theory?
Repeat this process with more challenging patterns and record them using a number line to create and repeat the pattern.

and/or

Picking apples
Students are given the problem:
At the beginning of the season an apple picker picks:
• One ripe apple on the first day
• Two on the second
• Four on the third and
• Eight on the fourth

Provide students with a number line to display the pattern allowing them to answer questions such as:
• How many is he likely to pick on the tenth day?
• How many on the fifteenth?

and/or
What is missing?
Teacher writes a collection of numbers on the board. Students investigate to decide what number is missing e.g. 17 53 41 11 35 59 47 5 23

- What number is missing?
- Why do you think this?
- How else could you discover the answer?

Provide small groups of students with whiteboards and markers. They are asked to create a pattern, record the numbers required to demonstrate that pattern and eliminate one. Then showing their group they must identify the missing number by solving the pattern.

Consolidation
Have students share their patterns with the class applying the rule to different pattern sequences, to demonstrate how the rule can vary. Discuss how they solve the pattern and what strategies they used to check they were correct.

INVERSE OPERATIONS

Introduction: Modelled
Pose the problem ‘I am thinking of a number, when I take 9 away from the number my answer is 19. What number am I thinking?’ or ‘I am thinking of a number that when I double it and add 5, the answer is 13. What is the number?’

Students discuss possible answers and create a number sentence that may be used to solve the problem.

Use the number sentences to explain inverse operations (Opposite operations that undo each other).

Development: Guided and independent tasks
Place students into pairs, they will take turns posing questions to one another, creating number sequences and using inverse operations to solve the problems.

Provide students with number sentences that include addition, subtraction, division and multiplication problems, allowing students to use inverse operations to find the missing numbers from each equation.

Consolidation
Have students share their number problems from the independent task.

MISSING NUMBERS

Introduction: Modelled
Write a sentence on the board with missing numbers e.g. ? – 9 = 19, ? = 19 + 9 and 9 x ? = 10 x 4.5

Discuss what strategies can be used to discover the missing numbers.

Students then write similar problems for their partner to complete. Students will be required to verbalise strategies they know will help solve the problem.

Development: Guided and independent tasks
Number squares with missing numbers
Show one of the number square cards such as the one below and ask students to work out which sequence of numbers is formed by the missing numbers. They label the sequence, not simply list the missing numbers, e.g.

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<table>
<thead>
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<td>33</td>
<td>34</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

The missing numbers are multiples of 12.

Provide students with number squares such as the following, working in pairs or small groups students will develop questions about these number squares for one another.

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<table>
<thead>
<tr>
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<td>73</td>
<td>74</td>
<td>76</td>
<td>77</td>
<td>79</td>
<td>80</td>
</tr>
</tbody>
</table>

Students write questions about these number squares.

Consolidation
Students reflect on their learning by sharing the strategies that they used throughout the lesson. They explain their thought process and why they selected that strategy. But sharing their ideas students may gain a different perspective or a more effective strategy.

NUMBER SENTENCES

Introduction: Modelled
Write a number story on the board; e.g. Add 5 to the number to get 17. Subtract 12 from the number to get 7 etc.

Discuss strategies that may be used to solve these problems. Brainstorm ideas onto the board then turn the number stories into appropriate number sentences to solve; e.g. ? + 5 = 17, 12 – ? = 12
Development: Guided and independent tasks
Create some cards with a set of incomplete multiplication or division number sentences e.g.

\[3 \times ? = 21 \quad 6 \times ? = 42\]
\[3 \times ? = 210 \quad 6 \times ? = 420\]
\[3 \times ? = 2100 \quad 6 \times ? = 4200\]

Students complete the number sentences, discuss their strategies for doing so, and discuss the pattern.

Increase the difficulty of the inverse equations. Have students provide incomplete number sentences for the whole class to solve. e.g.

\[\_ + 6 = \_ \times 3 \quad \frac{24}{2} = \frac{1}{2} \times \_\]
\[\_ + 11 = \_ \times 6 \quad 100 - \_ = 12 + \_\]

Consolidation
Invite students to share their independent tasks and explain how they solved the problem. What strategy did you use?
PATTERNING, GENERALISATIONS AND ALGEBRAIC REASONING

Addition, subtraction, multiplication and division

Understanding fractions, decimals, percentages, rates and ratios

Understanding money and finance

Understandings in texts

Understanding information in texts

Representing data in graphs and timelines

Interpreting and analysing data

Applying angles and geometry

Applying concepts of 2D shapes

Applying concepts of 3D objects

Understanding position, maps and grids

Understanding time

Understanding mass, volume and capacity

Understanding length

Understanding area

Estimating and problem-solving

A student
Continues and creates sequences involving whole numbers, fractions and decimals; describe the rule used to create the sequence (ACMNA133).

- Continue and create number patterns, with and without the use of digital technologies, using whole numbers, fractions and decimals, e.g. or 1.25, 2.5, 5, ...
  - Describe how number patterns have been created and how they can be continued. (Communicating, Problem Solving)

- Create simple geometric patterns using concrete materials, e.g.

- Complete a table of values for a geometric pattern and describe the pattern in words, e.g.
  - Describe the number pattern in a variety of ways and record descriptions using words, e.g. ‘It looks like the multiplication facts for four.’
  - Determine the rule to describe the pattern by relating the bottom number to the top number in a table, e.g. ‘You multiply the number of squares by four to get the number of matches.’

Creative art
Uses patterns e.g. Fibonacci sequence in nature as a stimulus for drawing and painting in visual arts or organising sound in music or play building in drama or composing in dance.

History
A student sequences events and people in chronological order.
A student compares and classifies information from a range of sources.

PURPOSE
The purpose of this sequence of activities to develop students understanding for patterns and algebra.

SYLLABUS OUTCOMES
Mathematics
MA3-8NA A student analyses and creates geometric and number patterns, constructs and completes number sentences, and locates points on the Cartesian plane.

A student
Continues and creates sequences involving whole numbers, fractions and decimals; describe the rule used to create the sequence (ACMNA133).

- Continue and create number patterns, with and without the use of digital technologies, using whole numbers, fractions and decimals, e.g. or 1.25, 2.5, 5, ...
  - Describe how number patterns have been created and how they can be continued. (Communicating, Problem Solving)

- Create simple geometric patterns using concrete materials, e.g.

- Complete a table of values for a geometric pattern and describe the pattern in words, e.g.
  - Describe the number pattern in a variety of ways and record descriptions using words, e.g. ‘It looks like the multiplication facts for four.’
  - Determine the rule to describe the pattern by relating the bottom number to the top number in a table, e.g. ‘You multiply the number of squares by four to get the number of matches.’
Use the rule to calculate the corresponding value for a larger number, e.g. ‘How many matches are needed to create 100 squares?’

• Complete a table of values for number patterns involving one operation (including patterns that decrease) and describe the pattern in words, e.g.
  - Describe the pattern in a variety of ways and record descriptions in words, e.g. ‘It goes up by ones, starting from four.’
  - Determine a rule to describe the pattern from the table, e.g. ‘To get the value of the term, you add three to the position in the pattern.’
  - Use the rule to calculate the value of the term for a large position number, e.g. ‘What is the 55th term of the pattern?’

• Explain why it is useful to describe the rule for a pattern by describing the connection between the ‘position in the pattern’ and the ‘value of the term.’ (Communicating, Reasoning)

• Interpret explanations written by peers and teachers that accurately describe geometric and number patterns. (Communicating)

• Make generalisations about numbers and number relationships, e.g. ‘If you add a number and then subtract the same number, the result is the number you started with.’

Introduce the Cartesian coordinate system using all four quadrants (ACMMG143).

• Recognise that the number plane (Cartesian plane) is a visual way of describing location on a grid.

• Recognise that the number plane consists of a horizontal axis (x-axis) and a vertical axis (y-axis), creating four quadrants.

PRERIOR KNOWLEDGE
Students are able to identifies, continues creates and describes increasing and decreasing number patterns with fractions, decimals and whole numbers; and find missing number sentences involving multiplication and Division on one or both sides of the equals sign.

NUMERACY LINKS
Numeracy Skills Framework, students are working at the end of Stage 3 for Aspects of Numeracy, Focus Area 2, patterning, generalisation, algebraic reasoning.

LITERACY STRATEGIES
Students should be able to communicate using the following language: pattern, increase, decrease, term, value, table of values, rule, position in pattern, value of term, number plane (Cartesian plane), horizontal axis (x-axis), vertical axis (y-axis), axes, quadrant, intersect, point of intersection, right angles, origin, coordinates, point, plot.

Teaching and Learning Activities and Assessment Sequence

GEOMETRIC PATTERNS

Introduction
On the board draw a number pattern, discuss the features of this pattern, what rule is it following, how could we solve this pattern and continue it? What is I wanted to find out what the 8th number was going to be after following the pattern? Is there another way beside continuing the pattern till we get there?

Development: Guided and independent tasks

Pattern block puzzles
Students investigate the patterns created when looking at sides of pattern blocks e.g. hexagon patterns 5, 10, 15

Joined pattern blocks - as above but joining the shapes 5, 9, 13

Predict how many sides when more shapes are used e.g. 10

Sticky puzzles
Students build a line of triangles using matchsticks.

Draw up a table to represent the sequence of triangles.

Students describe and explain the pattern.

Could their explanation help them find the 12th number in the pattern without using the table?
**Number patterns**

Provide students with pop sticks or matchsticks. Ask them to make a series of rhombuses from the sticks. Students keep a record of how many sticks they have used altogether after each rhombus is added. Record the number of rhombuses they construct.

As a class, create a table and record the data in the table.

<table>
<thead>
<tr>
<th>Number of rhombuses</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of popsticks</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>24</td>
<td>28</td>
</tr>
</tbody>
</table>

Ask students:

- Can you work out how many pop sticks you would need if you wanted to make 15 rhombuses?
- What are some different ways you can work this out?
- Does the table help you work this out?
- If I used 80 pop sticks, how many rhombuses could I make?

**NAPLAN teaching strategies.**

**Consolidation**

Students share their examples with peers discussing how they came up with their answers and other possible strategies that could have been used amongst the group.

**TABLE OF VALUES**

**Introduction**

Prepare a table of values, which shows a number pattern similar to the example below.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>12</td>
<td>18</td>
<td>24</td>
<td>30</td>
</tr>
</tbody>
</table>

- Discuss the information in the table with the students. Ask students what number patterns they can see. Identify the rule to describe each row, e.g. Top row: 1, 2, 3, 4, 5, 6, ... (rule is + 1) Bottom row: 6, 12, 18, 24, 30, 36, ... (rule is +6).
- Describe the number pattern in a variety of ways and record the descriptions in words, e.g. It looks like the 6 times table.
- Look at the relationship between the top row and the bottom row in the table.
- Determine a rule to describe the pattern from the table e.g. You multiply the top number by the six to get the bottom number.

**Development**

- Display the table below on a classroom wall; the table should not have a title or column headings. Students look at the numbers in the first column and compare to the numbers in the second column. Students write their suggestions for a title and column headings on paper.

<table>
<thead>
<tr>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heading</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
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<tr>
<td>3</td>
</tr>
</tbody>
</table>

Discuss, giving reasons to justify their suggested title and headings, e.g. number of fingers on a hand, number of sides of a pentagon.

Provide students a copy of the table below. The table has the title and headings only.

<table>
<thead>
<tr>
<th>HOURS IN A WEEK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Days</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

- Students suggest data which could go in each column to match the column headings. Ask students for reasons to justify the data they have suggested.
- Pose this problem for the class to solve.
- “How many numbers are in the following number pattern?“ The first 4 numbers and the last number have been given. 8, 16, 24, 32, ... , 144
- Discuss the strategies the students used. Ask students to draw a table to demonstrate how the problem can be solved.
- “What is the relationship between each number and the position of the number in the pattern?“
- Repeat for other number patterns. Continue the pattern by adding 5 more terms. Students determine what the last number would be. 8, 16, 24, 32, ... , 144,


View with the class on the interactive whiteboard and practise some questions. Discuss.
Consolidation
Ask students to evaluate their best learning style and reflect on the type of activities used. Use this information and data for further planning.

THE CARTESIAN PLANE
Introduction: Modelled
Draw an axis on the board, discuss the labelling of that axis with x and y. The position of any point on the Cartesian plane is described by using two numbers: (x, y). The first number, x, is the horizontal position of the point from the origin. It is called the x-coordinate. The second number, y, is the vertical position of the point from the origin. It is called the y-coordinate. Since a specific order is used to represent the coordinates, they are called ordered pairs.


Mark the coordinates (2,5) on the axis with a dot and ask students to identify the coordinates of that point. Discuss the order in which we state the coordinates.

Development
Provide students with a piece of grid paper, they rule an axis up and label that axis x and y with numerals up and across the page.

Students use their labelled axis to fill in coordinates such as (2,2), (5,2), (3,6), (6,6), (4,4), (2,2).

Students draw a four quadrant axis labelled x and y, also labelled with the positive and the negative numbers on the axis. Provide students with coordinates containing positive and negative numbers that go across the intersection point of 0,0.

Ask students questions such as:
• “What does the first number represent? The y or x axis?”
• “How did you mark the coordinates?”

“What shape is made?”
• “Why is the order of coordinates so important?”
• “How do the negative numbers affect that coordinates?”

Graphing worksheets

These graphing worksheets will produce a four quadrant coordinate grid and a set of ordered pairs that when correctly plotted and connected will produce different characters. You may select which one of the characters you wish to make.

These graphing puzzles contain over 100 ordered pairs to plot, divided into 6 to 57 different shapes. For each shape plot the ordered pairs on the axis and connect them in order.

Make the shape
An introduction to plotting co-ordinates on a chart and graph. The numbers are presented as an ordered pair, x, then y axis, or across then up (or down). Select from co-ordinates and negative co-ordinates. Users are asked to plot the positions on the chart to create a shape. Correct plots will turn green, current plot will be yellow. (You can’t plot the next spot unless you get the previous one correct!) Encourages following directions. See Teacher Tool for some more off iPad activities.

Consolidation
Have students share their Cartesian plane with each other, looking at and discussing the similarities and any differences, possibly with scale or positioning of points.

Reference
TEACHING ACTIVITIES FOR PATTERNS AND ALGEBRA Stage 3 - Analysing and Continuing Patterns

PURPOSE
This activity builds students’ capacity to analyse patterns, continue patterns and complete number sentences to describe the pattern.

Linking Straws Stage 3

STRAND AND SUBSTRAND
Number - Patterns and Algebra - Stage 3

SYLLABUS OUTCOMES

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

MA3-3WM A student gives a valid reason for supporting one possible solution over another.

MA3-8NA A student analyses and creates geometric and number patterns, constructs and completes number sentences, and locates points on the Cartesian plane.

NUMERACY LINKS
Numeracy Skills Framework, students are working at the end of Stage 3 for Focus Area 2, patterning, generalisations, algebraic reasoning.

ACTIVITY FOCUS
Identifies, continues, creates, describes and records increasing and decreasing number patterns.
Linking Straws Activity

INSTRUCTIONS
1. Organise the class in groups of 3.
2. Give students a set of straws that can be joined. You can also use matches.
3. Students create a simple geometric pattern by connecting the straws. Example:

\[ \Delta, \Delta, \Delta, \Delta, \Delta, \Delta, \Delta, \Delta, \Delta, \ldots \]

4. They then complete a table of value for that geometric pattern. Example:

<table>
<thead>
<tr>
<th>NUMBER OF TRIANGLES</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUMBER OF STRAWS NEEDED</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
</tr>
</tbody>
</table>

5. Describe the pattern in words. Example: It looks like a multiplication fact of 3.
6. Determine the rule to describe the pattern by relating the bottom number to the top number in a table. Example: You multiply the number of triangles by three to get the number of straws.
7. Use the rule to calculate the corresponding value for a larger number. Example: How many straws are needed to create 100 triangles?
8. At the end of the session, each group presents their patterns and talks about the rule.
TEACHING SEQUENCE FOR SPATIAL VISUALISATION, GEOMETRIC REASONING AND MAPPING Early Stage 1

PURPOSE
The purpose of this sequence of activities is to develop students’ understanding of spatial visualisation and to become familiar with different mathematical concepts. Students will learn to understand, locate and describe position. Sans Souci Public School implemented these activities with Early Stage 1 students to develop their understanding of various mathematical concepts.

STRAND AND SUBSTRAND
Measurement and Geometry - Position - Stage ES1

SYLLABUS OUTCOMES
MAE-16MG A student describes position and gives and follows simple directions using everyday language.

MAE-1WM A student describes mathematical situations using everyday language, actions, materials and informal recordings.

MAE-3WM A student uses concrete materials and/or pictorial representations to support conclusions.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 3, spatial visualisation, geometric reasoning and mapping.

ACTIVITY FOCUS
Gives and follows simple directions, describes position using everyday language and uses the terms ‘left’ and ‘right’ to describe position in relation to self.
Shared Reading Activity

Introduction
Show children the front cover of *Up & Down* by Britta Teckentrup. Read the title. Ask the children to name what they see in the illustration. Ask, 'Which penguin is going up? Which penguin is going down? What is going around?'

Complete a picture walk-through of the book, encouraging the children to use the illustrations to predict what is happening.

Development
Read *Up & Down* to the children, stopping to ask, 'Where is the little penguin?' or 'What is the little penguin doing?' at appropriate places throughout his journey. Stop at the double page spread at the beginning of the story that shows the penguins on different icebergs and ask questions about their positions, also in relation to each other. On each page ask focus questions such as 'Where is the little penguin now?', 'Which direction is the little penguin going?', 'What does he need to do next to get to his friend?' etc.

Consolidation and diagnostic assessment
Ask the children to follow directions to draw a picture based on the story. Directions might include: 'Draw something under the iceberg. Draw some seaweed on the bottom of the ocean. Draw a penguin on the iceberg. Draw a whale in the ocean. Draw something above the iceberg.' Ask students to describe their picture.

Positional Language Game Activity

Introduction
Show students the positional language flashcards and discuss what each of them means. Explain to students that they are going to play a game that will help them understand each of these terms.

Development
Place all the cards in a box. Invite the children to take turns taking a card and acting out the word (e.g. If a child selects 'under' he/she could crawl under a table). The teacher may need to read the word to the child.

Ask the rest of the group to guess the word the child is acting out. Another child is then chosen to act out a word. How can you act out this word? How can you show this word with counters?

Consolidation and formative assessment
Repeat the game using concrete objects (e.g. use different coloured counters to demonstrate the word 'between').

Teacher monitors students’ ability to demonstrate understanding of positional language and uses this opportunity to assist students' understanding through demonstration.

Positional Obstacle Course Activity

Introduction
Revise the positional language flashcards introduced in the previous lesson.

Introduce students to the various pieces of playground equipment set up. Choose one or more students to demonstrate how to use each piece of equipment (with teacher direction).

Explain to students that they are going to play a game that will help them to consolidate their understanding each of these terms.

Development
Place the cards at each piece of equipment on the obstacle course to remind the children what they need to do.

Observe the children as they follow the instructions to navigate their way through the obstacle course.

Consolidation and formative assessment
 Invite children to suggest other ways of using the equipment and support them to place the positional language flashcards in different places.

Provide students with the opportunity to give verbal instructions to their classmates to follow, using the positional language they have learned.
Drawing Instructions Activity

**Introduction**
Using the positional language flashcards give the students simple oral instructions (e.g. Simon Says) and observe them as they follow your instructions.

Example: Simon Says - Stand up; Put your hands on your head; Put your hands behind your back; Put your hands in front of your face; Lift one leg up; Put your hands under your leg; Put your leg down; Sit down.

**Development and summative assessment**
Give children A3 sheets of paper folded into thirds and ask them to draw an arctic sea picture by following your instructions.

Example: Starting in the lower section of the page draw the water. Then in the middle section draw an iceberg towering up towards the top of the page.

Next get students to draw the following: a penguin on the iceberg, a bird above the iceberg, a fish under the iceberg and a jellyfish in the water.

Show the children where to start drawing their water (lower fold line) so there is space to draw under the water.

Invite the children to add more to their picture.

**Consolidation and summative assessment**
Support the children to use words relating to position to describe their picture by asking, 'Where...?' questions. Encourage children to answer in a detailed sentence (e.g. The fish is in the water under the iceberg).

Invite the children to select a ‘positional language’ flash card that describes part of their picture and copy the word onto their picture to match the drawn position.

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**Lesson 6 - Where's Teddy?**

**ACTIVITY**
Provide 8 small teddy bears and 9 small boxes to each student.

Ask students to place the 8 teddy bears in the following 8 positions:
- Model the teddy bear left of the box
- Model the teddy bear behind the box
- Model the teddy bear between two boxes
- Model the teddy bear in front of a box
- Model the teddy bear on the box
- Model the teddy bear in the box
- Model the teddy bear right of the box
- Model the teddy bear under the box

Walk around to check how students are placing the teddy bears and guide them to think about their choices.

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**Lesson 7 - Where am I?**
Provide students with the table showing the eight positional language terms and ask students to create a drawing to show each position.
Where is the Penguin? Flashcards

Created by J. Lennon, Sans Souci Public School.
<table>
<thead>
<tr>
<th>left</th>
<th>behind</th>
</tr>
</thead>
<tbody>
<tr>
<td>between</td>
<td>in front</td>
</tr>
<tr>
<td>on</td>
<td>in</td>
</tr>
<tr>
<td>right</td>
<td>under</td>
</tr>
</tbody>
</table>
TEACHING SEQUENCE FOR UNDERSTANDING GEOMETRY AND APPLYING 2D SHAPES Stage 2

PURPOSE
The purpose of this sequence of activities is to develop students' understanding of 2D shapes and 3D objects, solve problems using multiplication, addition, subtraction and money. Woy Woy Public School implemented these activities with their Stage 2 students.

STRAND AND SUBSTRAND
Space and Geometry - Two-Dimensional Space - Stage 2

SYLLABUS OUTCOMES
MA2-15MG A student manipulates, identifies and sketches 2D shapes, including special quadrilaterals and describes their features.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning being used.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 3, spatial visualisation, geometric reasoning and mapping.

ACTIVITY FOCUS
A student understands and applies concepts of 2D shapes and 3D objects.
2D Activity

Shape guessing
Discuss the properties of any 2D shape. Allow students to guess what the shape could be as you go through the properties.

Geoboard shapes
Create any shape by stretching a rubber band around a geoboard. As each shape is made, students can discuss and record their observations in groups.
Ask questions:
How many sides does the shape have?
Can you find shapes that look like other shapes?
Can you make up names for them?
Do your shapes have sharp corners? Blunt corners?
What is the smallest number of sides you need to make a shape?
Why can’t we have a shape with two sides?

Shape hunt
Students walk around the school to investigate and identify 2D shapes and their properties.

Optical illusions
Give examples of shapes that have optical illusions.

Measure the angle
Have students measure different angles in the classroom using an ‘angle tester’.
Allow students to draw triangles with chalk in the playground and measure the angles using an ‘angle tester’.
Record the results.
Discuss the results, for example 90-degree angles are common in a built environment, ask why students think this is?
PURPOSE
To investigate congruent figures through transformations with a range of contexts including cultural designs and dynamic geometry software. Ambarvale High School developed and implemented this unit for Stage 4 students.

SYLLABUS OUTCOMES
Mathematics stage 4 outcomes
Define congruence of plane shapes using transformations (ACMMG200).

- Identify congruent figures by superimposing them through a combination of rotations, reflections and translations.
- Recognise congruent figures in tessellations, art and design work, e.g. mosaics. (Reasoning)

PRIOR KNOWLEDGE
Stage 3 outcome
Investigate combinations of translations, reflections and rotations, with and without the use of digital technologies (ACMMG142).

- Identify whether a two-dimensional shape has been translated, reflected or rotated, or has undergone a number of transformations, e.g. ‘The parallelogram has been rotated clockwise through 90° once and then reflected once.’
- Construct patterns of two-dimensional shapes that involve translations, reflections and rotations using computer software.
- Predict the next translation, reflection or rotation in a pattern, e.g. ‘The arrow is being rotated 90° anti-clockwise each time.’
- Choose the correct pattern from a number of options when given information about a combination of transformations. (Reasoning)

NUMERACY LINKS
Numeracy Skills Framework, students are working at early Stage 4 for Focus Area 3, applying concepts of 2D shapes, a student translates, rotates and reflects points and shapes on a number plane.

LITERACY STRATEGIES
Vocabulary (wordbank).
Teaching and Learning Activities and Assessment Sequence

Reviseshare_cartesian, plotting points and introduce moving a single point.
Identify congruent figures by superimposing them through a combination of rotations, reflections and translations.

Resources
Computers with internet access
Geogebra exercise 1
SMARTboard or projector

ACTIVITY 1 - TRANSFORMATIONS ON THE CARTESIAN PLANE

Introduction
Provide students with a word bank and explain the definitions for the three different transformations.

Development
Students perform these transformations using halved Post-it notes in their books while the teacher models the transformations on an A3 Cartesian plane.

Consolidation
Students create their own transformations in small groups and present their transformations to the class.

ACTIVITY 2 - GEOGEBRA

Students independently perform a range of transformations in Geogebra to create a basic animation. Suitable for students without Geogebra experience. The Geogebra Exercise sheets provide step-by-step instructions whilst the teacher can model the steps using a SMARTboard or projector.

Applying Reflections, Translations and Rotations

STRAND AND SUBSTRAND
Measurement and Geometry - Transformations - Stage 4

SYLLABUS OUTCOMES
MA4-17MG A student classifies, describes and uses the properties of triangles and quadrilaterals, and determines congruent triangles to find unknown side lengths and angles.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.
MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, students are working at early Stage 4 for Focus Area 3, applying concepts of 2D shapes, a student translates, rotates and reflects points and shapes on a number plane.

ACTIVITY FOCUS
Students revise the transformations learnt in Stage 3 Mathematics and apply these transformations to congruent shapes on the Cartesian plane.
Transformations on the Cartesian Plane Activity 1

Have each student copy the following word bank into their exercise books and then define them.

• Transformations
• Translations
• Reflection
• Rotation
• Congruence

ACTIVITY INSTRUCTIONS

• Hand out a copy of an A4 Cartesian Plane and 2 Post-it notes to each student.
• Have students cut the Post-it note diagonally in half to create two congruent triangles. Place the triangle with the sticky strip to the side and have the students glue the non-sticky triangle onto the top left-hand corner of their Cartesian plane. Have the students place the ‘sticky’ post-it note on top of the glued one. Once they have completed that, ask them to perform transformations such as the following whilst demonstrating the same transformations on a large A3 Cartesian Plane.

SAMPLE TRANSFORMATIONS

• Translate your triangle 3 units down and 2 units to the right.
• Now translate your triangle 4 units down and 1 unit to the left.
• Rotate your triangle 90 degrees.
• Rotate your triangle 90 degrees and translate it 3 units to the right.
• Reflect your triangle.
• Reflect your triangle a rotate it 180 degrees.

In pairs or small groups, have students create their own ‘tricky’ transformation and have them demonstrate their transformations to the class on the large A3 Cartesian Plane.

Applying Reflections, Translations and Rotations

STRAND AND SUBSTRAND

Measurement and Geometry - Transformations - Stage 4

SYLLABUS OUTCOMES

MA4-17MG A student classifies, describes and uses the properties of triangles and quadrilaterals, and determines congruent triangles to find unknown side lengths and angles.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS

Numeracy Skills Framework, students are working at early Stage 4 for Focus Area 3, applying concepts of 2D shapes, a student translates, rotates and reflects points and shapes on a number plane.

ACTIVITY FOCUS

Students revise the transformations learnt in Stage 3 Mathematics and apply these transformations to animations.
GeoGebra Activity 2

The GeoGebra Activity 2 allows students to consolidate their understanding of the transformations. Students are to complete the GeoGebra activity below.

The following activity allows students to create a basic animation using the transformations, translations, rotations and reflections.

Teachers are to provide guidance by demonstrating the activities on a SMARTboard or projector.

GeoGebra Activity 2
Performing Transformations in GeoGebra

TICK THE FOLLOWING AS YOU COMPLETE

☐ I know how to animate through translation
☐ I know how to animate through rotation
☐ I know how to animate through reflection

START-UP INSTRUCTIONS

1. Go to the website https://www.geogebra.org/ and select the ‘GeoGebra Maths Apps’ option.

2. Select ‘Geometry’ from this menu on the right-hand side.

3. Your blank screen should look as follows:

4. Find a picture online that you would like to animate. You can use the following website: http://www.clipartpanda.com

Save the image. Make sure you know where you saved it.

To insert the image into GeoGebra:

Select the and click IMAGE.

Press the BROWSE button.
Find where you saved your image.
Click on the file and then click OPEN.
Click OK.
Resize your image if needed.

Once you finished using a tool be sure to always click on the cursor tool.
CREATING A TRANSLATION

1. Underneath your image create a horizontal line segment by:
   
   Selecting \[ \text{Segment} \] from the top menu.
   
   Click SEGMENT.
   
   Click a spot underneath your image to create the beginning of the line segment and then click another.
   
   Spot away from your image to end your line segment.

2. Create a dependent point on that line by:
   
   Selecting \[ \text{Point} \] from the top menu.
   
   Click POINT.
   
   Click a point somewhere along your line segment. This point should be a lighter blue than all the other points so far. If it is not, you have not correctly placed the point on your line segment and must try again.

3. Create a vector from the start of your line segment to your dependent point by:
   
   Selecting \[ \text{Vector} \] from the top menu.
   
   Click VECTOR.
   
   Click on the point at the start of your line segment and the dependent point. Your vector should look like the following:

4. Right click on your dependent point and select ANIMATION ON from this menu.
   
   Your dependent point should now be moving along the line segment.

5. Pause your animation using the pause button on the bottom left hand side of the screen.

6. Now you are going to use the moving point to translate your image by:
   
   Selecting \[ \text{Translate by Vector} \] from the top menu.
   
   Click TRANSLATE BY VECTOR.
   
   Immediately click on your image and then click on the vector.
   
   Click the play button in the bottom to start your translation animation.

7. If you wish to hide your original image, right click on your original image and select ‘Show Object’ from this menu.

Congratulations! You are now translating your animation!
CREATING A ROTATION

1. Start with a fresh screen and the image you would like to animate.

2. Select this menu button.
   Click the SLIDER option to create a slider that will rotate your animation.
   Adjust the slider settings to be as follows:

   ![Slider settings](image)

   If you select the animation tab in these settings, you can adjust the speed of your animation.
   Once you click on OK and a slider should appear in your window. You may need to move the slider bar under your image rather than on top of it.

3. Select the option POINT from this menu and place the point on the middle of the image you wish to animate.

4. Select this option from the top menu.
   Click ROTATE AROUND POINT.
   Select the point in the middle of your image and select the image you want to rotate.
   The box below will pop up. Change the angle to ‘a’ (or whatever you have named your slider).

   ![Rotate around point](image)
   When you drag your slider, your character should rotate!

5. You can choose to add a start/stop button which will start and stop your animation. Select your slider menu button and then select ‘Button’. Click in your graphics window to create this button.
   Fill in the button settings as follows:

   ![Button settings](image)
   Create another button with the following settings:

   ![Another button settings](image)
   You should now have a Start and Stop button that starts and stops your animation!
CREATING A REFLECTION

1. Start with a fresh geometry GeoGebra screen. Insert the object or character you wish to reflect. I’ve used an image from http://free.clipartof.com/details/54-Free-Cartoon-Sheep-Clipart-Illustration.

Create a line segment by selecting this menu button and selecting SEGMENT. Your graphics screen should look a little like this:

![Geometry Screen](image)

2. Choose this menu button

Click the option REFLECT ABOUT LINE.

Then use your curser to place a box about your image as such: Then click on the line you wish to reflect this image about. Your image should now be reflected about this line!

Well done! You have now completed your first tutorial on animation using Geogebra!
TEACHING ACTIVITIES FOR MEASUREMENT
Stage 2 - Length and 2D Shapes

PURPOSE
Gilgandra Public School developed activities around length and 2D Shapes and problem solving using the four operations.

Length

STRAND AND SUBSTRAND
Measurement - Length - Stage 2

SYLLABUS OUTCOMES
MA2-9MG A student measures, records, compares and estimates lengths, distances and perimeters in metres, centimetres and millimetres.

MA2-2WM A student selects and uses appropriate mental or written strategies, or technology to solve problems.

NUMERACY LINKS
Numeracy Skills Framework, students are working at Stage 2 for Focus Area 4, understanding and applying length concepts.

FOCUS ACTIVITY
Uses informal and formal units to record measurements.
Length Activity

**WHAT YOU NEED**
Informal units of measure e.g. paper clips, lengths of string, blocks, rulers, paddle pop sticks

**TASK 1**
Measure student desk using a variety of informal units e.g. hand span, paddle pop sticks, paper clips.
Discuss the differences in answers and reasons as to why? e.g. Pose questions such as ‘Why did we need more paper clips than paddle pop sticks?’
Explain strategies used to estimate lengths and distances, such as by referring to a known length, e.g. ‘My hand span is 10 cm and my desk is 8 hand spans long, so my desk is about 80 cm long.’

**TASK 2**
Model how to use a ruler accurately (starting to measure from 0).
Students estimate their length of string.
Students measure length of string with ruler using formal unit e.g. cm and record it on board.

**CONSOLIDATION**
Students compare and order all lengths of string.
Students use a ruler and independently measure a set of items e.g. book, poster, folder, paper, desk, pencil and record results in a table.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MEASUREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

Shape Splitting

**STRAND AND SUBSTRAND**
Measurement - 2D Space - Stage 2

**SYLLABUS OUTCOMES**
MA2-15MG A student manipulates, identifies and sketches 2D shapes including special quadrilaterals and describes their features.
MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

**NUMERACY LINKS**
Numeracy Skills Framework, students are working at Stage 2 for Focus Area 4, understanding and applying concepts of 2D shapes.

**FOCUS ACTIVITY**
Describe and split common shapes into other shapes and record results.
Shape Splitting Activity

WHAT YOU NEED
- Posters/SMARTboard display of 2D shapes
- Worksheet of 2D properties
- SMARTboard
- Pattern blocks
- Shapes templates

Display a 2D shape and discuss the name and properties of the shape e.g. Square: (called square, 4 equal sides, 4 equal angles of 90°). Write up the properties discussed on poster/SMARTboard for that shape.

Distribute properties worksheets between pairs and repeat naming and describing of shapes - using 'think, pair, share' strategy.

As a whole class use SMARTboard and match labels/properties to 2D shapes. Choose students to participate.

Problem Solving

STRAND AND SUBSTRAND
Number and Algebra - Patterns and Algebra - Stage 2

SYLLABUS OUTCOMES
MA2-8NA A student generalises properties of odd and even numbers, generates number patterns and completes simple number sentences by calculating missing values.

MA2-2WM A student selects and uses appropriate mental or written strategies, or technology to solve problems.

DEVELOPMENT
- Using pattern blocks, model how to create a 2D shape from or by combining other 2D shapes e.g. hexagon = 6 triangles or hexagon = 2 trapeziums.
- Students form groups of 3-4 and investigate how many different combinations of shapes they can make e.g. hexagon can be created from 6 triangles or rectangle + 2 triangles or 2 triangles + 2 rhombuses or 2 trapeziums.
- Provide students with templates of outlines of shapes e.g. square, hexagon. Students then see how many different ways they can split their template into smaller shapes.

NUMERACY LINKS
Numeracy Skills Framework, students are working at Stage 2 for Focus Area 3, patterning, generalisations and algebraic reasoning.

FOCUS ACTIVITY
Recognise, continue and describe number patterns resulting from performing multiplication.
**Problem Solving Activity**

**TASK**

**INTRODUCTION**
In small groups, students write as many different words as they can to link mathematical terms to mathematical symbols e.g. gets =

<table>
<thead>
<tr>
<th>+</th>
<th>-</th>
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</thead>
<tbody>
<tr>
<td>PLUS</td>
<td>SUBTRACT</td>
</tr>
<tr>
<td>÷</td>
<td>×</td>
</tr>
<tr>
<td>DIVIDE</td>
<td>MULTIPLY</td>
</tr>
<tr>
<td>=</td>
<td></td>
</tr>
</tbody>
</table>

**DEVELOPMENT**

- Whole class - Solve problem questions using counters and blocks (NAPLAN questions can be used).

  **Example:** Lisa had a basket of 35 strawberries. Mark had a basket of 125 strawberries. How many strawberries did they have altogether? (Link to terms displayed on cards)

- Break into small groups. Provide different scenarios for groups to solve and match to number sentences and answer cards. e.g. Henry has 12 apples and gets 6 more, how many apples does he have now? 12 + 6 = 18

**CONSOLIDATION**

Model this task then provide numerical and operation cards. In pairs students write 4 problems using the 4 operations. e.g. 12 × 4, 12 + 4, 12 ÷ 4, 12 − 4.
PURPOSE
The purpose of this sequence of activities is for students to understand measurement and apply length concepts through fractions and decimals. They will learn how to convert units of length and apply different strategies to solve problems.

STRAND AND SUBSTRAND
Measurement and Geometry - Length - Stage 3

SYLLABUS OUTCOMES
MA3-9MG  A student selects and uses the appropriate unit and device to measure lengths and distances, calculates perimeters, and converts between units of length.

MA3-1WM  A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-2WM  A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 4, understanding and applying length concepts, converts between metres, centimetres and millimetres.

ACTIVITY FOCUS
Length, converting units of measurement, problem solving.
Converting Units of Measurement

It is easiest to use a conversion look-up diagram like the one below.

\[
\begin{array}{ccc}
\times 1000 & \times 100 & \times 10 \\
\div 1000 & \div 100 & \div 10 \\
\end{array}
\]

5 km = ? m  \quad \rightarrow \quad \text{We need to } \times 1000 \quad \rightarrow \quad 5 \times 1000 = 5000 \text{ m}

120 cm = ? m  \quad \rightarrow \quad \text{We need to } \div 100 \quad \rightarrow \quad 120 \div 100 = 1.2 \text{ m}

What pattern can you see?

### FURTHER ACTIVITIES

- a) Complete Length Scavenger Hunt Worksheet.
- b) Demonstrate how to measure large objects using a tape measure and convert the units to a different measurement using the conversion chart.

### Reference

Image Copyright 2013 by Passy’s World of Mathematics

Link: [http://passyworldofmathematics.com/converting-metric-units/](http://passyworldofmathematics.com/converting-metric-units/)
Length Scavenger Hunt

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>ESTIMATION</th>
<th>mm</th>
<th>cm</th>
<th>m</th>
<th>km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver seats</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Table</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sink</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet area table</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whiteboard</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handball court</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Development - Fractions and Decimals, Length Activity

**ACTIVITY**

**TASK**

1. Use the cm and mm flashcards (Column A and B) for students to arrange in order on a number line in their books or on individual whiteboards. The measurements can also be sorted in order on the board to as a whole class discussion on where each measurement should be placed.

2. Ask students to convert the measurements in cm (Column A) to mm.

3. Ask students to convert the measurements in mm (Column B) to cm. Students come up to the front board to share their thinking with the class and explain the strategy used.

4. Using the flashcards in column C and D, ask students to place the measurements in ascending order. Ask students “From these measurements which ones would be easier to use if converted to another unit of measurement?”

Ask students to convert 1000 m to km and 5000 m to km. Ask students to convert 0.1 km to m and 0.02 km to m.
### Measurement Flashcards

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
<th>Column C</th>
<th>Column D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cm</td>
<td>5 mm</td>
<td>23.57 m</td>
<td>5 000 m</td>
</tr>
<tr>
<td>2 cm</td>
<td>2 mm</td>
<td>46.9 m</td>
<td>0.1 km</td>
</tr>
<tr>
<td>12 cm</td>
<td>23.7 mm</td>
<td>30.1 m</td>
<td>4 km</td>
</tr>
<tr>
<td>4 cm</td>
<td>56.8 mm</td>
<td>1 m</td>
<td>0.02 km</td>
</tr>
<tr>
<td>5 cm</td>
<td>10 mm</td>
<td>1 000 m</td>
<td>1 km</td>
</tr>
</tbody>
</table>
Classroom Measurement Gallery Cards

CONVERSION FLASHCARDS

<table>
<thead>
<tr>
<th>How did you find your answer?</th>
<th>1.37 cm = _______ mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Show the strategy you used and your working.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.927 m = _______ cm</td>
</tr>
<tr>
<td></td>
<td>3.598 m = _______ cm</td>
</tr>
<tr>
<td></td>
<td>4.58 m = _______ cm</td>
</tr>
<tr>
<td></td>
<td>5.863 m = _______ cm</td>
</tr>
<tr>
<td></td>
<td>66.26 cm = _______ mm</td>
</tr>
<tr>
<td></td>
<td>7.38 m = _______ cm</td>
</tr>
<tr>
<td></td>
<td>8.771 m = _______ cm</td>
</tr>
<tr>
<td></td>
<td>9.38 m = _______ cm</td>
</tr>
<tr>
<td></td>
<td>10.442 cm = _______ km</td>
</tr>
<tr>
<td></td>
<td>11.34 m = _______ mm</td>
</tr>
<tr>
<td></td>
<td>12.646 mm = _______ m</td>
</tr>
<tr>
<td></td>
<td>13.23 m = _______ cm</td>
</tr>
<tr>
<td></td>
<td>14.830 cm = _______ mm</td>
</tr>
<tr>
<td></td>
<td>1.51230 km = _______ mm</td>
</tr>
</tbody>
</table>

Independent activity

• Put a collection of measurements around the classroom.
• Students are to move around the classroom and convert the measurements.

• Students make notes of their working and strategies used. Select three students to report back to the class on how they carried out their conversions.
Consolidation - Fractions and Decimals, Length Activity

**ACTIVITY**

**LESSON 3**

**Scootle game**

The Metrix – Understanding conversions


**Modelled activity**

Revise knowledge of measurement conversions. Highlight important mathematical terms and key words to assist students with measurement conversions. Use the Metrix Scootle Game to practice and understand measurement conversions. Use Newman’s Error Analysis to assist with problem solving.

**Guided activity**

Review highlighting important mathematical terms to calculate answers. Students work in pairs, teacher observes student learning and listens to conversations and guide student problem solving as required.
## Problem Solving Question Cards

### PROBLEM SOLVING QUESTION CARDS

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kristy is two years older than Michelle and 36 centimetres taller. How tall is Kristy if Michelle is 122 cm tall?</td>
<td>Adelaide’s step is 55 cm. What distance will she cover if she takes 10 steps? Convert the distance into metres.</td>
</tr>
<tr>
<td>While driving, Zack sees a sign that says 250 kilometres to a petrol station. How many kilometres is it to the petrol station?</td>
<td>If Caleb has walked 13 metres towards his destination measuring a total of 47 metres, how many metres does he need to travel to reach his destination?</td>
</tr>
<tr>
<td>Bobby’s surfboard is two metres long and fifty-three centimetres wide. What would the length of his surfboard be in centimetres?</td>
<td>Harry is two kilometres away from Gary. He has travelled 700 metres. How many metres does Harry need to travel to get to Gary?</td>
</tr>
</tbody>
</table>

### Guided activity

In groups of 2, provide students with appropriate word problem based on their ability/understanding. Students glue the question strip to the top of an A3 piece of paper. Students brainstorm vocabulary, question intent and possible operations/strategies and attempt question.

### Problem solving working mat

Explore Newman’s Prompts steps and the importance of following the steps to unpack a variety of problem solving questions.

### Guided

Using Newman’s Error Analysis, explore word problems with the class.

Project a word problem on the whiteboard. Review highlighting important mathematical terms to understand the problem and to calculate answers.

Explore questions together as a class, discussing vocabulary, question intent, possible operations needed and strategies needed. Record information on the Problem Solving Word Mat.

### Independent

In groups of 2, provide students with appropriate word problem based on their ability/understanding. Students are given a problem solving question. Students brainstorm vocabulary, question intent and possible operations/strategies and attempt question. Record information on the Problem Solving Word Mat. Students use inverse operations to check accuracy of answers.

When completed, students swap problem solving card with a neighboring group and attempt other questions.

### Gallery walk

Students walk around the room to see how students solved different problems, students communicate their thinking strategies and final solutions with their peers.
Newman's Prompts Problem Solving Mat

1. Read the question
2. What does it mean?
   - Find the question mark
   - Identify the key words and numbers
   - What is being asked
3. How do I solve it?
4. Do the maths
5. Write the answer

WHAT IS THE QUESTION?

HOW WILL I DO IT?

+  −  +  x

WORKING OUT

NUMBER SENTENCE

ANSWER

DIAGRAM

EXPLAIN HOW YOU DID IT
PURPOSE
Chifley College implemented this activity to develop students understanding of volume and capacity.

What is the Volume?

STRAND AND SUBSTRAND
Measurement and Geometry - Volume and Capacity - Stage 3

SYLLABUS OUTCOME
MA3-11MG A student selects and uses the appropriate unit to estimate, measure and calculate volumes and capacities, and converts between units of capacity.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-3WM A student gives a valid reason for supporting one possible solution over another.

NUMERACY LINKS
Numeracy Skills Framework, students are working at Stage 3 for Focus Area 4, understanding mass, volume and capacity.

FOCUS ACTIVITY
The purpose of this activity is to gain an understanding of capacity.
What is the Volume?

Step 1: Let us first go through the language of Volume and Capacity:

### Language

<table>
<thead>
<tr>
<th>VOLUME AND CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
</tr>
<tr>
<td>Cubic metre</td>
</tr>
<tr>
<td>Volume</td>
</tr>
</tbody>
</table>

Step 2: Now, let us brainstorm some ideas of where we use volume and capacity everyday.

### TASK: CAPACITY

#### Resources

Different sized empty containers and jugs

#### Discussion questions

- What are different containers used for?
- What measurements are used for liquids? (millilitres, litres)
- Look at the labelling on the containers, what measurements do they use?

#### MODELLED

Students then arrange their containers from what they think will hold the smallest amount of liquid to the one that holds the most. Introduce **capacity**.

Ask the students, why they chose that order for the containers. Was it because of their shape?

#### Extended activity

Students then fill a cup of water and pour it into the containers. They mark the level the water has reached. They discuss what they notice.

Ask the students whether the order of their containers changed or not.

#### CONSOLIDATION

Ask the students if they have understood the concept of capacity and what they have learnt from this activity.
TEACHING SEQUENCE FOR DISPLAYING DATA
Stage 2

PURPOSE
The purpose of this sequence of activities is for students to understand how data is displayed and to organise data. They will learn how to interpret and compare graphs, analyse data and to apply different strategies to solve problems.

STRAND AND SUBSTRAND
Statistics and Probability - Data - Stage 2

SYLLABUS OUTCOMES
MA2-17MG A student uses simple maps and grids to represent position and follow routes, including using compass directions.

MA2-18SP A student selects appropriate methods to collect data, and constructs, compares, interprets and evaluates data displays, including tables, picture graphs and column graphs.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, interpreting and analysing data.

ACTIVITY FOCUS
Interpret and compare data displays.
Create and interpret simple grid maps to show position and pathways.
Locates and describes position on maps using a grid-reference system.
Collects data using tables and interprets data using picture graphs.
Interpret and Compare Data Displays Activity

Identify questions or issues for categorical variables; identify data sources and plan methods of data collection and recording.
Collect data, organise it into categories, and create displays using lists, tables, picture graphs and simple column graphs, with and without the use of digital technologies.
Interpret and compare data displays.
Data can be collected from the internet, newspapers or magazines, as well as through students’ surveys, votes and questionnaires.

In Stage 2, students should consider the use of graphs in real-world contexts. Graphs are frequently used to persuade and/or influence the reader, and are often biased.
One-to-one correspondence in a column graph means that one unit (e.g. 1 cm) on the vertical axis is used to represent one response/item.
Categorical data can be separated into distinct groups, e.g. colour, gender, blood type.
Numerical data has variations that are expressed as numbers, e.g. the heights of students in a class, the number of children in families.

Create and Interpret Simple Grid Maps to Show Position and Pathways Activity

Describe the location of an object using more than one descriptor, e.g. ‘The book is on the third shelf and second from the left.’
Use given directions to follow routes on simple maps.
Use and follow positional and directional language.

Use grid references on maps to describe position, e.g. ‘The lion cage is at B3.’
Use grid references in games.
Identify and mark particular locations on maps and plans with grid references.

Directional Language Including Compass Directions Activity

Students will be able to describe a route taken on a map using landmarks and directional language, including compass directions.

Directional Language

around, through, between, below, up, down, outside, inside, in, out, front, behind, over, under, on, off, next to, beside, left, right, beginning, middle, end, near, far, start, finish, north, south, east, west

Data Activity

Students will be exposed to a variety of lessons involving the collection of data using tally marks and tables.
Further, they will display information collected using picture graphs. Students will be questioned and will formulate questions of their own which reflect the information contained in the picture graph.
TEACHING SEQUENCE FOR DISPLAYING AND INTERPRETING DATA Stage 2 and 3

PURPOSE
The purpose of this sequence of activities is to develop students’ understanding of interpreting and analysing data. Students will learn how to represent data in graphs and understand the terminology of data. Nowra Public School implemented these activities with their Stage 2 and 3 students.

STRAND AND SUBSTRAND
Statistics and Probability - Data - Stage 3

SYLLABUS OUTCOMES
MA3-18SP A student uses appropriate methods to collect data and constructs, interprets and evaluates data displays, including dot plots, line graphs and two-way tables.

MA2-18SP A student selects appropriate methods to collect data, and constructs, compares, interprets and evaluates data displays, including tables, picture graphs and column graphs.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

MA3-3WM A student gives a valid reason for supporting one possible solution over another.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, interpreting and analysing data and representing data in graphs and timelines, Stage 3.

ACTIVITY FOCUS
Creates and interprets data using lists and graphs.
Collecting and Displaying Data Activity

**TASK**

**Resources**
Poster board
5 pieces of paper per group or graphing templates
(See included resources)

**Instructions**
1. In small groups, students create a survey that they would use to collect data from peers within their class.
2. Possible examples can be displayed on the board: birthdays, eye colour, favourite fruits, favourite sports, number of members in a family.
3. Students analyse data and create multiple graphs/tables displaying findings on their 5 pieces of paper: tally chart, dot plot, line graph, picture graph and a summary of their findings.

**Teaching point**
Reinforce concepts of important features of a graph: title, labels, scale and axis.

Pose questions and direct mathematical conversation to assist students in their summary of findings.
1. What was the most common or frequent number recorded?
2. What was the difference between the highest and lowest score recorded?

**Differentiation**
This activity can be adapted to suit all learners.
1. Results can be recorded using tally marks and information can be turned into simple column and picture graphs.
2. To extend students, results can be turned into pictographs where 1 image represents more than 1 score. Data can also be recorded in two-way tables, separating for boys and girls. If computers are available, groups could generate graphs by putting results into computer programs such as excel.

---

**Students Eye Colour**

<table>
<thead>
<tr>
<th>Eye colour</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>8</td>
</tr>
<tr>
<td>Brown</td>
<td>4</td>
</tr>
<tr>
<td>Hazel</td>
<td>6</td>
</tr>
<tr>
<td>Grey</td>
<td>7</td>
</tr>
<tr>
<td>Black</td>
<td>5</td>
</tr>
<tr>
<td>Green</td>
<td>3</td>
</tr>
</tbody>
</table>

---

**Favourite Sport**

<table>
<thead>
<tr>
<th>Sport</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Football</td>
<td>🏈 🏈 🏈 🏈 🏈</td>
</tr>
<tr>
<td>Basketball</td>
<td>🏃 🏃 🏃 🏃</td>
</tr>
<tr>
<td>Netball</td>
<td>🏃 🏃 🏃 🏃 🏃</td>
</tr>
<tr>
<td>Soccer</td>
<td>🏃 🏃 🏃</td>
</tr>
<tr>
<td>Rugby</td>
<td>🏃 🏃 🏃</td>
</tr>
<tr>
<td>Hockey</td>
<td>🏃 🏃</td>
</tr>
</tbody>
</table>

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**Number of Members in a Family**

<table>
<thead>
<tr>
<th>Number of Family Members</th>
<th>Tally</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>🏛️ 🏛️ 🏛️</td>
</tr>
<tr>
<td>4</td>
<td>🏛️ 🏛️ 🏛️ 🏛️</td>
</tr>
<tr>
<td>5</td>
<td>🏛️ 🏛️ 🏛️ 🏛️</td>
</tr>
<tr>
<td>6</td>
<td>🏛️ 🏛️</td>
</tr>
<tr>
<td>7 or more</td>
<td>🏛️</td>
</tr>
</tbody>
</table>
Templates of Graphs

Title of Graph: ________________

Label Axis: ____________________

Title of Table: ________________

<table>
<thead>
<tr>
<th>Heading of Column</th>
<th>Heading of Column</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>
Focus on Language

STRAND AND SUBSTRAND
Statistics and Probability - Data - Stage 2 and 3

SYLLABUS OUTCOMES
MA3-18SP A student uses appropriate methods to collect data and constructs, interprets and evaluates data displays, including dot plots, line graphs and two-way tables.

MA2-18SP A student selects appropriate methods to collect data, and constructs, compares, interprets and evaluates data displays, including tables, picture graphs and column graphs.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, interpreting and analysing data and representing data in graphs and timelines.

ACTIVITY FOCUS
Words with terminology specific to data.

Activity

TASK

Resources
Taboo template (See resources)
Bingo template (See resources)
Mathematics Vocabulary template

Instructions
Use the math vocab template throughout lessons, to reinforce language used.
Play Taboo and Bingo before starting this data unit to reinforce language.

Taboo
1. In pairs, using Player A and Player B Taboo Boards, players take turns to describe/give clues for their partner to guess the missing word (without saying the actual word).
2. When a player guesses a word, they write it in the corresponding blank box on their Taboo board.
3. As a class discuss the definitions and contexts of the specific data words.
This game can be played before commencing this data unit and at the end.
Encourage students to assess and make judgements on their knowledge of the given words.

Bingo
1. Teacher displays words on a board.
2. Players fill in a personal Bingo Language Board.
3. Teacher selects a word, players place a counter/cross off a word as it is drawn.
4. First player to get 3 in a row wins.

Differentiation
Use Stage 2 or Stage 3 lists to make simpler/more difficult.
Integrate words into spelling and literacy program.
Mathematics Vocabulary

Data words from syllabus
Information, data, collect, category, display, symbol, list, table, column, graph, picture graph, vertical columns, horizontal bars, equal spacing, title, key, vertical axis, horizontal axis, axes, spreadsheet, tally, pictograph, dot plots and rows.

Print the language games templates provided for each recommended stage. Or alternatively, use the blank templates and write your own words of choice in from the above list.

Taboo Stage 2

<table>
<thead>
<tr>
<th>PLAYER 1 TABOO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. information</td>
</tr>
<tr>
<td>5. table</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PLAYER 2 TABOO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>5.</td>
</tr>
</tbody>
</table>
### Bingo Stage 2 and 3

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
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<td></td>
</tr>
</tbody>
</table>
### Taboo Stage 3

#### PLAYER 1 TABOO

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. information</td>
<td>2.</td>
<td>3. least</td>
<td>4.</td>
</tr>
<tr>
<td>5. table</td>
<td>6.</td>
<td>7. column graph</td>
<td>8.</td>
</tr>
<tr>
<td>9.</td>
<td>10. symbol</td>
<td>11.</td>
<td>12. data</td>
</tr>
</tbody>
</table>

#### PLAYER 2 TABOO

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>2. collect</td>
<td>3.</td>
<td>4. dot plot</td>
</tr>
<tr>
<td>5.</td>
<td>6. tally</td>
<td>7.</td>
<td>8. title</td>
</tr>
<tr>
<td>9.</td>
<td>10. symbol</td>
<td>11.</td>
<td>12. data</td>
</tr>
</tbody>
</table>
One Minute Data

STRAND AND SUBSTRAND
Statistics and Probability - Data - Stage 2 and 3

SYLLABUS OUTCOMES
MA3-18SP A student uses appropriate methods to collect data and constructs, interprets and evaluates data displays, including dot plots, line graphs and two-way tables.
MA2-18SP A student selects appropriate methods to collect data, and constructs, compares, interprets and evaluates data displays, including tables, picture graphs and column graphs.
MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.
MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

One Minute Data Activity

TASK

Resources
Paper/sticky notes to record results
Timer/stop watch
Equipment as needed (e.g. basketballs, bean bags, skipping ropes etc.)

Instructions
Count and record how many times students can do a selected activity in one minute.

Example: Students are given skipping ropes.
• Teacher starts timer and students begin skipping. They count each skip.
• At the end of 1 minute, teacher calls out “Stop!”
• Students are then asked to share their final count. This is recorded.
• Teacher displays results and poses the question, “How can this information be better organised?”
• Students are encouraged to suggest a table, tally marks or graph.
• As a class or in small groups, information is organised in a table or graph.

Teaching point
Reinforce concepts of title, labels, scale, axis
Pose questions and direct mathematical conversation:
1. What was the highest number of skips?
2. What was the most common/frequent number recorded?
3. What was the difference between the highest and lowest score recorded?

Differentiation
This activity can be adapted to suit multiple stages. It is a great activity for reinforcing the concept of 1 minute intervals.

For Stages 1 and 2, results can be recorded using tally marks and information can be turned into simple column and picture graphs. These stages may require more teacher support.

For Stage 3, results can be turned into pictographs where 1 image represents more than 1 score. Data can also be recorded in two-way tables, separating for boys and girls. Stage 3 students may require less teacher support and could complete table and graphing activities in small groups or pairs.

Data can be generated in multiple ways.

Suggested ideas to suit 1 minute
• How many times a beanbag can be thrown and caught?
• Sit ups
• Push ups
• Burpees
• Running intervals
• Ball bounces
• Words typed per minute

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, interpreting and analysing data and representing data in graphs and timelines.

ACTIVITY FOCUS
Creates and interprets data using lists and graphs.
TEACHING SEQUENCE FOR DATA
Stage 2 and 3 - Interpreting Displaying Data

PURPOSE
The purpose of this sequence of activities is to ensure that students understand how to interpret, discuss and create a range of graphs to improve the NAPLAN results in the area of Statistics and Probability.

SYLLABUS OUTCOMES
MA2-1WM Uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

MA2-2WM Selects and uses appropriate mental or written strategies, or technology, to solve problems.

MA2-3WM Checks the accuracy of a statement and explains the reasoning used.

MA2-18SP Selects appropriate methods to collect data, and constructs, compares, interprets and evaluates data displays, including tables, picture graphs and column graphs.

Students
- Recognise that data can be collected either by the user or by others.
- Identify possible sources of data collected by others, e.g. newspapers, government data-collection agencies, sporting agencies, environmental groups.
- Pose questions about a matter of interest to obtain information that can be recorded in categories.
- Predict and create a list of categories for efficient data collection in relation to a matter of interest, e.g. ‘Which breakfast cereal is the most popular with members of our class?’
- Identify issues for data collection and refine investigations, e.g. ‘What if some members of our class don’t eat cereal?’ (Problem Solving)
- Collect data and create a list or table to organise the data, e.g. collect data on the number of each colour of lollies in a packet.

<table>
<thead>
<tr>
<th>Colour</th>
<th>Number of Lollies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>5</td>
</tr>
<tr>
<td>Blue</td>
<td>2</td>
</tr>
<tr>
<td>Yellow</td>
<td>7</td>
</tr>
<tr>
<td>Green</td>
<td>1</td>
</tr>
</tbody>
</table>
• Use computer software to create a table to organise collected data, e.g. a spreadsheet. (Communicating)

• Construct vertical and horizontal column graphs and picture graphs that represent data using one-to-one correspondence.

• Use grid paper to assist in constructing graphs that represent data using one-to-one correspondence. (Communicating)

• Use the terms ‘horizontal axis’, ‘vertical axis’ and ‘axes’ appropriately when referring to column graphs. (Communicating)

• Use graphing software to enter data and create column graphs that represent data. (Communicating)

• Mark equal spaces on axes, name and label axes, and choose appropriate titles for column graphs. (Communicating)

• Choose an appropriate picture or symbol for a picture graph and state the key used. (Communicating)

• Describe and interpret information presented in simple tables, column graphs and picture graphs.

• Make conclusions about data presented in different data displays, e.g. ‘Football is the most popular sport for students in Year 3 at our school.’ (Communicating, Reasoning)

• Represent the same data set using more than one type of display and compare the displays. (Communicating, Reasoning)

• Create a survey and related recording sheet, considering the appropriate organisation of categories for data collection.

• Choose effective ways to collect and record data for an investigation, e.g. creating a survey with a scale of 1 to 5 to indicate preferences (1 = don’t like, 2 = like a little, 3 = don’t know, 4 = like, 5 = like a lot) (Communicating, Problem Solving)

• Refine survey questions as necessary after a small trial.

• Discuss and decide the most suitable question to investigate a particular matter of interest, e.g. by narrowing the focus of a question from ‘What is the most popular playground game?’ to ‘What is the most popular playground game among Year 3 students at our school?’ (Communicating, Reasoning)

• Compare the effectiveness of different methods of collecting and recording data, e.g. creating categories of playground games and using tally marks, compared to asking open-ended questions such as ‘What playground game do you like to play?’

PRIOR KNOWLEDGE
What do the students already know?

NUMERACY LINKS
Numeracy Skills Framework, student is at end of Stage 2, Focus Area 1, understanding fractions, decimals, percentages, rates and ratios.

Teaching and Learning Activities and Assessment Sequence

DATA PRE-TEST
Learning about tables and different types of graphs - ‘How do we organise data’

Introduction
In Small groups students are given a range of different graphs, in their group students discuss what they know about these graphs i.e. What are the names of these graphs? What the features of each graph? What do these graphs have in common? Where and when are these graphs used?

Development
Students play ‘What am I?’ Students each come up with clues to describe each different table. They then read out to their clues to the class and each group must call out which table they think it is.

Consolidation
As a class teacher models different ways data can be organised.

LINE GRAPHS
Instruction
Review previous lesson and discuss the features of different types of graphs.

Explain to students that each day this week they will be doing shuttle runs and recording the number of runs they complete in a minute in their maths books.

Ask students which graph would be most appropriate for displaying this data.

Review features of graphs using the SALTY PowerPoint.
Development
Teacher starts timer and students begin running. They count each run they do.

At the end of 1 minute, teacher calls out “Stop!”

Students are then asked to record their final number.

Students repeat this each day of the week and record all their results in a table.

On the SMARTboard create a line graph as a class; discussing what is features need to be included.

Discuss what questions could be created about their graph.

Students use the results recorded in their maths books to create their own line graphs.

Fast finishers: Add results of another student(s) to their graph and create a key to show the differences between students.

Students create their own questions on their line graph for another student to answer.

Consolidation
Students evaluate each other's graphs and discuss any missing features.

Students answer questions on another student's graph.

Resources
Maths books to record results
Timer/stop watch
Line graph examples on Smart notebook
SALTY PowerPoint

PICTURE GRAPHS

Instruction
Using the open ended question on a picture graph used in the pre-test model to students what an answer with full marks could look like. Discuss with the class the features such as title, independent and dependent axis, labels and key.

As a class collect information on children's eye colour and tally on the board. As a class create a scale for the picture graph i.e. one eye = 2 students. As a class discuss the features needed and create a picture graph on the students eye colour.

Explain to students that each day this week they will be recording how many students in the class play in the bush at lunch.

Development
After lunch each day as a class a tally is collected about how many students have played in the bush during part of lunch. Students record these results in their maths books.

As a class revise the features of a picture graph and discuss possible keys that could be used.

Using the information collected about the bush students create their own picture graphs, selecting their own title, labels and key.

Fast finishers create their own questions on their graph and swap with another student to answer.

Consolidation
Pose questions/direct mathematical conversation:

- Why do you think more children played in the bush on one day over another? (It was wet one day, the bush was closed, more children away in class, there were other events on during lunch i.e. Year 6 market day).
- What other factors could have influenced the amount of children playing in the bush?
- How could this data be used by the school or staff?

Resources
Maths books

COLUMN GRAPHS

Instructions
Ask students: What is a column graph? What are the features? What types of data are column graphs effective at displaying?

Review different column graphs and discuss the information shown and identify its features.

Explain to the class that each student is going to see how many bottle flips they land in 90 seconds.

Development
Students form small groups and each child in the group has a turn at bottle flipping for 90 seconds.

Students record the results for each student in their group.

These results are then shared with the class so that every student has the results of all 30 members in the class.

After all results are collected a tally is created showing how many students landed 1 bottle flip, 2, 3 and so on.

On the Interactive White Board create a column graph discussing the features and scales of a column graph.

Using the results from the bottle flipping, students create their own column graph, creating their own title, labels, and scales.

Fast finishers create their own questions for a class mate to answer.

Consolidation
Students share their column graphs with another student and discuss how their partner could have improved their graph.

Students then play ‘What am I’ and demonstrate the new mathematical language involving graphs that they have learnt.

Resources
Timers
Water bottles
Column graph examples
How Do We Organise Data?

STRAND AND SUBSTRAND
Statistics and Probability - Stage 2

SYLLABUS OUTCOMES
MA2-18SP Selects appropriate methods to collect data, and constructs, compares, interprets and evaluates data displays, including tables, picture graphs and column graphs.
MA2-1WM Uses appropriate terminology to describe, and symbols to represent, mathematical idea.
MA2-2WM Selects and uses appropriate mental or written strategies, or technology, to solve problems.
MA2-3WM Checks the accuracy of a statement and explains the reasoning used.
MA3-3WM Gives a valid reason for supporting one possible solution over another.
MA1-3WM Supports conclusions by explaining or demonstrating how answers were obtained.

NUMERACY LINKS
Numeracy Skills Framework, students are working at Stage 2 for Focus Area 5, evaluates effectiveness of different displays and infers relationships to draw conclusions.
Early in Stage 3, infers relationships to draw conclusions.

ACTIVITY FOCUS
Identifies key features of different graphs.

How Do We Organise Data? Activity

ACTIVITY
In small groups students are given a range of different graphs/tables, in their group students discuss what they know about these graphs i.e. What are the names of these graphs? What the features of each graph? What do these graphs have in common? Where and when are these graphs used?

Examples of graphs/table

<table>
<thead>
<tr>
<th>NUMBER OF STRAWBERRIES EATEN BY STUDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lisa</td>
</tr>
<tr>
<td>Marie</td>
</tr>
<tr>
<td>John</td>
</tr>
<tr>
<td>Andrew</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOLLIES IN A BOWL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Red</td>
</tr>
<tr>
<td>Blue</td>
</tr>
<tr>
<td>Yellow</td>
</tr>
<tr>
<td>Green</td>
</tr>
</tbody>
</table>

Language
Information, data, collect, category, display, symbol, list, table, column graph, picture graph, vertical columns, horizontal bars, equal spacing, title, key, vertical axis, horizontal axis, axes, spreadsheet.
DEVELOPMENT
Students play ‘What am I?’ Students each come up with clues to describe each different graph. They then read out to their clues to the class and each group must call out which table they think it is.

CONSOLIDATION
Class teacher models’ different ways data can be organised. Teacher models the important features of different graphs and demonstrates how to interpret information shown on these graphs.

Discussion questions about features of graph:
• What is the title?
• What type of graph is it?
• What is the label on the horizontal axis?
• What is the scale being used, what is the unit of measurement?
• What is the label on the vertical axis?
• What is the scale being used, what is the unit of measurement?
• Is there a key?
• What symbol is used?

Picture Graphs

STRAND AND SUBSTRAND
Statistics and Probability - Data - Stage 2

SYLLABUS OUTCOMES
MA2-18SP A student selects appropriate methods to collect data, and constructs, compares, interprets and evaluates data displays, including tables, picture graphs and column graphs.
MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical idea.
MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.
MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.
MA3-3WM A student gives a valid reason for supporting one possible solution over another.
MA1-3WM Supports conclusions by explaining or demonstrating how answers were obtained.

NUMERACY LINKS
Numeracy Skills Framework, students are working at Stage 2 for Focus Area 5, evaluates effectiveness of different displays and infers relationships to draw conclusions.
Early in Stage 3, infers relationships to draw conclusions.

FOCUS ACTIVITY
Students collect data and display it on a picture graph.
Picture Graph Activity

INSTRUCTIONS
1. Teacher to demonstrate how to complete the open-ended activity of picture graph (attached below).
   Model what a full mark answer looks like.
2. Discuss with the class the features such as title, vertical and horizontal axis, labels and key.

TASK
As a class collect information on student’s eye colour and provide a tally on the board.

![Students Eye Colour Table]

- Create a scale/symbol/key for the picture graph i.e. one eye = 2 students.
- Discuss the features needed and create a picture graph on the student’s eye colour.

FURTHER ACTIVITY
Explain to students that each day this week they will be recording how many students in the class play in the bush at lunch.

DEVELOPMENT
After lunch, each day as a class a tally is collected about how many students have played in the bush during part

![Students Who Played in Bush at Lunch Table]

of lunch. Students record these results in their maths books.
- As a class revise the features of a picture graph and discuss possible keys that could be used.
- Using the information collected about the bush, students create their own picture graphs, selecting their own title; labels and key.
- Students can also create their own questions about their graph and swap with another student to answer.

CONSOLIDATION
Pose questions/direct mathematical conversation:
1. On which day, did most of the students play in the bush on lunch?
2. Why do you think more students played in the bush on one day over another? (Suggestions: It was wet one day, the bush was closed, more children away in class, there were other events on during lunch i.e. Year 6 market day).
3. What other factors could have influenced the number of students playing in the bush?
4. How could this data be used by the school or staff?
Open Ended Activity

Name: ____________________
Class: ____________________

PICTURE GRAPH
This following picture graph is about a Year 3 class.
Title: ____________________

1. The graph is incomplete. Finish the graph, labelling all relevant information (axes, labels, horizontal axis, vertical axis, title ...)

2. Write a description of what the graph could be about?

3. How many students might be in the class? Explain your answer.

4. From your last answer, how many students are in each group?
**Column Graphs**

**STRAND AND SUBSTRAND**
Statistics and Probability - Data - Stage 2

**SYLLABUS OUTCOMES**
MA2-18SP A student selects appropriate methods to collect data, and constructs, compares, interprets and evaluates data displays, including tables, picture graphs and column graphs.

MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical idea.

MA2-2WM A student selects and uses appropriate mental or written strategies, or technology, to solve problems.

MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

MA3-3WM A student gives a valid reason for supporting one possible solution over another.

MA1-3WM A student supports conclusions by explaining or demonstrating how answers were obtained.

**NUMERACY LINKS**
Numeracy Skills Framework, students are working at Stage 2 for Focus Area 5, evaluates effectiveness of different displays and infers relationships to draw conclusions. Early in Stage 3, infers relationships to draw conclusions.

**FOCUS ACTIVITY**
Students collect data and display it on a column graph.

---

**Column Graph Activity**

**WHAT YOU NEED**
- Timers
- Water bottles
- Column graph examples

**INSTRUCTIONS**
- Ask students: What is a column graph? What are the features? What types of data are column graphs effective at displaying?
- Review different column graphs and discuss the information shown and identify its features.

The colour of students' caps

<table>
<thead>
<tr>
<th>Type of colours</th>
<th>Number of caps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>5</td>
</tr>
<tr>
<td>Blue</td>
<td>2</td>
</tr>
<tr>
<td>Yellow</td>
<td>7</td>
</tr>
<tr>
<td>Green</td>
<td>1</td>
</tr>
</tbody>
</table>
DEVELOPMENT
Students form small groups and each child in the group has a turn at bottle flipping for 90 seconds.
• Students record the results for each student in their group.
• These results are then shared with the class so that every student has the results of all 30 members in the class.
• After all results are collected a tally is created showing how many students landed 1 bottle flip, 2, 3 and so on.

<table>
<thead>
<tr>
<th>Number of Flips</th>
<th>Tally</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

• On the Interactive White Board create a column graph discussing the features and scales of a column graph.
• Using the results from the bottle flipping, students create their own column graph, creating their own title, labels, and scales.
• Students can also create their own questions for a class mate to answer.

CONSOLIDATION
• Students share their column graphs with another student and discuss how their partner could have improved their graph.
• Students then play ‘What am I’ and demonstrate the new mathematical language involving graphs that they have learnt.

Line Graphs

STRAND AND SUBSTRAND
Statistics and Probability - Data - Stage 3

SYLLABUS OUTCOMES
MA3-18SP A student uses appropriate methods to collect data and constructs, interprets and evaluates data displays, including dot plots, line graphs and two-way tables.
MA3-3WM A student gives a valid reason for supporting one possible solution over another.
MA1-3WM A student supports conclusions by explaining or demonstrating how answers were obtained.

NUMERACY LINKS
Numeracy Skills Framework, students are working at Stage 3 for Focus Area 5, evaluates effectiveness of different displays and infers relationships to draw conclusions.
Early in Stage 3, infers relationships to draw conclusions.

FOCUS ACTIVITY
Students collect data and display it on a line graph.
Line Graph Activity

INSTRUCTION
• Review previous lesson and discuss the features of different types of graphs.
• Explain to students that each day this week they will be doing shuttle runs and recording the number of runs they complete in a minute in their maths books.
• Ask students which graph would be most appropriate for displaying this data.

DEVELOPMENT
• Teacher starts timer and students begin running. They count each run they do.
• At the end of 1 minute, teacher calls out “Stop!”
• Students are then asked to record their final number.
• Students repeat this each day of the week and record all their results in a table.
• On the SMARTboard create a line graph as a class; discussing what features need to be included.

Example of a line graph and features
• Discuss what questions could be created about their graph.
• Students use the results recorded in their maths books to create their own line graphs.
• Students can also add results of another student(s) to their graph and create a key to show the differences between students.
• Students create their own questions on their line graph for another student to answer.

CONSOLIDATION
• Students evaluate each other’s graphs and discuss any missing features.
• Students answer questions on another student’s graph.
TEACHING SEQUENCE FOR CHANCE
Stage 3 - Understanding Chance and Events

PURPOSE
These activities focus on understanding and being familiar with the language of probability. Students are encouraged to use this mathematical language to assign probabilities and explain their thinking. Students conduct chance experiments and find probabilities.

Spinner Activity Stage 3

STRAND AND SUBSTRAND
Statistics and Probability - Chance - Stage 3

SYLLABUS OUTCOMES
MA3-19SP A student conducts chance experiments and assigns probabilities as values between 0 and 1 to describe their outcomes.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

NUMERACY LINKS
Numeracy Skills Framework, students are working at Stage 3 for Focus Area 5, interpreting chance events and probability.

ACTIVITY FOCUS
Chance - What is the likelihood of outcomes?
Spinner Activity

Language students need to be familiar with and understand
Chance, event, likelihood, equally likely, experiment, outcome, expected outcomes, random, fair, trials, probability, expected probability, observed probability, frequency, expected frequency, observed frequency.

ACTIVITY
Students work in groups of four working in two teams. They are given a black and white template spinner and an arrow.

1. Students start by colouring in their spinners, each triangle a colour of their choosing.
2. Once the spinner is ready, each team has to give the other team 4 questions such as:
   • What is the probability of getting a red?
   • What is the probability of getting a colour other than red?
   • Which colour is the arrow most likely to land on?
   • What is the frequency of green?
   • Which colour is least likely to occur?
3. The other team writes the answers in using the language of probability and in fractions in their books.

Example: What is the probability of obtaining a green in the following spinner:

![Spinner Diagram](image)

Probability of obtaining a green is \( \frac{3}{6} \)

4. When they create their spinners with an arrow, they spin them to observe how many times they actually get that colour and if it’s the same probability. They try it a couple of times and see whether the results vary. They compare the results with the other team.
Chance Dice Game Stage 3

STRAND AND SUBSTRAND
Statistics and Probability - Chance - Stage 3

SYLLABUS OUTCOMES
MA3-19SP A student conducts chance experiments and assigns probabilities as values between 0 and 1 to describe their outcomes
MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions

NUMERACY LINKS
Numeracy Skills Framework, students are working at Stage 3 for Focus Area 5, interpreting chance events and probability.

ACTIVITY FOCUS
Chance - What is the likelihood of outcomes?

Chance Dice Game Activity

DICE ACTIVITY
1. Students work with a partner.
2. They take turns in rolling the die and record the outcomes in a table with tally marks.
3. As they roll the die, they record their results in the table below. The frequency is the total of the tally for that number that was rolled.
4. They have 20 rolls altogether.
5. Then they compare the data with the next pair and it is discussed as a class as well.

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>TALLY</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

POSSIBLE QUESTIONS
1. How many times (frequency) did you roll a 2?
2. What was the chance of obtaining a 3?
3. What is the expected probability of obtaining a 6 on a normal die?
4. From the table, what was the observed probability of obtaining a 6?
TEACHING ACTIVITY FOR DATA
Stage 3 and 4 - Displaying Data, Sector Graphs

PURPOSE
This activity was designed to develop students understanding of how to construct sector graphs, Yass Public School implemented the activity with Stage 3 students.

Sector Graphs

STRAND AND SUBSTRAND
Statistics and Probability - Data - Stage 4

SYLLABUS OUTCOMES

MA4-1WM  A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-3WM  A student recognises and explains mathematical relationships using reasoning.

MA4-19SP  A student collects, represents and interprets single sets of data, using appropriate statistical displays.

NUMERACY LINKS
Numeracy Skills Framework, students are working at Stage 4 for Focus Area 5, representing and displaying data.

FOCUS ACTIVITY
Creating and interpreting sector graphs.
Sector Graphs Activity

**TASK**
Constructing a sector graph.

**REVIEW SECTOR GRAPHS**
When do we use them, what are the features, how do we create one.

**ACTIVITY**
As a class collect a tally of the different eye colours of each student in the class.
1. Record each colour and the frequency of students in a table like the one below. Write your fractions in simplest form.

<table>
<thead>
<tr>
<th>EYE COLOUR</th>
<th>TALLY</th>
<th>FREQUENCY</th>
<th>FRACTION</th>
<th>NUMBER OF DEGREES FOR EACH FRACTION (SEE BELOW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grey</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A pie graph shows each fraction of the whole as a sector. Each sector can be measured as an angle. The whole circle’s angle is 360°. For each eye colour you need to calculate its fraction of the whole before you can work out the angle size of its sector.

2. Calculate the number of degrees needed for each sector to represent each eye colour and show your working in the table above.

For example, in a class of 24, if there were 18 people with brown eyes:

<table>
<thead>
<tr>
<th>EYE COLOUR</th>
<th>TALLY</th>
<th>FREQUENCY</th>
<th>FRACTION</th>
<th>NUMBER OF DEGREES FOR EACH FRACTION (SEE BELOW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>18</td>
<td>18</td>
<td>(\frac{18}{24})</td>
<td>(\frac{18}{24} \times 360° = 270°)</td>
</tr>
</tbody>
</table>

3. Construct a circle or ask your teacher for a coloured circle and fold in half, then fourths to locate the middle. Use a protractor and pencil to mark and draw each eye colour on your sector graph.
TEACHING SEQUENCE FOR DATA Stage 4 - Interpreting and Representing Data Variables

PURPOSE
The purpose of this activity is to develop students understanding of data representation and collection. The activities also involve students in Stage 4 interpreting graphs and tables.

Data Activity

STRAND AND SUBSTRAND
Statistics and Probability - Data Collection and Representation - Stage 4

SYLLABUS OUTCOMES
MA4-19SP A student collects, represents and interprets single sets of data, using appropriate statistical displays.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, students are working at Stage 4 for Focus Area 5, interpreting and analysing data.

ACTIVITY FOCUS
The purpose of this sequence of activities is for students to identify examples of categorical and numerical data.
Variables Activity

1. **Activity**: Complete the flow chart by identifying categorical data. List as many examples as you can.

2. **Activity**: Complete the flow chart by identifying numerical data as discrete or continuous. List as many examples as you can.
Categorical and Numerical Graph Flowchart Summary

Variable

Numerical
- Discrete
  - Histogram
  - Dot Plot
  - Stem and Leaf Plots
- Continuous
  - Line Graph

Categorical
- Picture Graph
- Column Graph
- Horizontal Bar Graph
- Divided Bar Graph
- Sector Graph

COLUMN GRAPH
Chris' bank deposits

PICTURE GRAPH
Ball sports played by students in Year 4

Football
Basketball
Netball
Soccer
Rugby
Hockey

Key = 10 Students
Categorical and Numerical Graph Flowchart Summary

SIDE BY SIDE COLUMN GRAPH
Students' hair colour

DIVIDED BAR GRAPH
Colour of cars

NSW Mathematics Syllabus for the Australian Curriculum

SECTOR GRAPH
Marine areas of Australia's States and Territories

FREQUENCY HISTOGRAM
Tree Heights

NSW Department of Education 2017 | Numeracy Activities and Lesson Sequences K-10
Categorical and Numerical Graph Flowchart Summary

**DOT PLOT**
Number of passengers travelling in cars

**SIDE BY SIDE COLUMN GRAPH**
Australian population since 1900

**STEM AND LEAF**
Pulse Rate

**BACK TO BACK STEM AND LEAF**
Pulse Rate

Before

| 6 | 8 8 8 9 |
| 7 | 0 1 1 4 6 6 8 |
| 8 | 2 6 8 8 |
| 9 | 0 6 |
| 10 | 4 |
| 11 | 0 |

After

| 6 | 9 8 8 8 |
| 7 | 8 6 6 4 1 1 0 |
| 8 | 8 8 6 2 |
| 9 | 6 0 |
| 10 | 4 |
| 11 | 0 |
| 12 | 11 |
| 13 | 8 |
| 14 | 6 |

NSW Mathematics K-10 Syllabus for the Australian Curriculum
Data Representation Activity

STRAND AND SUBSTRAND
Statistics and Probability - Data Collection and Representation - Stage 4

SYLLABUS OUTCOMES
MA4-19SP  A student collects, represents and interprets single sets of data, using appropriate statistical displays.
MA4-1WM  A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

Data Representation Activity

Name: ______________________
Class: ______________________

1. What is a Population?
   ____________________________________________
   ____________________________________________

2. What is a Census?
   ____________________________________________
   ____________________________________________

3. List 2 advantages and 2 disadvantages of using a census.
   Advantages
   a) ____________________________________________
   b) ____________________________________________
   Disadvantages
   a) ____________________________________________
   b) ____________________________________________

4. What is a Sample?
   ____________________________________________

5. List 2 advantages/2 disadvantages of using a sample
   Advantages
   1) ____________________________________________
   2) ____________________________________________
   Disadvantages
   1) ____________________________________________
   2) ____________________________________________
Primary and Secondary Sources

1. Primary Data is data that: _____________________________
   _____________________________
   _____________________________

2. List some ways that you can collect primary data.
   _____________________________
   _____________________________
   _____________________________

3. Secondary Data is data that: _____________________________
   _____________________________

4. List some ways that you can collect secondary data
   _____________________________

5. Decide if the following are primary or secondary sources
   a) Newspapers _____________________________
   b) Conducting observations _____________________________
   c) Bureau of Statistics _____________________________
   d) Conducting an interview _____________________________
   e) Conducting a survey/questionnaire _____________________________
   f) Radio _____________________________
   g) TV _____________________________
   h) Internet _____________________________
   i) Websites _____________________________
   j) Maps _____________________________

Interpreting Graphs Activity

STRAND AND SUBSTRAND
Statistics and Probability - Data Collection and Representation - Stage 3

SYLLABUS OUTCOMES

MA3-18SP A student uses appropriate methods to collect data and constructs, interprets and evaluates data displays, including dot plots, line graphs and two-way tables.

MA4-19SP A student collects, represents and interprets single sets of data, using appropriate statistical displays

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, students are working at Stage 4 for Focus Area 5, interpreting and analysing data.

ACTIVITY FOCUS
The purpose of this is to describe and interpret data presented in tables, column graphs, line graphs and dot plots.
Interpreting Tables

Name: _______________________
Class: _______________________

ACTIVITY
Data Table 1

## PLANETS

<table>
<thead>
<tr>
<th>PROFILE</th>
<th>MARS</th>
<th>MERCURY</th>
<th>VENUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter at the equator</td>
<td>6800 km</td>
<td>4900 km</td>
<td>12100 km</td>
</tr>
<tr>
<td>Period of orbit around Sun (length of year)</td>
<td>687 Earth days</td>
<td>88 Earth days</td>
<td>225 Earth days</td>
</tr>
<tr>
<td>Distance from the Sun</td>
<td>228 million km</td>
<td>58 million km</td>
<td>108 million km</td>
</tr>
<tr>
<td>Period of rotation</td>
<td>24.5 hours</td>
<td>59 Earth days</td>
<td>243 Earth days</td>
</tr>
<tr>
<td>Surface gravity</td>
<td>0.38 times that of Earth</td>
<td>0.38 times that of Earth</td>
<td>0.91 times that of Earth</td>
</tr>
<tr>
<td>Surface temperature</td>
<td>-120°C to -30°C</td>
<td>-180°C to 420°C</td>
<td>450°C average</td>
</tr>
</tbody>
</table>

2001 New South Wales Department of Education and training.

When I see a TABLE of information, I need to ask

1. What is the title of the table? _______________________

2. What are the headings on each column? _______________________

3. What are the headings on each row? _______________________

4. What are the units of measurement? _______________________

5. How are the numbers represented? Whole Numbers, Fractions, Percentages, Dates. _______________________

6. Can you see any trends in the numbers? _______________________

7. What information do I expect to find from the table? _______________________

---

NSW Department of Education 2017 | Numeracy Activities and Lesson Sequences K-10
Data Table 2
Chocolate consumption per person in selected countries (over a two-year period)

**CHOCOLATE CONSUMPTION**

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>YEAR 1</th>
<th>YEAR 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norway</td>
<td>6.8</td>
<td>6.7</td>
</tr>
<tr>
<td>France</td>
<td>4.3</td>
<td>4.5</td>
</tr>
<tr>
<td>Germany</td>
<td>6.5</td>
<td>6.4</td>
</tr>
<tr>
<td>Austria</td>
<td>5.5</td>
<td>5.7</td>
</tr>
<tr>
<td>Switzerland</td>
<td>9.8</td>
<td>9.1</td>
</tr>
<tr>
<td>Finland</td>
<td>2.9</td>
<td>2.3</td>
</tr>
<tr>
<td>Spain</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Italy</td>
<td>1.1</td>
<td>0.9</td>
</tr>
<tr>
<td>Belgium</td>
<td>6.6</td>
<td>6.4</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>6.2</td>
<td>6.6</td>
</tr>
<tr>
<td>Sweden</td>
<td>5.6</td>
<td>5.2</td>
</tr>
<tr>
<td>Netherlands</td>
<td>5.2</td>
<td>5.2</td>
</tr>
<tr>
<td>Denmark</td>
<td>5.2</td>
<td>5.0</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.5</td>
<td>0.6</td>
</tr>
<tr>
<td>New Zealand</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Canada</td>
<td>3.6</td>
<td>3.6</td>
</tr>
<tr>
<td>United States</td>
<td>3.8</td>
<td>3.7</td>
</tr>
<tr>
<td>Australia</td>
<td>4.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Japan</td>
<td>1.1</td>
<td>1.0</td>
</tr>
</tbody>
</table>

2001 New South Wales Department of Education and training.

When I see a TABLE of information, I need to ask
1. What is the title of the table? ____________________________

2. What are the headings on each column? ________________________

3. What are the headings on each row? _________________________

4. What are the units of measurement? _________________________

5. How are the numbers represented? Whole Numbers, Fractions, Percentages, Dates.

6. Can you see any trends in the numbers? ________________________

7. What information do I expect to find from the table? ________________
Graph 3

AUSTRALIAN IMMIGRATION 1945-1980

![Graph showing Australian immigration from 1945 to 1980 by country, with countries including India, Vietnam, Italy, Great Britain, Yugoslavia, Netherlands, Germany, and Greece. The graph uses a horizontal axis representing thousands of immigrants, ranging from 0 to 800,000.]  

When I see a graph, I need to ask

1. What is the title? ________________________________________________________________________

2. What type of graph is it? __________________________________________________________________

3. What data is represented on the horizontal axis? ____________________________________________________________________

4. What data is represented on the vertical axis? ____________________________________________________________________

5. What scale is used on the horizontal axis? ____________________________________________________________________

6. How are the numbers represented on the scale? Whole Numbers, Fractions, Percentages, Dates.

7. What information do I expect to find from this graph? ____________________________________________________________________

2001 New South Wales Department of Education and training.
When I see a graph, I need to ask

1. What is the title? 

2. What type of graph is it? 

3. What type of data is represented? 

4. What data is represented on the horizontal axis? 

5. What is the dependent variable? 

6. What data is represented on the vertical axis? 

7. What is the independent variable? 

8. What scale is used on the horizontal axis? 

9. What are the units of measurement? 

10. What conclusion can be made from this graph? 

2001 New South Wales Department of Education and training.
Data Table 5

PRIME MINISTERS OF AUSTRALIA 1972-2018

<table>
<thead>
<tr>
<th>PRIME MINISTER</th>
<th>YEARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gough Whitlam</td>
<td>1972-1975</td>
</tr>
<tr>
<td>Malcom Fraser</td>
<td>1975-1983</td>
</tr>
<tr>
<td>Paul Keating</td>
<td>1991-1996</td>
</tr>
<tr>
<td>John Howard</td>
<td>1996-2007</td>
</tr>
<tr>
<td>Kevin Rudd</td>
<td>2007-2010</td>
</tr>
<tr>
<td>Julia Gillard</td>
<td>2010-2013</td>
</tr>
<tr>
<td>Tony Abbot</td>
<td>2013-2015</td>
</tr>
<tr>
<td>Malcolm Turnbull</td>
<td>2015-current</td>
</tr>
</tbody>
</table>

2001 New South Wales Department of Education and training.

When I see a TABLE of information, I need to ask

1. What is the title of the table?  
   PRIME MINISTERS OF AUSTRALIA 1972-2018

2. What are the headings on each column?  PRIME MINISTER, YEARS

3. What are the headings on each row?  

4. What are the units of measurement?  

5. How are the numbers represented? Fractions, Percentages, Dates.  

6. What do I expect to find from the table?  

7. Which prime minister held office the longest period of time?  Malcolm Turnbull (2015-current)

8. Which prime minister held office the shortest period of time?  Malcom Fraser (1975-1983)

9. Who was the first female prime minister? How long did she hold office?  Julia Gillard (2010-2013)
# WORLD RIVERS

<table>
<thead>
<tr>
<th>RIVER</th>
<th>LOCATION</th>
<th>LENGTH IN KM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nile</td>
<td>Africa</td>
<td>6671</td>
</tr>
<tr>
<td>Yangtze</td>
<td>China</td>
<td>6300</td>
</tr>
<tr>
<td>Amazon</td>
<td>Brazil</td>
<td>6280</td>
</tr>
<tr>
<td>Mississippi</td>
<td>USA</td>
<td>6019</td>
</tr>
<tr>
<td>Huang Ho</td>
<td>China</td>
<td>5464</td>
</tr>
<tr>
<td>Ob-Irtysh</td>
<td>China-Russia</td>
<td>5150</td>
</tr>
<tr>
<td>Mekong</td>
<td>Asia</td>
<td>4500</td>
</tr>
<tr>
<td>Congo</td>
<td>Africa</td>
<td>4160</td>
</tr>
<tr>
<td>Niger</td>
<td>Africa</td>
<td>4160</td>
</tr>
<tr>
<td>Murray-Darling</td>
<td>Australia</td>
<td>3490</td>
</tr>
<tr>
<td>Indus</td>
<td>Asia</td>
<td>3180</td>
</tr>
<tr>
<td>Brahmaputra</td>
<td>Asia</td>
<td>2900</td>
</tr>
<tr>
<td>Ganges</td>
<td>India</td>
<td>2700</td>
</tr>
</tbody>
</table>

When I see a TABLE of information, I need to ask

1. What is the title of the table?  

2. What are the headings on each column?  

3. What are the headings on each row?  

4. What are the units of measurement?  

5. How are the numbers represented? Whole Numbers, Fractions, Percentages, Dates.  

6. Can you see any trends in the numbers?  

7. What do I expect to find from the table?  

8. Which river is the longest? Where is it located?  

9. Which river is the shortest? Where is it located?
## Location of the World's Tropical Rainforests

<table>
<thead>
<tr>
<th>Region</th>
<th>Millions of Hectares</th>
<th>% of the World's Tropical Rainforests</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Africa</td>
<td>162</td>
<td>9.2</td>
</tr>
<tr>
<td>Central Africa</td>
<td>204</td>
<td>11.6</td>
</tr>
<tr>
<td>Southern Africa</td>
<td>162</td>
<td>9.2</td>
</tr>
<tr>
<td>South Asia</td>
<td>64</td>
<td>3.6</td>
</tr>
<tr>
<td>South-East Asia</td>
<td>211</td>
<td>12.0</td>
</tr>
<tr>
<td>Pacific</td>
<td>36</td>
<td>2.1</td>
</tr>
<tr>
<td>Central America, Caribbean</td>
<td>115</td>
<td>6.5</td>
</tr>
<tr>
<td>South America</td>
<td>802</td>
<td>45.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1756</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

2001 New South Wales Department of Education and training.

**When I see a table of information, I need to ask**

1. What is the title of the table?  
   [Location of the World's Tropical Rainforests]

2. What are the headings on each column?  
   [Region, Millions of Hectares, % of the World's Tropical Rainforests]

3. What are the headings on each row?  
   [West Africa, Central Africa, Southern Africa, South Asia, South-East Asia, Pacific, Central America, Caribbean, South America, Total]

4. What are the units of measurement?  
   [Millions of Hectares, % of the World's Tropical Rainforests]

5. How are the numbers represented? Whole Numbers, Fractions, Percentages, Dates.

6. Can you see any trends in the numbers?  
   [Yes, South America has the largest percentage of the world's tropical rainforests]

7. What do I expect to find from the table?  
   [The total percentage of the world's tropical rainforests]

8. What is the largest percentage of the worlds tropical rainforest's found in one region?  
   [South America: 45.8%]

9. In which region is the largest percentage of the worlds tropical rainforest's? How many hectares of rainforest's were formed in this region?  
   [South America: 802 million hectares]

10. How many hectares of rainforest's are in South Asia?  
    [64 million hectares]
Interpreting Graphs

The purpose of this is to interpret statistics and draw conclusions from the information in the form of a report.

Name: __________________________

Class: __________________________

LIFESTYLE ANALYSIS: Favourite sport (%) in 2012

FAVOURITE SPORT BY SEX (%)

<table>
<thead>
<tr>
<th>FAVOURITE SPORT</th>
<th>MALES 2011</th>
<th>MALES 2012</th>
<th>FEMALES 2011</th>
<th>FEMALES 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athletics</td>
<td>2.1</td>
<td>2.1</td>
<td>4.1</td>
<td>3.9</td>
</tr>
<tr>
<td>Baseball/Softball</td>
<td>1.7</td>
<td>1.8</td>
<td>1.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Basketball</td>
<td>8.1</td>
<td>8.5</td>
<td>6.9</td>
<td>7.6</td>
</tr>
<tr>
<td>Cricket</td>
<td>5.6</td>
<td>4.8</td>
<td>0.6</td>
<td>0.7</td>
</tr>
<tr>
<td>Cycling</td>
<td>2.0</td>
<td>2.1</td>
<td>0.8</td>
<td>1.1</td>
</tr>
<tr>
<td>Dancing</td>
<td>1.0</td>
<td>1.1</td>
<td>15.3</td>
<td>14.9</td>
</tr>
<tr>
<td>Football (AFL)</td>
<td>15.6</td>
<td>15.7</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Football (Rugby League)</td>
<td>9.4</td>
<td>8.1</td>
<td>11</td>
<td>0.9</td>
</tr>
<tr>
<td>Football (Rugby Union)</td>
<td>3.9</td>
<td>3.9</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Football (Soccer)</td>
<td>17.3</td>
<td>17.5</td>
<td>7.0</td>
<td>6.6</td>
</tr>
<tr>
<td>Golf</td>
<td>1.4</td>
<td>1.4</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Gymnastics</td>
<td>0.6</td>
<td>0.8</td>
<td>4.2</td>
<td>3.8</td>
</tr>
<tr>
<td>Hockey</td>
<td>2.5</td>
<td>2.5</td>
<td>3.0</td>
<td>3.3</td>
</tr>
<tr>
<td>Martial Arts</td>
<td>3.4</td>
<td>3.3</td>
<td>2.0</td>
<td>1.9</td>
</tr>
<tr>
<td>Netball</td>
<td>0.4</td>
<td>0.3</td>
<td>22.7</td>
<td>22.8</td>
</tr>
<tr>
<td>Skateboarding/Rollerblading</td>
<td>2.8</td>
<td>2.6</td>
<td>1.2</td>
<td>1.6</td>
</tr>
<tr>
<td>Swimming</td>
<td>4.2</td>
<td>3.9</td>
<td>9.4</td>
<td>9.9</td>
</tr>
<tr>
<td>Tennis</td>
<td>4.3</td>
<td>5.5</td>
<td>4.3</td>
<td>4.2</td>
</tr>
<tr>
<td>Other activities/sports</td>
<td>10.5</td>
<td>10.1</td>
<td>10.8</td>
<td>10.7</td>
</tr>
<tr>
<td>None</td>
<td>3.4</td>
<td>4.0</td>
<td>3.6</td>
<td>3.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.2</strong></td>
<td><strong>100.0</strong></td>
<td><strong>99.9</strong></td>
<td><strong>100.2</strong></td>
</tr>
</tbody>
</table>

When I see a TABLE of information, I need to ask

1. What is the title of the table? __________________________

2. What are the headings on each column? __________________________

3. What are the headings on each row? __________________________

4. What are the units of measurement? __________________________

5. How are the numbers represented? Whole Numbers, Fractions, Percentages, Dates.

6. Can you see any trends in the numbers? __________________________

7. What do I expect to find from the table? __________________________

8. Is the data Primary or secondary? Explain __________________________

9. What type of graph would be most suitable to represent the above data? (Explain) __________________________

www.abs.gov.au/censusatschool
Writing a Report

Look at the information in the table. Fill in the gaps in the report below with correct data from the table.

An Australian Bureau of Statistics study (Lifestyle Analysis) was conducted in ________________ and the favourite sport of both boys and ________________ was recorded.

For the last two years, soccer has remained the favourite sport for Australian boys, around ____%.
______________ was the second most popular sport for boys in 2012, around ____%.

For boys, tennis as a favourite sport has continued to increase in popularity to nearly _____%,
whilst for girls it has remained steady at _____%.
______________ has been increasing in popularity for boys and girls, with nearly _____% of boys and _____% of girls indicating that this was their favourite sport.

Nearly a quarter of Australian girls chose ________________ as their favourite sport whilst dancing remains girls ________________ favourite sport, steady at approximately _____%.

Swimming for girls has also increased in popularity to nearly _____% whilst for boys it is significantly lower at _____%.
The two least favourite sports for boys in 2011 and 2012 are ________________ and ________________.
The least favourite sport for girls is ________________ at less than 1%.
TEACHING SEQUENCE FOR DATA Stage 4
- Understanding Statistical Surveys and Data Collection

PURPOSE
The sequence of activities were developed to enhance students understanding of data variables and collection through surveys and the analysis of the data to write up statistical information. These activities were developed Bankstown Girls High School for Stage 4 students.
Stage 4 Statistics Project

STRAND AND SUBSTRAND
Mathematics - Data Collection and Representation - Stage 4 - Year 8

SYLLABUS OUTCOMES
MA4-19SP A student collects, represents and interprets single sets of data, using appropriate statistical displays.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, students are working at Stage 4 for Focus Area 5, graphical representation and data analysis.

ACTIVITY FOCUS
A student represents and interprets data in graphs, tables and diagrams.

Stage 4 Statistics Project

TASK
You are a journalist and your local newspaper has asked you to write a report/article about the students that attend Bankstown Girls' High School.

You are required to demonstrate the extent to which you can:
1. Conduct a survey.
2. Organise and display data using frequency distribution tables.
3. Interpret and analyse data displayed in a variety of formats.
4. Calculate the mean, mode, median and range from simple data sets.
5. Draw conclusions based on analysis of data displays.

CONSIDERATIONS
• Who will you survey and why?
• How many students should you survey and why?
• What methods will you use to survey the students?
• Is this survey a census or a sample?
• Is the data collected primary or secondary?
• What type of data (variables) have you collected e.g. numerical, categorical, discrete, continuous
• What obstacles, if any, did you encounter while conducting the survey?

FORMAT OF THE REPORT
1. Maximum of 250 words.
2. Must reflect your findings with mathematical justification and reasoning.
Graphical Representation and Data Analysis

Name: __________________________
Class: __________________________

You are a journalist and your local newspaper has asked you to write an article about the students that attend your school.

1. In pairs, you are going to choose a topic from the list below for which you are going to design a survey which will give you information about the students that attend your school.
   • Music
   • Sport
   • Diet/Exercise
   • Hobbies/Interests
   • Holidays
   • School
   • Family
   • Technology

2. Write 2 questions that you could ask about your chosen topic that will give you two types of data.
   (e.g. Categorical, discrete)

3. Once you have decided on the questions create your survey.

4. Design a data collection sheet (This is to note down student responses).

5. Conduct your survey.

6. Collect, organise and display your data.

7. Analyse your data.

8. Draw conclusions based on analysis of your data.

9. Write your report.

10. You have now performed a statistical inquiry.

Group Task: Steps 1-5
Individual Tasks: Steps 6-9

POSSING QUESTIONS

1. What is it that you want to find out? (Write your 2 questions)

2. What type of data will you be collecting?

3. What type of questions will you ask to collect your data?
4. Is a census or sample more appropriate to collect your data?

5. Will you be using a primary or secondary source to collect your data? Explain

6. What methods will you use to collect your information? E.g. survey, interview, observation ...

7. Who are you going to survey? (Sample size, students, grade ...)

8. Is the data you will collect reliable? (Give reasons)

COLLECTING DATA

9. In the space below design a data recording sheet to help you collect your data.

ORGANISING AND DISPLAYING DATA

10. Organise your data in such a way that it is easy to interpret e.g. Frequency table
11. Display your data using appropriate graphs and data displays. (Histograms, Dot plots)

ANALYSING DATA AND DRAWING CONCLUSIONS

12. Summarise your data by calculating the mean, mode range and median. Analyse the data and identify any trends.

WRITING A REPORT
What interesting facts did you find about the students that attend your school? Write your report/article. Remember to include your data to justify your reasoning.
## Statistics Cards

### When I see NUMBERS in text, I need to ask
- Are the numbers in sentences, tables or graphs?
- What is their place value? Tens? Hundreds?
  Thousands etc.?
- Are they dates, fractions, percentages or decimals?
- Are there any units of measurement following the numbers?
- Why are these numbers significant in this particular text?

### When I see TEXT, I need to ask
- What does the heading tell me?
- What will the passage be about (predict)?
- What clues do any pictures, diagrams or graphs give me about the topic?
- Skim the layout of the page - what do you notice about the structure, language and numbers (are there bold words, sub-headings, bullet points, paragraphs, technical terms, boxed information or separate sections)?
- Are the main words highlighted?
- What do I expect to find out from this text?
- Why was the text written?
- List and discuss any words or numbers that need further explanation.

### When I see a TABLE of information, I need to ask
- What is the caption?
- What are the headings on each column/row?
- What are the units of measurement?
- Can you see any trends in the numbers?
- What do I expect to find from the table?
- Why was the table written?

### When I see DIAGRAMS or GRAPHS, I need to ask
- What is the title?
- What scales are used?
- What are the units of measurement?
- What are the labels on the axes?
- What type of diagram or graph is it?
- Are there any sub-headings or labels?
- How are the numbers represented?
  - Fractions? Percentages? Dates?
- What extra information is given by including numbers in the text?

Reference developed by Bankstown Girls High School, NSW Department of Education.
TEACHING SEQUENCE FOR DATA
Stage 4 - Variables, Data Analysis and Surveys

PURPOSE
The area of focus for this teaching sequence and activities is to develop students understanding and interpreting of data and representation of data in graphs in Stage 4. Birrong Girls High School implemented these activities across all key learning areas, the activities were used in the mathematics classes and the concepts were applied in all subject areas during the same time. This resulted in students understanding the application and evaluation of data in many contexts.

Data and Graph Activity

STRAND AND SUBSTRAND
Statistics and Probability - Data Collection and Representation - Stages 3 and 4

SYLLABUS OUTCOMES
MA3-18SP A student uses appropriate methods to collect data and construct, interprets and evaluates data displays, including dot plots, line graphs and two-way tables.

MA4-19SP A student collects, represents and interprets single sets of data, using appropriate statistical displays.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, interpreting and analysing data, Stage 3 and 4.

ACTIVITY FOCUS
The purpose of this sequence of activities is for students to use problem solving strategies to select the correct operation in word problems. The problem solving questions are from NAPLAN 2016.
Graphical Representation and Data Analysis

Name: ____________________
Class: ____________________

UNIT
Data and graphs (Year 8)

BY THE END OF THIS UNIT, YOU WILL ...

<table>
<thead>
<tr>
<th>Basic level</th>
<th>Developing level</th>
<th>Complex level</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Recognise that data can be categorical or numerical data</td>
<td>• Identify data as categorical or numerical and provide an example</td>
<td>• Define the difference between categorical and numerical data and provide examples of each (discrete or continuous)</td>
</tr>
<tr>
<td>• Locate the horizontal and vertical axes of graphs and provide axes labels</td>
<td>• Name and label the horizontal and vertical axes from a table of information</td>
<td>• Interpret and comprehend data displayed in various graphical forms</td>
</tr>
<tr>
<td>• Determine a scale for simple data and record the scale on the vertical axis</td>
<td>• Determine a suitable scale for data and record the scale on the vertical axis</td>
<td>• Choose and draw an appropriate form to display data</td>
</tr>
<tr>
<td>• Read information from simple graphs using the scales on the axes</td>
<td>• Read and interpret graphs using the scales on the axes</td>
<td></td>
</tr>
<tr>
<td>• Draw simple graphs to represent data</td>
<td>• Draw a variety of graphs to represent data given in a table</td>
<td></td>
</tr>
</tbody>
</table>

Literacy/Numeracy focus
• Comparative and polarised terms - highest, lowest, smallest, largest, twice as large as etc.
• Vocabulary - data, survey, tabulate, table, sample, axis, horizontal, vertical, column, lines, axes, scale
• Abbreviations and prefixes for units of measurement

The assessment will be on data and graphs in an everyday context and will test the skills of
• Choosing appropriate scales, labelling graphs and axes.
• Sketching graphs to display the data
• Read and interpret data from graphs
• Create graphs from a given table of values

What I already know

Questions that I have and would like to answer
Data and Graphs Stage 4

OBJECTIVE
This task builds on what we have been learning about in Mathematics about data and graphs. You are required to demonstrate the extent to which you can:

• Define variables as categorical or numerical.
• Read and interpret data from graphs.
• Create graphs from a given table of values, choose appropriate scales, label axes and select a title.

What is a Variable?
A variable is something measurable or observable that is expected to change either over time or between individual observations.

Examples of Variables: Age, Hair Colour, Height, Temperature, Time, Country of Birth, Eye Colour

Variable can be classified into numerical and categorical data.

<table>
<thead>
<tr>
<th>CATEGORICAL VARIABLE</th>
<th>NUMERICAL VARIABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Categorical Variable</strong> is a variable whose values are categories.</td>
<td></td>
</tr>
<tr>
<td>• Blood group is a categorical variable; its values are A, B, AB, or O</td>
<td></td>
</tr>
<tr>
<td>• Construction type of a house; its values brick, concrete, timber, steel</td>
<td></td>
</tr>
<tr>
<td>• Categories may have numerical labels such as postcodes, where there is no numerical significance e.g. 2219, 2010, 2218</td>
<td></td>
</tr>
<tr>
<td>• Eye colour</td>
<td></td>
</tr>
<tr>
<td>• Hair colour</td>
<td></td>
</tr>
<tr>
<td>• Type of pets</td>
<td></td>
</tr>
<tr>
<td>• Data collected on a rating scale (Likert-type scale) is categorical, e.g. 1 = dislike, 2 = neutral, 3 = like</td>
<td></td>
</tr>
</tbody>
</table>

| **Numerical Variables** are variables whose values are numbers. |
| A discrete numerical variable is a variable each of whose possible values is separated from the next by a definite number. |
| • Number of children |
| • Number of cars |
| • Shoe size |

A continuous numerical variable is a measurement. | Height |
| Temperature |
| Weight |
Data Activity A

Name: _____________________
Class: _____________________

a) Select whether the data collected below is classified as categorical or numerical data.

b) Once you have determined which variable represents numerical data, decide if it is continuous or discrete data.

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>CATEGORICAL</th>
<th>NUMERICAL DISCRETE</th>
<th>NUMERICAL CONTINUOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different types of hair colour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Categorical or numerical?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height of people</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Categorical or numerical?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students favourite icecream flavour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Categorical or numerical?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Different shoe sizes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Categorical or numerical?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student’s pet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Categorical or numerical?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student’s month of birth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Categorical or numerical?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student’s postcodes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Categorical or numerical?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student’s ratings for films</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Categorical or numerical?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Reading Tables

Strategies for students - Reading Tables

• What is the title?
• What are the headings on each row?
• What are the headings on each column?
• What are the units of measurement?
• Are the values increasing or decreasing?
• What information can I extract from the table?

Data Activity B

Name: __________________________
Class: __________________________

1. What is the difference between categorical and numerical data? Provide an example of each.

   Categorical data is _______________________________________________________
   Numerical data is _______________________________________________________

<table>
<thead>
<tr>
<th>TYPE OF READING MATERIAL</th>
<th>NUMBER READ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novel</td>
<td>5</td>
</tr>
<tr>
<td>Newspaper</td>
<td>16</td>
</tr>
<tr>
<td>Magazine</td>
<td>14</td>
</tr>
<tr>
<td>Storybook</td>
<td>10</td>
</tr>
</tbody>
</table>

2. Is the data represented in the table ‘Type of reading material’ below categorical or numerical data?

3. A group of Year 10 students were surveyed. They were asked “What is your favourite type of reading material?” Use the graph to answer the following questions.
a. What type of graph is displayed? ____________________________
b. What is the title of the graph? ____________________________
c. What is the title of the vertical axis? ______________________
d. What is the title of the horizontal axis? ____________________
e. How many people read magazines? _________________________
f. What material do people read the most? ____________________
g. How many more people read magazines compared to novels? ______
h. What is the most popular reading material? ________________
i. How many students were surveyed? _______________________

4.
A group of 100 Year 8 students were asked "What is your favourite sport?" The collected data is displayed below.

**FAVOURITE SPORT OF YEAR 8 STUDENTS**

<table>
<thead>
<tr>
<th>Rugby League</th>
<th>Soccer</th>
<th>Netball</th>
<th>AFL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. What kind of data is represented above, categorical or numerical? ____________________________
b. Which type of graph is represented above? ____________________________
c. How many students selected Soccer? ____________________________
d. How many students selected AFL? ____________________________
e. What is the most popular sport? ____________________________
f. What is the least popular sport? ____________________________

5.
A group of Year 11 students were asked to provide a reason for buying a new mobile phone.

<table>
<thead>
<tr>
<th>REASON</th>
<th>NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buying one for the first time</td>
<td>2</td>
</tr>
<tr>
<td>Old mobile lost/stolen</td>
<td>14</td>
</tr>
<tr>
<td>Upgrading old model</td>
<td>18</td>
</tr>
<tr>
<td>Old mobile broken</td>
<td>9</td>
</tr>
</tbody>
</table>

a. How many students were surveyed? ____________________________
b. What was the most common reason provided? __________________
c. Create a column graph to display the data in the table above.
6. Mr. Masey measured the temperature outside his classroom. The data is displayed in the following table:

<table>
<thead>
<tr>
<th>TIME</th>
<th>TEMPERATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>9am</td>
<td>5°C</td>
</tr>
<tr>
<td>10am</td>
<td>11°C</td>
</tr>
<tr>
<td>11am</td>
<td>16°C</td>
</tr>
<tr>
<td>12pm</td>
<td>16°C</td>
</tr>
<tr>
<td>1pm</td>
<td>14°C</td>
</tr>
<tr>
<td>2pm</td>
<td>12°C</td>
</tr>
<tr>
<td>3pm</td>
<td>11°C</td>
</tr>
</tbody>
</table>

a. Display this data as a line graph below.

Success Checklist
Tick each of the items in the list below as you complete them, I have:

☐ A title on the graph
☐ Labelled the horizontal axis
☐ Labelled the vertical axis
☐ Created a scale on the horizontal axis
☐ Created a scale on the vertical axis
☐ Plotted the points on the graph and checked that each dot represents the data in the table of temperatures.

b. In what season do you think these measurements were taken? Justify your answer.
Graph Activity - Problem Solving

Question 1

This graph shows the number of people in a school hall at 5-minute intervals over 2 hours.

At which of these times were the greatest number of people in the hall?

Question 2

The graph below shows the number of students with each eye colour in Mrs Smith’s class.

Which statement is true?

- Most students have brown eyes than black eyes.
- Less students have hazel eyes than grey eyes.
- Green is the most common eye colour.
- Blue is the most common eye colour.

Question 3

The table shows the number of different birds Anne and Elizabeth saw.

<table>
<thead>
<tr>
<th></th>
<th>FINCH</th>
<th>MAGPIE</th>
<th>PIGEON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Elizabeth</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

They drew a correct picture graph to show the number of birds they saw altogether. Which picture graph did they draw?

= 1 bird
Random Sample Research Task

STRAND AND SUBSTRAND
Statistics and Probability - Data Collection - Stage 3 and 4

SYLLABUS OUTCOMES
MA3-18SP A student uses appropriate methods to collect data and constructs, interprets and evaluates data displays, including dot plots, line graphs and two-way tables.
MA4-19SP A student collects, represents and interprets single sets of data, using appropriate statistical displays.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, interpreting and analysing data, Stage 3 and 4.

ACTIVITY FOCUS
Explain why certain types of information need to be collected in a range of investigation types. Sample should be chosen randomly to avoid bias.

Random Sample Research Task

Name: ____________________
Class: ____________________

SECTION ONE: CENSUS AND SAMPLE SURVEY

<table>
<thead>
<tr>
<th>CENSUS</th>
<th>SAMPLE</th>
</tr>
</thead>
</table>
| A census is collecting information from everyone in that population. For example, if all batteries were tested before they were sold. | A sample survey involves collecting information from only part of the population.  
The sample can be biased or random. Biased data does not represent the whole population. A random sample is fairer and can represent the whole population. A sample survey is not as accurate as a census. |

ACTIVITY A
Comment on any possible bias in the following situations.

a) Year 7 students are interviewed about school uniform changes.

b) Motorists stopped in peak hour are interviewed about traffic problems.

c) Real estate agents are interviewed about house prices.

d) People are asked to phone in to register their vote on an issue.

e) An opinion poll is conducted by posting a questionnaire to people.

f) A manufacturing company tests a sample of its products every Monday morning.

g) A survey of 20 people indicates that 80% of people watch the Channel 9 News.

h) A company claims that 4 out of 5 dentists recommend their brand of toothbrush.
**ACTIVITY B**
Read the following scenarios and then answer the following:

a) List all the advantages/disadvantages on choosing the samples in each.

b) Describe the possible causes of bias in each situation.

### Scenario 1
The government wants to improve sporting facilities on the north coast of Queensland. They decide to survey 500 people about what facilities they would like to see improved. To do this, they choose the first 500 people through the gate at a soccer match.

### Scenario 2
Surveying customers on food product choices at a large supermarket in store between 9.00 am and 2.00 pm on a Tuesday.

---

**SECTION TWO: SAMPLING TECHNIQUES**
Many techniques are used to ensure that samples are random. Five of these techniques are:

- Simple random sampling
- Interval sampling (or systematic sampling)
- Stratified random sampling
- Cluster sampling
- Multi-stage sampling

**ACTIVITY A**
Using Google search engine, investigate each of these sampling techniques and how they are used.

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>DEFINITION</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple random sampling</td>
<td></td>
<td>---------</td>
</tr>
<tr>
<td>Interval sampling or systematic sampling</td>
<td></td>
<td>---------</td>
</tr>
<tr>
<td>Stratified random sampling</td>
<td></td>
<td>---------</td>
</tr>
<tr>
<td>Cluster sampling</td>
<td></td>
<td>---------</td>
</tr>
<tr>
<td>Multi-stage sampling</td>
<td></td>
<td>---------</td>
</tr>
</tbody>
</table>
SECTION THREE: SURVEY TYPE QUESTIONS

ACTIVITY A

Question 1
Write open-ended questions on each survey topic.

a) Favourite FM radio station.

b) Food at the canteen.

c) Pedestrian safety around your school.

d) Career choices.

Question 2
Write Yes or No questions for a) and c) in Question 1.

Question 3
Write tick-box questions for b) and d) in Question 1.
Graph Activity - Problem Solving

Question 1
Ten people were each asked how many times they went to the supermarket last month. The results were: 3, 4, 2, 2, 2, 3, 1, 5, 3, 4
Select the dot plot that correctly displays this data.

Question 2
A shop sells new and used computers.
The graph shows the price of 2 similar computers and their age in years.
Which one of these statements is true?
☐ Computer B is older and less expensive than computer A.
☐ Computer A is newer and less expensive than computer B.
☐ Computer A is older and more expensive than computer B.
☐ Computer B is newer and more expensive than computer A.
Graphs in Mathematics

STRAND AND SUBSTRAND
Statistics and Probability - Data Presentation - Stages 3 and 4

SYLLABUS OUTCOMES
MA3-18SP A student uses appropriate methods to collect data and constructs, interprets and evaluates data displays, including dot plots, line graphs and two-way tables.

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MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, interpreting and analysing data, Stage 3 and 4.

ACTIVITY FOCUS
Constructs, interprets and evaluates data displays, including dot plots and bar graphs.

Graphs in Mathematics

Name: ______________________

Class: ______________________

TASK 1: PRACTICAL ACTIVITY

ACTIVITY A

What you need
- Multi coloured sticks/counters/smarties
- Ruler
- Pencil
- A3 Paper
- Markers

Instructions
1. Teacher will pull out several handfuls of sticks/counters/smarties.
2. Teacher will organise the class in groups of 4 students.
3. Each group to sort the sticks into piles by colour.
4. Each group to count how many pieces of sticks are in each pile and organise them into a frequency distribution table.
5. Each group to create a bar graph. Along the bottom line, which is referred to as the x-axis, a section for each colour is needed. Along the vertical line, called the y-axis, the scale should go up by 2, 5 or 10 depending on the number of sticks with the highest frequency.
6. Each group to draw bars that show the number of sticks they have for each colour.
7. Each group to use the markers to colour the bars to emphasize the colours they represent and to make their graph more visually stimulating.
8. Make sure that the height of the bar corresponds with the number of sticks in each pile.
9. Look at your sample data and write three sentences which draw conclusions from the data display. E.g. “The sticks colour with the lowest frequency is yellow” or “The graph shows that the majority of Smarties are red”
10. Teacher will be walking around to facilitate the understanding of what it is required.
**Task 2: Game of Sum**

**Activity A**

**Instructions**
- This is a game for two players.
- Players take turns rolling two dice 50 times (25 times each).
- After each roll of the dice, players calculate the sum between the two dice (e.g. If a 2 and a 6 are rolled then the sum is 8).
- Players tally the sum on the following frequency distribution table.
- Each group to construct a dot plot to represent their data.
- Each group to answer the questions written below.

Fill in the following frequency distribution table:

<table>
<thead>
<tr>
<th>Score (sum of the faces of two dice)</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Question 1**
Explain why isn’t possible to have a sum of 1 or zero.

**Question 2**
Draw a dot plot to represent the data in the frequency table.

**Question 3**
Which number is the most occurring one? Explain why.

**Question 4**
All class results will be displayed on the board and have a class discussion on the outcomes.
Graph Activity - Problem Solving

Question 1

The heights, in centimetres, of children on the tennis team are as follows:
119, 122, 119, 127, 127, 117, 128, 124, 127

Select the dot plot that correctly displays the data.

---

Question 2

Some children were asked to name their favourite sport.

The table below shows their responses.

<table>
<thead>
<tr>
<th>FAVOURITE SPORT</th>
<th>NUMBER OF STUDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basketball</td>
<td>⬞ ⬞ ⬞ ⬞ ⬞ ⬞ ⬞ ⬞ ⬞</td>
</tr>
<tr>
<td>Tennis</td>
<td>⬞ ⬞ ⬞ ⬞ ⬞</td>
</tr>
<tr>
<td>Hockey</td>
<td>⬞ ⬞ ⬞ ⬞ ⬞</td>
</tr>
</tbody>
</table>

How many children were asked this question altogether?

---

Question 3

Matt spins the arrow on this spinner.

Which colour is the spinner most likely to land on?

Red  Blue  Yellow  All colours are equally likely
School Survey

STRAND AND SUBSTRAND
Statistics and Probability - Data Representation - Stage 4

SYLLABUS OUTCOMES
MA4-19SP A student collects, represents and interprets single sets of data, using appropriate statistical displays.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.
MA4-2WM A student applies appropriate mathematical techniques to solve problems.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, interpreting and analysing data, Stage 4.

FOCUS ACTIVITY
Collect the data and use the appropriate graph to represent and interpret data.

Name: ______________________
Class: ______________________

INSTRUCTIONS
• Divide the class into groups of 5 students.
• Teacher will provide A3 paper to each group.
• Teacher will provide each group with questions to be surveyed in school (10 junior students and 10 senior students).
• Students will have a week to collect their data in school.
• Once the data is collected, they will be working on constructing a graph of their choice (E.g. column, line or pie graph) and write a statement on each graph on A3 paper.
• Each group will present their finding in class.
• Teacher needs to assist students during the lesson if needed.
• You need to answer the following questions on your A3 paper.

1. How many students did you survey?
2. How many senior and junior students like to play OZ tag?
3. Would junior students spend more time study/do homework or watch TV?
4. What is the least popular movie category for junior and senior students?
5. What is the most popular colour among juniors and what percentage of juniors chose that colour?
Survey Questions

Group Name: __________________________
• Interview 10 Junior (Year 7-9) and 10 Senior (Year 10-12) students from your school.
• Each student to choose one from the list of the following questions.

Question 1
Which sport do you like the most from the following list?

<table>
<thead>
<tr>
<th>JUNIOR</th>
<th>SPORT</th>
<th>TALLY</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basketball</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soccer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Netball</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oz Tag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cricket</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SENIOR</th>
<th>SPORT</th>
<th>TALLY</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basketball</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soccer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Netball</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oz Tag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cricket</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Question 2
Which colour do you like the most from the following list?

<table>
<thead>
<tr>
<th>JUNIOR</th>
<th>COLOUR</th>
<th>TALLY</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pink</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purple</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SENIOR</th>
<th>COLOUR</th>
<th>TALLY</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pink</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purple</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Question 3
How many hours on average do you study/do homework in a week?

<table>
<thead>
<tr>
<th>JUNIOR</th>
<th>HOURS</th>
<th>TALLY</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 - 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 - 8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 - 11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 12</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SENIOR</th>
<th>HOURS</th>
<th>TALLY</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 - 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 - 8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 - 11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 12</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Question 4**
How many hours on average do you watch TV in a week?

<table>
<thead>
<tr>
<th>HOURS</th>
<th>TALLY</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 - 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 - 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 - 20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HOURS</th>
<th>TALLY</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 - 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 - 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 - 20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Question 5**
Which animal do you like from the following list?

<table>
<thead>
<tr>
<th>ANIMALS</th>
<th>TALLY</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bird</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ANIMALS</th>
<th>TALLY</th>
<th>FREQUENCY</th>
</tr>
</thead>
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<td></td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bird</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Question 6**
Which is your favourite movie category from the following?

<table>
<thead>
<tr>
<th>MOVIE</th>
<th>TALLY</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drama</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Romance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horror</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comedy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MOVIE</th>
<th>TALLY</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
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<td>Drama</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Romance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horror</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comedy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Data Activity - Problem Solving

Question 1

The graph shows the origin and type of all vehicles in a town.

Which statement is most accurate based on the graph?

- [ ] There are more four-wheel drives than passenger cars.
- [ ] Commercial vehicles are the most common type of vehicles.
- [ ] There are more Asian vehicles than European vehicles.
- [ ] There are more Australian vehicles than European vehicles.

Question 2

The dogs at a dog show were weighed. All the weights were then recorded in a graph.

How many dogs were at the dog show?

- 3
- 7
- 14
- 26
Research Task on Data Analysis

STRAND AND SUBSTRAND
Statistics and Probability - Data Analysis - Stage 4

SYLLABUS OUTCOMES
MA4-19SP A student collects, represents and interprets single sets of data, using appropriate statistical displays.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.
MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, interpreting and analysing data, Stage 4.

FOCUS ACTIVITY
Students have the knowledge, skills and understanding in collecting, analysing and evaluating information.

Research Task on Data Analysis

Name: ________________
Class: ________________

MEAN, MODE AND MEDIAN

<table>
<thead>
<tr>
<th>Mean</th>
<th>Mode</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>The mean is calculated by adding all scores, then dividing by the number of scores.</td>
<td>The mode is the score with the highest frequency. The score that occurs the most when all the score are arranged in order.</td>
<td>The median is the middle score for an odd data set or average of the two middle scores for an even data set. (Scores should be ordered)</td>
</tr>
</tbody>
</table>

- The median is used when the mean is not a good measure of central tendency.
- The mode is the best measure in some examples where discrete data means that the mean and median may have very little meaning.

ACTIVITY: RESEARCH ON HOUSE PRICES
Conduct a search on the following link: (www.Domain.com.au) and collect and record the prices of at least 6 three bedroom houses in your suburb in your exercise book.

Now answer the following questions:
1. Calculate the mean, median and mode price for the houses showing full working out.
2. Would you quote the mean, mode or median to a person who wanted to buy a house in the area? Explain your answer.
3. Provide one example of a situation where the mean mode or median is the best one to use.
Analysing Data - Problem Solving

Question 1

At the zoo Tran saw 8 koalas, 16 kangaroos and 12 emus.
In the tables below, \( x = 4 \) animals.
Which table correctly shows the number of animals Tran saw at the zoo?

<table>
<thead>
<tr>
<th>ANIMALS</th>
<th>NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koala</td>
<td>XX</td>
</tr>
<tr>
<td>Kangaroo</td>
<td>XXXX</td>
</tr>
<tr>
<td>Emu</td>
<td>XXXX</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ANIMALS</th>
<th>NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koala</td>
<td>X X</td>
</tr>
<tr>
<td>Kangaroo</td>
<td>X XXXX</td>
</tr>
<tr>
<td>Emu</td>
<td>X XXXX</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ANIMALS</th>
<th>NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koala</td>
<td>X XXXX</td>
</tr>
<tr>
<td>Kangaroo</td>
<td>X X X</td>
</tr>
<tr>
<td>Emu</td>
<td>X X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koala</td>
<td>X X</td>
</tr>
<tr>
<td>Kangaroo</td>
<td>X X X</td>
</tr>
<tr>
<td>Emu</td>
<td>X X X</td>
</tr>
</tbody>
</table>

Question 2

Leo recorded the number of pages he printed over five weeks.
17, 22, 17, 24, 20
What is the mean number of pages Leo printed?

Question 3

Anne made a dot plot to show the ages of the students in her dance class.

What is the range of ages of the students in Anne’s dance class?
4 8 10 11
Question 4

The mean age of employees at a company is 40.
The median age of employees at the same company is 35.
A new employee is hired who is 55 years old.
Which of these is possible?
- The mean age stays the same and the median age increases.
- The mean age stays the same and the median age decreases.
- The mean age decreases and the median age increases.
- The mean age increases and the median age stays the same.

Question 5

The number of people waiting at the checkouts in a supermarket is counted once every hour.
The results on Saturday were 4, 2, 11, 16, 14, 11, 5, 12, 6, 9.
Which of these statements is correct?
- The mean is 9 and the median is 10.
- The median is 9 and the mode is 11.
- The median is 11 and the mean is 9.
- The mode is 11 and median is 14.

Question 6

A cricket batsman has played three innings and his batting average is 91 runs.
If two of his scores are 85 runs and 93 runs, what is his third score?

Question 7

The list shows the number of films that nine members of a film club watched in April.

<table>
<thead>
<tr>
<th>NUMBER OF FILMS WATCHED</th>
</tr>
</thead>
<tbody>
<tr>
<td>0, 1, 2, 2, 3, 4, 5, 5, 5</td>
</tr>
</tbody>
</table>

Which of the following is true for this data?
- Mean > Median = Mode
- Mean < Median < Mode
- Mean = Median = Mode
- Mean = Median < Mode
TEACHING SEQUENCE FOR PROBABILITY
Stage 4 - Understanding Probability

PURPOSE
The purpose of this sequence of activities is to develop students' understanding of probability concepts and the language of probability. Ambarvale High School implemented these activities with Stage 4 students to develop student's understanding of probability terms, language and hence understanding of problems involving probability.

Using Probability Terminology

STRAND AND SUBSTRAND
Statistics and Probability - Probability - Stage 4

SYLLABUS OUTCOMES
MA4-21SP A student represents probabilities of simple and compound events.

MA4-1WM A student communicates with and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, interpreting change events and probability, Stage 4.

ACTIVITY FOCUS
Recognising and using probability terms.
# Using Probability Terminology

Name: ______________________

Class: ______________________

**ACTIVITY A**

Determine the sample space and outcome of the following scenarios:

<table>
<thead>
<tr>
<th>SCENARIO</th>
<th>SAMPLE SPACE</th>
<th>OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A standard die is thrown and the result is 4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. A coin is tossed and the result is a head.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. A bag contains 3 blue, 4 red and 2 yellow counters. A counter is draw at random and the colour is noted. It was a red counter.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. A spinner divided into 10 equal sections with numbers 1-10 labelled on each section. When spun, the result was 3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. A card is drawn from a standard deck of 52 cards. The suit (hearts, spades, clubs, and diamonds) is noted. The result was a 3 of hearts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. A 20 sided die is rolled and the result was an even number.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. In a bag with 5 red counters, 3 blue counters and 8 green counters. Two counters are drawn out. The result was two green counters.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. A coin was tossed three times and the result recorded. The result was Head, Tail, Head in that order.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Language of Probability

Name: ______________________
Class: ______________________

**ACTIVITY B**

1. Define the following:
   - A chance experiment refers to ______________________
   - An outcome refers to ______________________
   - The sample space refers to ______________________

2. Write the chance experiment, outcome and sample space for each of the following events:

<table>
<thead>
<tr>
<th>EVENT</th>
<th>CHANCE EXPERIMENT</th>
<th>OUTCOME</th>
<th>SAMPLE SPACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A standard die is thrown and the result is 4.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
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</tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EVENT</td>
<td>CHANCE EXPERIMENT</td>
<td>OUTCOME</td>
<td>SAMPLE SPACE</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------</td>
<td>---------</td>
<td>--------------</td>
</tr>
<tr>
<td>A 20 sided die is rolled and the result was an even number.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two standard dice are thrown and then added together. The result is 7.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In a bag with 5 red counters, 3 blue counters and 8 green counters. Two counters are drawn out. The result was two green counters.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A coin was tossed three times and the result recorded. The result was Head, Tail, Head in that order.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Extension exercise**

Write an event for each of the following given outcome and sample space:

a) The outcome is 4 and the sample space is \( \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K\} \).

b) The outcome is ‘vanilla’ and the sample space is \( \{\text{vanilla, chocolate, cookies & cream}\} \).
PURPOSE
Hunter River High School developed a sequence of numeracy activities to be implemented in each key learning area which focused on developing Stage 4 students’ skills in Statistics and probability.

Music: String Quartet - Venn Diagram

STRAND AND SUBSTRAND
Statistics and Probability - Data Collection and Representation - Stage 4

SYLLABUS OUTCOMES
MA4-19SP A student collects, represents and interprets single sets of data, using appropriate statistical displays.

Music outcome
4.8 A student demonstrates an understanding of musical concepts through aural identification and discussion of the features of a range of repertoire.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, graphical representation and data analysis, Stage 4.

ACTIVITY FOCUS
Multi-step problem solving and graphical representation and data analysis.
String Quartet - Venn Diagram

STRAND AND SUBSTRAND

Lesson intentions

• Revise our knowledge of the string quartet.
• Develop our understanding of how to construct a Venn diagram.

Success criteria

An understanding of:

• Listening/aural skills - referencing the musical concepts.
• How to correctly display information in a Venn diagram.

Venn Diagram String Quartet

Identify similarities and differences in the following two pieces

PACHELBEL'S CANON

SMOOTH CRIMINAL

1. Students will recap their knowledge of the string quartet.
2. Students are provided with the worksheet to complete throughout the listening task.
3. Students listen to two musical excerpts - identifying the similarities and differences in each.
Venn Diagram String Quartet

Example answer
Construct a Venn diagram - identifying the differences and similarities in the following two excerpts. Refer to the six aural concepts.

- Classical music
- Slow tempo
- Close harmonies throughout the piece
- Viola playing melody

- Feature a cello in the opening
- Instruments are being played using a bow
- Texture is homophonic - harmonies
- A $\frac{4}{4}$ time signature
- Features crescendos and decrescendos
- Arrangement of popular music (Smooth Criminal)
- High pitched melody
- Fast and lively tempo
- First violin playing melody

HSIE: Ancient Rome - The Importance of Conserving the Remains of the Ancient Past

**STRAND AND SUBSTRAND**
Statistics and Probability - Data Collection and Representation - Stage 4

**SYLLABUS OUTCOMES**

**MA4-19SP** A student collects, represents and interprets single sets of data, using appropriate statistical displays.

**MA3-6NA** A student selects and applies appropriate strategies for multiplication and division, and applies the order of operations to calculations involving more than one operation.

**History outcomes**
4.8, 4.10

**MA4-1WM** A student communicated and connects mathematical ideas using appropriate terminology, diagrams and symbols.

**MA4-2WM** A student applies appropriate mathematical techniques to solve problems.

**MA4-3WM** A student recognises and explains mathematical relationships using reasoning.

**NUMERACY LINKS**
Numeracy Skills Framework, Focus Area 5, graphical representation and data analysis, Stage 4.

**ACTIVITY FOCUS**
Multi-step problem solving and graphical representation and data analysis.
Ancient Rome - The Importance of Conserving the Remains of the Ancient Past

Step 1: Discuss with students what constitutes an ancient site.
Step 2: As a class, research and identify at least twenty ancient sites around the world. Group the sites into one of the 7 continents and represent the data in a vertical or horizontal column graph.

Example

Step 3: Discuss the outcome of the column graph. Questioning why there may have been more ancient sites in Europe, Asia and South America. Why were there not as many in Antarctica and Australia?
Step 4: Place the details of the ancient sites into a timeline.
Step 5: Compare the timeline with the results on the column graph. Discovering why there have been more ancient sites in Europe, Asia and South America. Why there were not as many in Antarctica and Australia?

PDHPE: Activities
- Venn Diagram/Y-Chart/Flow Chart

STRAND AND SUBSTRAND
Statistics and Probability - Data Collection and Representation - Stage 4

SYLLABUS OUTCOMES
MA4-19SP A student collects, represents and interprets single sets of data, using appropriate statistical displays.

PDHPE outcomes
4.6, 4.7, 4.11, 4.12

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, graphical representation and data analysis, Stage 4.

NUMERACY SKILLS
Multi-step problem solving and graphical representation and data analysis.
**PDHPE: Activities - Venn Diagram Activity 1**

Step 1: Select at least two contrasting topics (e.g. health impacts of marijuana and tobacco).

Step 2: Identify similarities and differences within the topic.

Step 3: In the Venn diagram place unique information on the outer sections and common or similarities in the overlapping area.

![Venn Diagram](image)

**PDHPE: Activities - Y Diagram Activity 2**

Step 1: Select a topic that involves emotions and the senses, sight and sound.

Step 2: While discussing the topic/watching a video or excerpt, identify how a person would feel, look and sound.

![Y Diagram](image)
PDHPE: Activities - Flow Chart Activity 3

Step 1: Select/create a scenario that involves decision making.
Step 2: Students are to consider the consequences or impacts of the decision they make.
Place these steps into a flowchart.
Step 3: Discuss how this process could be used to identify when or how to seek help in different situations.

Science: Graph Types and Flow Charts

**STRAND AND SUBSTRAND**
Statistics and Probability - Data Collection and Representation - Stage 4

**SYLLABUS OUTCOMES**

**MA4-19SP** A student collects, represents and interprets single sets of data, using appropriate statistical displays.

**MA3-6NA** A student selects and applies appropriate strategies for multiplication and division, and applies the order of operations to calculations involving more than one operation.

**SCIENCE OUTCOMES**

**SC4-7WS and SC4-9WS**

**NUMERACY LINKS**
Numeracy Skills Framework, Focus Area 5, graphical representation and data analysis, Stage 4.

**ACTIVITY FOCUS**
Multi-step problem solving and graphical representation and data analysis.
Graph Types - Science Activity 1

Students construct the correct graph type based on the given data:

**Examples**

Line graph

<table>
<thead>
<tr>
<th>TEMPERATURE OF SALT SOLUTION (°C)</th>
<th>TIME HEATED (MINS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>29</td>
<td>12</td>
</tr>
<tr>
<td>35</td>
<td>20</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>TYPE OF CAR</td>
<td>NO. COUNTED IN 1 HOUR</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Holden</td>
<td>97</td>
</tr>
<tr>
<td>Toyota</td>
<td>33</td>
</tr>
<tr>
<td>Mazda</td>
<td>52</td>
</tr>
<tr>
<td>Hyundai</td>
<td>19</td>
</tr>
<tr>
<td>Ford</td>
<td>67</td>
</tr>
<tr>
<td>Mercedes</td>
<td>1</td>
</tr>
</tbody>
</table>
Graph Types - Science Activity 1

Sector graph

<table>
<thead>
<tr>
<th>GAS</th>
<th>% COMPOSITION OF AIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>77</td>
</tr>
<tr>
<td>Oxygen</td>
<td>20</td>
</tr>
<tr>
<td>Water Vapour</td>
<td>2</td>
</tr>
<tr>
<td>Inert Gases</td>
<td>1</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>Trace</td>
</tr>
</tbody>
</table>
Student Research Project Planning Activity 2

Students construct a Timeline to plan out their Student Research Project (SRP).

Constructing a timeline.

1. Draw a line to represent the total amount of time available; for example, if you have 6 weeks to work on your project, you might draw a 12 cm line.

2. Divide the line evenly to represent blocks of time; for example, 2 cm might represent 1 week.

3. Indicate on the timeline when you plan to have completed particular tasks.

Example

```
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Mar</td>
<td>Project handed out</td>
</tr>
<tr>
<td>8 Mar</td>
<td>Decide on problem</td>
</tr>
<tr>
<td>15 Mar</td>
<td>Library research</td>
</tr>
<tr>
<td>22 Mar</td>
<td>Experiments completed</td>
</tr>
<tr>
<td>29 Mar</td>
<td>Work on report</td>
</tr>
<tr>
<td>5 Apr</td>
<td>Results entered in spreadsheet</td>
</tr>
<tr>
<td>12 Apr</td>
<td>Due date</td>
</tr>
</tbody>
</table>
```

Student Research Project Graph Activity 3

Students collect data during the SRP (e.g. strength of sticky tape, absorbency of paper towel).

1. Correctly tabulate data using appropriate columns.

2. Construct the appropriate graph based on the data. Correctly labelling each axis.

Example

<table>
<thead>
<tr>
<th>Type of Paper Towel</th>
<th>Test 1</th>
<th>Test 2</th>
<th>Test 3</th>
<th>Total</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Brand</td>
<td>9</td>
<td>8</td>
<td>10</td>
<td>27</td>
<td>9</td>
</tr>
<tr>
<td>Kleenex</td>
<td>10</td>
<td>9</td>
<td>11</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Handee</td>
<td>11</td>
<td>9</td>
<td>10</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Science Brand</td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>19</td>
<td>6</td>
</tr>
</tbody>
</table>

```
Which paper towel is the most absorbent

<table>
<thead>
<tr>
<th>Type of Paper Towel</th>
<th>Water absorbed (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home brand</td>
<td>10</td>
</tr>
<tr>
<td>Kleenex</td>
<td>9</td>
</tr>
<tr>
<td>Handee</td>
<td>10</td>
</tr>
<tr>
<td>Science brand</td>
<td>6</td>
</tr>
</tbody>
</table>
```
Flow Charts Activity 4

**TASK**
Students construct a flow chart from the following text:

**INTRODUCTION**
Present all relevant background information. Include a statement of the problem that you are investigating, saying why it is relevant or important. You could also explain why you became interested in the topic.

**AIM OR PROBLEM**
State the purpose of your investigation: that is, what you are trying to find out.

**HYPOTHESIS**
Using the knowledge you already have about your topic, write a statement that will be tested in your investigation.

**MATERIALS AND METHOD**
Describe in detail how you did your experiments. Begin with a list of the equipment used and include photographs of your equipment if appropriate. The description of the method must be detailed enough to allow somebody else to repeat your experiments. It should also convince the reader that your investigation is well controlled. Labelled diagrams can be used to make your description clear. Using a step-by-step outline makes your method easier to follow.

**RESULTS**
Observations and measurements (data) are presented in this section. Wherever possible, present data as a table so that they are easy to read. Graphs can be used to help you and the reader interpret data. Each table and graph should have a title. Ensure that you use the most appropriate type of graph for your data.

**DISCUSSION**
Discuss your results here. Begin with a statement of what your results indicate about the answer to your question. Explain how your results might be useful. Any weaknesses in your design or difficulties in measuring could be outlined here. Explain how you could have improved your experiments. What further experiments are suggested by your results?

**CONCLUSION**
This is a brief statement of what you found out and may link with the final paragraph of your ‘Discussion’. It is a good idea to read your ‘Aim’ again before you write your conclusion. Your conclusion should also state whether your hypothesis was supported. Don’t be disappointed if it is not supported. Some scientists deliberately set out to reject hypotheses!

Example:

```
<table>
<thead>
<tr>
<th>Introduction</th>
<th>Aim</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results</td>
<td>Method</td>
<td>Materials</td>
</tr>
<tr>
<td>Discussion</td>
<td>Conclusion</td>
<td></td>
</tr>
</tbody>
</table>
```
TAS: Materials Cutting List and Pencil Box

STRAND AND SUBSTRAND
Statistics and Probability - Data Collection and Representation - Stage 4

SYLLABUS OUTCOMES
MA4-19SP A student collects, represents and interprets single sets of data, using appropriate statistical displays.
MA4-1WM A student communicated and connects mathematical ideas using appropriate terminology, diagrams and symbols.
MA4-2WM A student applies appropriate mathematical techniques to solve problems.
MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, graphical representation and data analysis, Stage 4.

ACTIVITY FOCUS
Multi-step problem solving and graphical representation and data analysis.

Materials Cutting List and Pencil Box Activity 1

MATERIALS CUTTING LIST
Step 1: Students will be given a dimensioned workshop drawing of a practical project.
Step 2: Students will then read and interpret the drawing and transfer the information from the drawing into a table format.
Step 3: The Materials Cutting list table should include the headings Part, Description, Material and Size (L × W × T) in mm.

Alternatively - The activity can be varied by presenting students with a completed table and then the students can use the information to place the correctly dimension the workshop drawing.

Extension - This activity could be extended by adding a column for the cost of each item and students could then work out the total cost.

This activity could be further extended by then breaking the costs into percentages and the costing break up could be presented in a sector graph (pie chart).
Pencil Box Activity 2

WOODEN PENCIL BOX UNIT
Step 1: Discuss that plans or technical drawings are often used to generate and communicate design ideas and solutions.
Step 2: Look at the plans for the Wooden Pencil box and use the information to complete the Material Cutting list below.

<table>
<thead>
<tr>
<th>PART</th>
<th>DESCRIPTION</th>
<th>MATERIAL</th>
<th>SIZE - L × W × T</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Side</td>
<td>Radiata Pine</td>
<td>200 × 70 × 12</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Step 3: Show all calculations for the following questions:
1. If you are provided with one piece of Radiata Pine to cut out parts A, B, C and D, how long would that piece need to be? (HINT: Remember to include the space between cuts).
2. Why is the base 24 mm wider than the ends of the box? (HINT: Look at how the box is assembled in the image)
3. There is a groove cut in the sides to allow the lid to slide in and out. The ends are 100 mm wide and the lid is 108 mm wide. How deep does the groove need to be cut in the sides to allow the lid to freely slide?
TEACHING ACTIVITIES FOR PROBLEM SOLVING
Stage 3 and 4

PURPOSE
The purpose of this sequence of activities is for students to become familiar with problem solving strategies. Keira High School implemented these activities with their Stage 4 students to develop their understanding of how to solve worded problems.

Problem Solving Strategies

STRAND AND SUBSTRAND
Number and Algebra - Working Mathematically - Stage 4

SYLLABUS OUTCOMES

MA4-4NA A student compares, orders and calculates with integers, applying a range of strategies to aid computation.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

MA3-3WM A student gives a valid reason for supporting one possible solution over another.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, understanding mathematical information in texts and tasks, estimating and problem solving.

ACTIVITY FOCUS
Using different strategies to solve various problems. Summary of strategies is provided as resource (attached).
**PROBLEM SOLVING STRATEGIES**

### Guess, check and refine

- **Guess 1:** Your first guess
- **Check 1:** Check whether it matches the conditions
- **Guess 2:** Your second guess
- **Check 2:** Check whether it matches the conditions

### Eliminating possibilities

- Write down all possibilities
- Using the conditions in the questions and logic, eliminate the options that will not work

### Drawing diagrams/Acting it out

- Draw a diagram of the problem or act it out with objects
- Use the diagram or objects to assist solving the problem

### Looking for a pattern

1. Read through question and/or write down what the sequence looks like
2. Identify a common pattern in the sequence
3. Use this information to calculate the solution

### Make an organised list

1. Read question
2. Write down a list of all the options that are a part of the question
3. Use the list to identify the answer

### Working backwards

1. Start from the solution
2. Follow the reverse order of how you would regularly solve a problem

### Make it simpler

1. Replace the number in the question with easier numbers
2. Solve the problem, gaining confidence with the process of completing it
3. Attempt the more difficult problem

### Tables or charts

1. Read question
2. Create a table or chart of the information
3. Use the table or chart to solve the problem

### Tape diagram

1. Draw at least one bar
2. Separate this bar into different segments to represent information from the question
3. Complete the problem using the visual as an assistant
### Problem Solving Strategies 1

**Drawing a Diagram or Acting it Out**

#### Problem 1

4 km of fencing encloses a square paddock of area 100 hectares. If 14 km of fencing encloses a rectangular paddock, how many hectares would be enclosed?

<table>
<thead>
<tr>
<th></th>
<th>1. What is the key information?</th>
<th>2. What is the question asking you to do?</th>
<th>3. What tool will you use?</th>
<th>4. Apply the tool and do the mathematics.</th>
<th>5. Write the answer.</th>
<th>6. Is your answer reasonable? How do you know?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Problem 2

Twelve equally spaced posts are used as uprights in a square pen. How many posts would be placed on each side of the pen?

<table>
<thead>
<tr>
<th></th>
<th>1. What is the key information?</th>
<th>2. What is the question asking you to do?</th>
<th>3. What tool will you use?</th>
<th>4. Apply the tool and do the mathematics.</th>
<th>5. Write the answer.</th>
<th>6. Is your answer reasonable? How do you know?</th>
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<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>2</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Problem**
Maddy had one pair of rabbits. These rabbits had five baby rabbits, all female. Within the next nine months each female rabbit produced four baby rabbits. If no rabbits died, how many did Maddy have at the end of nine months?

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>What is the key information?</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>What is the question asking you to do?</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>What tool will you use?</td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>6.</td>
<td>Is your answer reasonable? How do you know?</td>
<td></td>
</tr>
</tbody>
</table>

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**Problem**
Mr. and Mrs. Rogers and their two children were walking to a wedding when they came across a muddy part of the pathway. Luckily Mr. Rogers’ camel was grazing nearby. It could, however, only carry one adult or two children at the one time. The camel always needs a person with it. Explain how the whole family got over the mud using the camel.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>What is the key information?</td>
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<td>4.</td>
<td>Apply the tool and do the mathematics.</td>
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<td>Write the answer.</td>
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<tr>
<td>6.</td>
<td>Is your answer reasonable? How do you know?</td>
<td></td>
</tr>
</tbody>
</table>
## Problem Solving Strategies 2

### ELIMINATING POSSIBILITIES

#### Problem
Find the number less than 50 that has the sum of its digits equal to 6 and the difference of its digits equal to 4.

<table>
<thead>
<tr>
<th>1. What is the key information?</th>
<th>2. What is the question asking you to do?</th>
<th>3. What tool will you use?</th>
<th>4. Apply the tool and do the mathematics.</th>
<th>5. Write the answer.</th>
<th>6. Is your answer reasonable? How do you know?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Problem
If a restaurant sells meals for $8.60, $9.20, $10.80 and $12.40, which of these could be the cost of 6 meals?

- a) $51.40
- b) $74.80
- c) $63.30
- d) $62.60

<table>
<thead>
<tr>
<th>1. What is the key information?</th>
<th>2. What is the question asking you to do?</th>
<th>3. What tool will you use?</th>
<th>4. Apply the tool and do the mathematics.</th>
<th>5. Write the answer.</th>
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</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
</tbody>
</table>

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NSW Department of Education 2017 | Numeracy Activities and Lesson Sequences K-10

310
Problem
Lago and Emilia opened a corner store in Balgownie. They received ten sample packets of trail mix, all of which had a net mass of either 225 g, 400 g, 425 g or 450 g. Which of the following could be the total net mass of the ten sample tins?

- a) 4600 g
- b) 3830 g
- c) 3625 g
- d) 1850 g

1. What is the key information?
2. What is the question asking you to do?
3. What tool will you use?
4. Apply the tool and do the mathematics.
5. Write the answer.
6. Is your answer reasonable? How do you know?

Problem
Three children, Aiden, Brayden and Caden, are friends. Their surnames are Daniels, Michaels and Stevens, but not necessarily in that order. Mr. Stevens lives in a blue house and Mr. Daniels does not live in a red house. Brayden lives in a red house and Aiden lives in a grey house. What are the full names of each of the boys?

1. What is the key information?
2. What is the question asking you to do?
3. What tool will you use?
4. Apply the tool and do the mathematics.
5. Write the answer.
6. Is your answer reasonable? How do you know?
## Problem Solving Strategies 3

### GUESS AND CHECK

**Problem**
Mary is six years older than Dorothy. The sum of their ages is 20. How old is Mary?

| 1. What is the key information? | 1. |
| 2. What is the question asking you to do? | 2. |
| 3. What tool will you use? | 3. |
| 4. Apply the tool and do the mathematics. | 4. |
| 5. Write the answer. | 5. |

**Problem**
Helen is told to build 22 stools. Each stool must have either 3 or 4 legs and all 81 legs supplied must be used. How many of each type will she build?

| 1. What is the key information? | 1. |
| 2. What is the question asking you to do? | 2. |
| 3. What tool will you use? | 3. |
| 4. Apply the tool and do the mathematics. | 4. |
| 5. Write the answer. | 5. |
Problem
The product of two numbers is 140 and their difference is 6. Find the two numbers.

1. What is the key information?
2. What is the question asking you to do?
3. What tool will you use?
4. Apply the tool and do the mathematics.
5. Write the answer.
6. Is your answer reasonable? How do you know?

Charles decided to swim 10 km up Bega river without leaving the river. He swam 2 km every hour then floated on his back for 10 minutes. Each time he floated, the current dragged him back 1 km. How long did it take Charles to complete the swim?

1. What is the key information?
2. What is the question asking you to do?
3. What tool will you use?
4. Apply the tool and do the mathematics.
5. Write the answer.
6. Is your answer reasonable? How do you know?
Problem Solving Strategies 4
LOOKING FOR A PATTERN

Problem
Calculate $9 - 7 + 9 - 7 + 9 - 7 + 9 - 7 + 9 - 7 + 9 - 7 + 9 - 7 + 9 - 7 + 9 - 7 + 9 - 7 + 9 - 7 = \underline{}$

1. What is the key information?
2. What is the question asking you to do?
3. What tool will you use?
4. Apply the tool and do the mathematics.
5. Write the answer.
6. Is your answer reasonable? How do you know?

Problem
Calculate the sum of the counting numbers from 1 to 400.

1. What is the key information?
2. What is the question asking you to do?
3. What tool will you use?
4. Apply the tool and do the mathematics.
5. Write the answer.
6. Is your answer reasonable? How do you know?
**Problem**

Emma was given an ant farm by her grandparents for her 12th birthday. The farm holds a total of 100,000 ants. Emma's farm had 1000 ants when it was given to her. If the number of ants in the farm on the day after her birthday was 2000, and the number of ants the day after that was 4000, in how many days will the farm be full?

<table>
<thead>
<tr>
<th></th>
<th>1. What is the key information?</th>
<th>2. What is the question asking you to do?</th>
<th>3. What tool will you use?</th>
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<tr>
<td></td>
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<td></td>
<td>5.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Problem**

In a high school of 1000 students, every student has a locker. Imagine that one student opens all the doors of all 1000 cupboards. Then a second student starts at the second locker and closes every second door. Then a third student starts at the third locker and changes the state of every third door (closes it if it was open or opens it if it was closed). Then a fourth student starts at the fourth locker and changes the state of every fourth door and so on. After 1000 students have followed the same patterns, which doors will be open and which doors will be closed?

<table>
<thead>
<tr>
<th></th>
<th>1. What is the key information?</th>
<th>2. What is the question asking you to do?</th>
<th>3. What tool will you use?</th>
<th>4. Apply the tool and do the mathematics.</th>
<th>5. Write the answer.</th>
<th>6. Is your answer reasonable? How do you know?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td></td>
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<td></td>
<td>3.</td>
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<td></td>
<td>4.</td>
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<td></td>
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<tr>
<td></td>
<td>5.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

NSW Department of Education 2017 | Numeracy Activities and Lesson Sequences K-10
Problem Solving Strategies 5

MAKE AN ORGANISED LIST

Problem
The numerals 1 to 10 are written on ten separate cards, one on each card. How many groups of four cards are there that have a sum of 30?

1. What is the key information?
2. What is the question asking you to do?
3. What tool will you use?
4. Apply the tool and do the mathematics.
5. Write the answer.
6. Is your answer reasonable? How do you know?

Problem
The order of activities at year assembly must be decided. The items to be put in order are the awards (A), the Year Advisor’s address (Y), Acknowledgement of Country (C) and the SRC address (S). The Acknowledgment of Country comes first, so in how many ways can the rest of the activities be arranged?

1. What is the key information?
2. What is the question asking you to do?
3. What tool will you use?
4. Apply the tool and do the mathematics.
5. Write the answer.
6. Is your answer reasonable? How do you know?
Problem
The team known as Mystery Incorporated includes five members, Scooby (Sc), Shaggy (Sh), Fred (F), Velma (V) and Daphne (D). This gang often splits up. How many different pairs could be chosen?
Note: FD (Fred and Daphne) is the same as DF (Daphne and Fred).

1. What is the key information?
2. What is the question asking you to do?
3. What tool will you use?
4. Apply the tool and do the mathematics.
5. Write the answer.
6. Is your answer reasonable? How do you know?

Problem
How many different amounts of money can be made by using two of the six Australian coins: 5c, 10c, 20c, 50c, $1, $2?

1. What is the key information?
2. What is the question asking you to do?
3. What tool will you use?
4. Apply the tool and do the mathematics.
5. Write the answer.
6. Is your answer reasonable? How do you know?
Problem Solving Strategies 6

MAKING IT SIMPLER

Problem
At Easter, five friends decide to give each other presents. How many presents are given together?

1. What is the key information?

2. What is the question asking you to do?

3. What tool will you use?

4. Apply the tool and do the mathematics.

5. Write the answer.

6. Is your answer reasonable? How do you know?

Problem
Curtis is a pirate who is following an unusual map. The map states that when your ship arrives on the shores of Wild Golden Sands, you are to take 58 steps through the wet sand to find gold. If Curtis has one good leg and one peg leg, how many foot prints will he make?

1. What is the key information?

2. What is the question asking you to do?

3. What tool will you use?

4. Apply the tool and do the mathematics.

5. Write the answer.

6. Is your answer reasonable? How do you know?
### Problem Solving Strategies 7

**WORKING BACKWARDS**

**Problem**
How many lines of length 1 cm are needed to draw a 5 cm by 5 cm grid?

<table>
<thead>
<tr>
<th>1.</th>
<th>What is the key information?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>What is the question asking you to do?</td>
</tr>
<tr>
<td>3.</td>
<td>What tool will you use?</td>
</tr>
<tr>
<td>4.</td>
<td>Apply the tool and do the mathematics.</td>
</tr>
<tr>
<td>5.</td>
<td>Write the answer.</td>
</tr>
<tr>
<td>6.</td>
<td>Is your answer reasonable? How do you know?</td>
</tr>
</tbody>
</table>

| 4. | 5 | 6 |

**Problem**
Bobby is 12 years younger than Jimmy. Lenny is 28 years older than Bobby. If Lenny is 34, how old is Jimmy?

<table>
<thead>
<tr>
<th>1.</th>
<th>What is the key information?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>What is the question asking you to do?</td>
</tr>
<tr>
<td>3.</td>
<td>What tool will you use?</td>
</tr>
<tr>
<td>4.</td>
<td>Apply the tool and do the mathematics.</td>
</tr>
<tr>
<td>5.</td>
<td>Write the answer.</td>
</tr>
<tr>
<td>6.</td>
<td>Is your answer reasonable? How do you know?</td>
</tr>
</tbody>
</table>

| 4. | 5 | 6 |
### Problem
Roger has $52 now but during the last week he has bought ten cheeseburgers at $2.15 each and eight frozen cokes at $1 each. He also earned $27.50 washing cars during the last week. How much money did he have one week ago?

1. What is the key information?  
2. What is the question asking you to do?  
3. What tool will you use?  
4. Apply the tool and do the mathematics.  
5. Write the answer.  
6. Is your answer reasonable? How do you know?

---

### Problem
I think of a number, multiply it by 5, and then subtract 12 from that answer. I am left with 38. What was the number I first thought of?

1. What is the key information?  
2. What is the question asking you to do?  
3. What tool will you use?  
4. Apply the tool and do the mathematics.  
5. Write the answer.  
6. Is your answer reasonable? How do you know?
Problem
Four children were bouncing balls. Samuel's ball bounced six more times than Samantha's. Samantha's ball bounced half as many times as Samson's. Samson's bounced eight times. How many times did Samuel's ball bounce?

1. What is the key information?
2. What is the question asking you to do?
3. What tool will you use?
4. Apply the tool and do the mathematics.
5. Write the answer.
6. Is your answer reasonable? How do you know?

1.
2.
3.

4.
5
6.

Problem

1. What is the key information?
2. What is the question asking you to do?
3. What tool will you use?
4. Apply the tool and do the mathematics.
5. Write the answer.
6. Is your answer reasonable? How do you know?

1.
2.
3.

4.
5
6.
Problem Solving Assessment Resource

PROBLEM SOLVING MID-ASSESSMENT

Student Name: ________________________________

Class: _______________________________________

Time: 35 minutes

Calculators are allowed in this mid-assessment. Use the working space wisely.

**Question 1**
The difference between Mr. Law's and Mr. Page's ages is 4 years. The sum of their ages is 50.
How old are these two teachers?

What method did you use to solve this problem?

**Question 2**
In a review task, Ms. Ward wrote 12 more questions than Mr. Law. Mr. Law wrote three times as many questions as Mr. Page. Mr. Page wrote 5 questions. How many questions are in the review task?

What method did you use to solve this problem?
**Question 3**
Ms. Ward’s favourite number is less than 50. It is an odd number. It has two-digits. The sum of the digits is 5. The difference of the digits is 1. What is Ms. Ward’s favourite number?

What method did you use to solve this problem?

---

**Question 4**
Mr. Page loves surfing. Mr. Page can paddle out 5 metres but then a wave picks him up and takes him back 1 metre. It takes 1 minute to paddle the 5 metres and 5 seconds to be pushed back each 1 metre. He wants to paddle out behind the last set of waves which is 45 metres away. How long does it take him to get there?

What method did you use to solve this problem?
Question 5
Mr. Page and Mr. Law both have Star Wars toys. There are R2D2 robot toys and Chewbacca figures. Together, both teachers share 11 toys. Mr. Page has twice as many R2D2 toys as his Chewbacca toys. Mr. Law has one more Chewbacca toy than his R2D2 toys. How many does each teacher have of each toy?

What method did you use to solve this problem?

Question 6
Ms. Ward’s classroom has groups of desks. These groups of desks are made up of the smaller student desks. One student can sit at each of the student desks. There are 4 groups that sit 6 students. There are also 2 groups that seat 4 students. How can Ms. Ward rearrange the same desks to fit only 4 students in each grouping without any left over desks?

What method did you use to solve this problem?
Question 7
Mr. Law gives canteen vouchers at the lunch break to the students who have collected 5 merit stamps. On Friday, he gave out 1 more canteen voucher than he did on Thursday. On Thursday, he gave out 3 less than on Wednesday. On Wednesday, he gave out half of the vouchers he gave out on Monday. On Tuesday, he gave out twice as many as Friday. On Tuesday, he gave out 2 canteen vouchers.

How many more did he give out on Monday compared to the rest of the week?

What method did you use to solve this problem?

Question 8
Ms. Ward’s favourite sport to watch is AFL. In AFL, teams can score in two ways. One way is a “goal” where a team earns 6 points. The other is a “behind” where a team earns 1 point.

At the end of the 2016 Grand Final, the Sydney Swans scored 67 points.
Which of the following is a possible score they could have made?

a) 5 goals, 5 behinds  b) 7 goals, 10 behinds  c) 10 goals, 7 behinds  d) 12 goals, 1 behind

What method did you use to solve this problem?
Question 9
Ms. Ward, Mr. Law and Mr. Page were discussing their favourite topics in Mathematics, their favourite colour and their favourite movies. Ms. Ward doesn't like the colour purple but the Algebra loving teacher does. The Teacher who likes Trigonometry also likes The Gremlins. Mr. Page is not a fan of Statistics but loves the movie The Man from Earth. The teacher that loves the movie The Lord of the Rings also dislikes the colour teal. Mr. Law doesn't like red but loves The Gremlins.
Can you determine which teacher likes which topic, colour and movie?

What method did you use to solve this problem?
PURPOSE

The purpose of this sequence of activities is to develop numeracy activities across the different Key Learning Areas. Students will learn how numeracy is embedded in different KLAs. Kurri Kurri High School implemented these activities with their Stage 4 students to increase the numeracy skills across various subjects.
KLA - LOTE: France and Australia - Comparing Size

STRAND AND SUBSTRAND
Moving Between Cultures - Measurement and Geometry - Properties of Geometrical Figures, Number and Algebra - Ratios and Rates - Stage 4

SYLLABUS OUTCOMES
French
4.MBC.2 A student demonstrates knowledge of key features of the culture of French-speaking communities.

Mathematics
MA4-7NA A student operates with ratios and rates, and explores their graphical representation.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA5.1-11MG A student describes and applies the properties of similar figures and scale drawings.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 3, spatial visualisation, geometric reasoning and mapping and understand position, maps and grid references, Stage 4.
Numeracy Skills Framework, Focus Area 4, measurement and time calculations and understanding and applying length concepts, Stage 3.

ACTIVITY FOCUS
Uses ratios to solve problems, calculates the perimeter of a parallelogram and calculates the perimeters of rectangles from their side lengths.

France and Australia - Comparing Size Activity

PRE-TEST
Students are given rectangles, squares and parallelograms to calculate the perimeter. The results are recorded.

BASE ACTIVITY
Part 1
Students are issued with a worksheet "En Comparison" that contains a map of France super imposed on a map of Australia to demonstrate comparative size.

Teacher points out key features of the map and as a class the capital cities are labelled. Teacher explicitly points out the scale line and as a class students measure the line and calculate the scale. Teacher then demonstrates an example of calculating distance with the scale (e.g. The widest cross section of Tasmania).

Students are then given the following series of questions to calculate distances using the scale on the worksheet.

   a) At its widest point, how wide is France?
   b) At its widest point, how wide is Australia?
   c) What is the difference between your responses to a and b?
   d) At its longest point, how long is France?
   e) At its longest point, how long is Australia?
   f) What is the difference between your responses to d and e?

Students compare their answers and discuss as a class. Discussion particularly focuses on prior knowledge of the population of both countries.

Part 2
Students join the five extreme points of France to make a hexagon. Students estimate the perimeter of this hexagon then using the scale, calculate it. Their estimate is then compared to their calculated distance and the actual perimeter of France.

Adjustments for students working towards stage level.
Students are provided with a map that is on a grid to make measurements easier.
Students are also provided with yarn that can be cut to size when measuring and then measured with a ruler before recording results.

EXTENSION
Option 1
• Students convert the scale from centimetres to metres.
• Using witches hats and tape measures students measure and mark a section of the playground to demonstrate the length and width of both France and Australia.

Option 2
• Students are provided with a second, more detailed map of France, with main cities marked.
• Students use the scale to determine the distance between Paris and other major regional cities.
• As a further extension activity, students may use a map of Australia to determine the distance between Canberra and state capital cities.

POST TEST
Students are given rectangles, squares and parallelograms to calculate the perimeter. The results are recorded and compared to their pre-test.
France - Comparing Size Activity

- Paris
- France
- Spain
- United Kingdom
- Netherlands
- Belgium
- Germany
- Switzerland
- Italy

Distance scales:
- 0 km
- 50 km
- 100 km
- 0 mi
- 50 mi
- 100 mi
Australia - Comparing Size Activity
France and Australia - Comparing Size Activity

1000 km
Languages and Numeracy – Post Task

<table>
<thead>
<tr>
<th></th>
<th>Stage 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year Level</td>
<td>Year 7</td>
</tr>
<tr>
<td>Language</td>
<td>French</td>
</tr>
<tr>
<td>Unit of Work</td>
<td>Food</td>
</tr>
<tr>
<td>Numeracy Activity Name</td>
<td>What foods do we like? Surveys and Graphs</td>
</tr>
<tr>
<td>Focus Area to be Addressed</td>
<td>Focus Area 5: Graphical representation and data analysis</td>
</tr>
<tr>
<td>Language Structures Incorporated</td>
<td>J'adore ...</td>
</tr>
<tr>
<td></td>
<td>J'aime ...</td>
</tr>
<tr>
<td></td>
<td>Je n'aime pas ...</td>
</tr>
</tbody>
</table>

**How will the numeracy skills be supported by this activity**
Students will develop their basic statistic skills through the creation and tallying of a survey and graphing the results.

**TASK OUTLINE**
Students create a basic five question survey to poll food preferences in the class.

e.g. Aimes – tu le chocolat?

Students draw up a table to record the results and survey ten students in the class in target language.

e.g. S1: Aimes tu le poulet?
   S2: Non, je déteste le poulet.

<table>
<thead>
<tr>
<th></th>
<th>Poulet</th>
<th>Chocolat</th>
<th>Poisson</th>
<th>Frites</th>
<th>Bonbons</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>✓</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>S2</td>
<td>×</td>
<td>✓</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Students are then shown a column graph and explicitly taught its components.

The following graph may be used as an example:


Students then use this information and these skills to create their own graph on graph paper provided.

Students are informed that their graph must have:
- An appropriate title (e.g. La Nourriture que nous aimes – Food we like)
- Labelled X and Y axis (La nourriture – food; Nombre de personnes – number of people)
- Accurate and consistent scale
- Consistent column width
- A half column width gap at the beginning
- Consistent spacing between columns
- A legend
- Colour
- Data represented accurately
TEACHING SEQUENCE FOR COLOUR MIXING
Stage 4 - CAPA

PURPOSE
The purpose of this sequence of activities is to develop numeracy activities across the different Key Learning Areas. Students will learn how numeracy is embedded in different KLAs. Kurri Kurri High School implemented these activities with their Stage 4 students to increase the numeracy skills across various subjects.

KLA - CAPA: Colour Mixing

STRAND AND SUBSTRAND
Number and Algebra - Fractions and Percentages - Stage 4

SYLLABUS OUTCOMES
Art
VA-4.6 A student selects different materials and techniques to make artworks.

Mathematics
MA4-7NA A student operates with ratios and rates.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.
MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, mental computation and numerical reasoning and understanding fractions, decimals, percentages, rates and ratios, Stage 4.

ACTIVITY FOCUS
Finds percentages of a quantity and operates with simple ratios.
Colour Mixing Activity

ACTIVITY
• Students form small groups 2-3.
• Each group is given a colour chip and prime colour paint.
• Using only the prime colours, they are to discover the ratio needed to develop that colour.
• Students draw up a table to identify to amount of each colour used.

Example

<table>
<thead>
<tr>
<th>Colour</th>
<th>RED</th>
<th>BLUE</th>
<th>GREEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purple</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Each card increases in difficulty.

Students are then asked to write in ratio form the mix of colours used to develop each new colour. E.g. red : blue = 2 : 1

Students could be given a pie graph with different colours that were used in a specific ratio to make a new colour. Students would be asked to write the ratio, based on the information in the sector graph, of the colours used to make the new colours.

EXTENSION ACTIVITY

Students could be asked to see how much of each paint quantity they would need if they wanted to mix up 10 L of a paint colour that they have created.

Students draw a pie graph to show the percentage used from each colour.

Ways of Thinking About Ratios Activity

Ratio is a comparison of two like quantities
Rate is a comparison of two unlike quantities (E.g. km/hour)

EXAMPLE 1
The ratio of Boys to Girls is 2 : 3. If there are 30 students How many are boys and how many are girls?

1. Ratio is a comparison of two like quantities. Rate is a comparison of two different quantities. E.g. km/hour

2. For example, if we say that the ratio of boys to girls in the class is 2 to 3, we are comparing the number of boys to the number of girls.

3. We are using the base comparison to apply it to the whole situation. In order to understand this relationship proportional reasoning is used.

4. Proportional thinking and reasoning, is knowing the multiplicative relationship between the base ratio and the proportional situation to which it is applied.

Boys : Girls

2 : 3

2 of 30 are boys

3 of 30 are girls

There are 30 children in the class we know that, proportionally, the number of boys is 12 and the number of girls is 18.
**EXAMPLE 2**
Modelling the ratios, draw diagrams to represent comparative amounts within the ratios.

40 M&Ms are divided between Joe and Kerry in the ratio 4 : 6.
How many M&Ms will each child receive?
Show how you could model the answer?

<table>
<thead>
<tr>
<th>Red : Green</th>
<th>Total number of parts is 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 : 2</td>
<td>1 part out of 3 total number of parts is red</td>
</tr>
<tr>
<td>1/3 red</td>
<td>2/3 green</td>
</tr>
<tr>
<td>1 : 3</td>
<td>2 parts out of 3 total number of parts is green</td>
</tr>
<tr>
<td>1/4 red</td>
<td>3/4 green</td>
</tr>
<tr>
<td>3 : 2</td>
<td></td>
</tr>
<tr>
<td>3/5 red</td>
<td>2/5 green</td>
</tr>
<tr>
<td>4 : 7</td>
<td></td>
</tr>
<tr>
<td>4/11 red</td>
<td>7/11 green</td>
</tr>
</tbody>
</table>
EXAMPLE 4
The Perfect Pink Paint, concrete real life ratios for students to create colours form ratios of mixtures.

Discussions about colour mixture ratios and the importance of using the same measure of each quantity of parts and the total parts of paint required to create the colour.

Black 2:1 1:1 1:2 White

Cyan 2:1 1:1 1:2 Magenta

<table>
<thead>
<tr>
<th>Task: The Perfect Pink Paint Batch</th>
<th>How do we use fractions to understand ratios?</th>
<th>Student Observation</th>
</tr>
</thead>
</table>
| Perfect pink paint can be created using red and white paint mixed in a certain ratio of Red : White | Draw a diagram  
Linear model - Tape diagrams  
Grid paper  
Use a whiteboard or butchers paper  
Use Unifix cubes | The understanding of part, part and whole, listen to the language students are using.  
Students need to get into the mathematics and numeracy.  
What are students saying, we need to observe and listen?  
What are the student misconceptions? |

Student investigation
Example: Perfect pink paint can be created using red and white paint mixed in a certain ratio of Red : White

a) If we created pink paint in the ratio 3 : 4 and 2 : 3 which would be the perfect pink colour and which would be the darker pink colour?

b) As a group create as many models as you can to show how many white and red cups you need to make 20 cups of perfect pink paint?

c) How do we create 20 cups of perfect pink paint?

d) How many cups of white paint and red paint do we need?

Extend the problem

a) How do we make 10 litres of perfect pink paint?
PRACTICAL ACTIVITIES

Pink paint mixtures
Create the paint mixtures using the rations below, paint each circle to show the pink shade.

2 : 1  1 : 1  1 : 2

RED : WHITE

Create your own ratios for pink paint. Colour each circle and write the ratio for each paint mixture.
TEACHING SEQUENCE FOR KING RICHARD III
Stage 4 - HSIE

PURPOSE
The purpose of this sequence of activities is to develop numeracy activities across the different Key Learning Areas. Students will learn how numeracy is embedded in different KLAs. Kurri Kurri High School implemented these activities with their Stage 4 students to increase the numeracy skills across various subjects.

KLA - HSIE: Richard III – Dot Plot and Timeline

STRAND AND SUBSTRAND
Statistics and Probability - Collecting and Presenting Data

HSIE
The ancient to the modern world: Depth Study 4, The Western and Islamic World. Topic 4b: Medieval Europe (c. AD 590 – c. 1500).

SYLLABUS OUTCOMES
HSIE
HT4-2 A student describes major periods of historical time and sequences events, people and societies from the past.

Mathematics
MA4-19SP A student collect, represent, analyse, interpret and evaluate data, assign and use probabilities, and make sound judgements.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 4, measurement and time calculations and reads and interprets simple timetables, timelines and calendar.
Numeracy Skills Framework, Focus Area 2, patterns and algebraic reasoning and sequence events and people in chronological order, Stage 3.

ACTIVITY FOCUS
Creates a timeline and dot plot. Calculates the range and mode of a data set from a dot plot.
Richard III – Dot Plot and Timeline Activity

PRE-TEST
Recap knowledge and examples on using dot plots.

INSTRUCTIONS
1. Have a discussion with students on dot plots and calculating the mode.
2. Give students a timeline of King Richard III, which is not in correct order.
3. Create a timeline and place it in chronological order.
4. Students then create a dot plot from the timeline: The number of events that occurred.
5. Calculate the mode from the dot plot.
6. Calculate mode year of King Richard III, i.e. when did the most events occur.

ADJUSTMENTS
Provide less events in the original list of events.
Complete as a whole class.
Create a grid on the wall.
Create a dot plot on the classroom wall.

Reference
Middle Ages for Kids: http://www.lordsandladies.org/timeline-of-king-richard-iii.html
Put the following timeline in chronological order:

**Timeline not in order**

<table>
<thead>
<tr>
<th>Timeline of key dates</th>
<th>Timeline of King Richard III key events</th>
<th>Order events in ascending time</th>
</tr>
</thead>
<tbody>
<tr>
<td>r. 1483-1485</td>
<td>Reigned as King of England: 26 June 1483 - 22 August 1485</td>
<td></td>
</tr>
<tr>
<td>1485</td>
<td>Richard was the last king of the Plantagenet family, who had ruled over England for more than three hundred years. Richard's defeat at Bosworth Field by Henry Tudor ended the Plantagenet dynasty and the Wars of the Roses and heralded the Tudor dynasty.</td>
<td></td>
</tr>
<tr>
<td>1483</td>
<td>July 6 1483: Richard was crowned at Westminster Abbey.</td>
<td></td>
</tr>
<tr>
<td>1484</td>
<td>March 16 1484: Anne Neville, the wife of King Richard III died of tuberculosis.</td>
<td></td>
</tr>
<tr>
<td>1472</td>
<td>July 12 1472: Richard married Anne Neville (c. 1456-1485) who was the younger daughter of Richard Neville, Earl of Warwick and Anne Beauchamp.</td>
<td></td>
</tr>
<tr>
<td>1485</td>
<td>Battle of Bosworth Field 22 August 1485: King Richard III was killed and his supporters defeated at the Battle of Bosworth Field in Leicestershire against Lancastrian forces led by Henry Tudor.</td>
<td></td>
</tr>
<tr>
<td>1484</td>
<td>April 9 1484: Edward of Middleham, also known as Edward Plantagenet the only son of King Richard III of England died suddenly, cause unknown.</td>
<td></td>
</tr>
<tr>
<td>1483</td>
<td>26 June 1483: Richard, Duke of Gloucester was declared King Richard III.</td>
<td></td>
</tr>
<tr>
<td>1483</td>
<td>Easter: King Edward IV fell ill during Easter 1483. He named his brother Richard, Duke of Gloucester as Protector after his death and entrusted his young sons and little princes, Edward and Richard, to his care. Richard had always remained loyal to King Edward IV.</td>
<td></td>
</tr>
<tr>
<td>1483</td>
<td>16th June 1483: The coronation of Edward V was cancelled.</td>
<td></td>
</tr>
<tr>
<td>1483</td>
<td>June 25 1483: Parliament declared the two little princes illegitimate and, as next in line to the throne, their uncle and Protector, Richard, Duke of Gloucester, was declared the true King. The two little princes were never seen again.</td>
<td></td>
</tr>
<tr>
<td>1460</td>
<td>The Battle of Wakefield: Richard's father was killed in the battle. Richard spent his childhood at Middleham Castle under the tutelage of his uncle Richard Neville, the Earl of Warwick (the Kingmaker).</td>
<td></td>
</tr>
<tr>
<td>1483</td>
<td>The young prince ascended the throne as Edward V when his father died in 9 April 1483. Edward V was joined by his brother Prince Richard at the Tower of London to await his coronation.</td>
<td></td>
</tr>
<tr>
<td>1482</td>
<td>Richard recaptured Berwick-upon-Tweed from the Scots.</td>
<td></td>
</tr>
<tr>
<td>1473</td>
<td>King Richard has a son: Edward of Middleham, also known as Edward Plantagenet (1473 - April 9, 1484) was born in 1473, he was the only son of King Richard III of England and his wife Anne Neville.</td>
<td></td>
</tr>
<tr>
<td>1461</td>
<td>Warwick was instrumental in deposing King Henry VI and replacing him with Richard's eldest brother, Edward on March 4: Edward of York was declared King Edward IV of England.</td>
<td></td>
</tr>
<tr>
<td>1452</td>
<td>King Richard III was born on 2 October 1452 at Fotheringay Castle. He was the son of Richard, Duke of York (1411-1460) and Cecily Neville (1415-1495) and the brother of King Edward IV.</td>
<td></td>
</tr>
</tbody>
</table>
Create a horizontal timeline showing the key events of King Richard III. Include an accurate scale showing the years. Place a title on your timeline and label each event.
Create a dot plot from the information in the timeline to show the number of events that occurred each year.
TEACHING SEQUENCE FOR DATA PERSPECTIVE ON SOURCES Stage 4 - English

PURPOSE
The purpose of this sequence of activities is to develop numeracy activities across the different Key Learning Areas. Students will learn how numeracy is embedded in different KLAs. Kurri Kurri High School implemented these activities with their Stage 4 students to increase the numeracy skills across various subjects.

KLA - English: Perspective on Sources

STRAND AND SUBSTRAND
Statistics and Probability - Collecting and Presenting Data

English
Persuasive English Writing - Stage 4

SYLLABUS OUTCOMES
EN4-1A A student responds to and composes texts for understanding, interpretation, critical analysis, imaginative expression and pleasure.

EN4-5C A student thinks imaginatively, creatively, interpretively and critically about information, ideas and arguments to respond and compose texts.

MA4-20SP A student analyses single sets of data using measures of location, and range.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, interpreting and analysing data, representing data in graphs and timelines, Stage 4.

ACTIVITY FOCUS
Uses mathematics to evaluate the effectiveness of a persuasive text. Ensure that students are able to calculate the range and mean of a data set. Identifies a possible effect of a new data value on the mean.
**Persuasive Writing Activity**

**PRE-TEST**

Students predict the most effective device in a persuasive text and the most commonly used device within the protest text and explain why. Get them to chart their predictions as a class in a manner that they understand. This will pre-test students on their abilities to graph and interpret data.

**INSTRUCTIONS**

1. Students are to read printed copies of the lyrics and listen to the song lyrics by Horrible Histories on Richard III and identify the persuasive devices used to convey their perspective and decide if he is presented as a hero or a villain.

2. Students will then be broken up into groups and given a specific persuasive device to locate within the song lyrics and have to tally the number of times which it has been used within the text. Students then share the data they have collected on the techniques used in each song lyric to build a class overview to determine the most frequent technique used and evaluate its effectiveness in the text.

3. Explicit teaching on graphing and how best to represent the information collated from the analysis of the song lyrics.

4. Using the collected information from the tallying, groups are to decide on a data display and graph the data. Data display to be used include dot plots, column graphs, picture graphs.

5. Explicit teaching of range, mode and mean will have already occurred in mathematics lessons. Review these skills and understanding. Students are to apply their knowledge of range and mode to explore the effectiveness of the techniques and the persuasiveness of the text.

**ADJUSTMENTS**

Students may need to work in groups with teacher explicitly guiding the activity to make sure they are able to understand the skills while other groups will be able to independently work through the activity at their own pace or collaborate with others.

**EXTENSION**

Students will be able to complete the same activity on their own text on Richard III and compare its effectiveness to the one completed in class.

**POST TEST**

Students will complete numeracy questions involving statistical measures of central tendency such as mean, mode and range.
TEACHING SEQUENCE FOR DATA BERTIE BOTT’S GRAPHING Stage 4 - Science

PURPOSE
The purpose of this sequence of activities is to develop numeracy activities across the different Key Learning Areas. Students will learn how numeracy is embedded in different KLAs. Kurri Kurri High School implemented these activities with their Stage 4 students to increase the numeracy skills across various subjects.

KLA - Science: Bertie Bott’s Jelly Bean Graphing

STRAND AND SUBSTRAND
Statistics and Probability - Single Variable Data Analysis - Stage 4

SYLLABUS OUTCOMES
Science
SC4-7WS A student processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions.

Mathematics
MA4-20SP A student analyses single sets of data using measures of location, and range.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.
MA4-20WM A student applies appropriate mathematical techniques to solve problems.
MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, interpreting and analysing data, graphical representation and data analysis, representing data in graphs and timelines, Stage 4.

ACTIVITY FOCUS
Calculates the mean for a set of data in context and identifies a possible effect of a new data value on the mode and range.
Bertie Bott's Jelly Bean Graphing Activity

The Bertie Bott's factory have run out of colouring. Bertie Botts Beans are so popular in the Wizarding world, they must continue to produce the jelly beans without the different colouring. One worker suggested they could number the beans based on their flavour using the numbers 1 to 12.

- Each student is given a “packet” (30) of numbered Bertie Botts Beans. They construct and complete a frequency distribution table based on their packet showing the colour of beans.
- Students then calculate the mode and range for their packet of jelly bean colours.
- Students are given five more beans, then recalculate the mode and range and complete the following questions:
  1. What happened to the mode? Did this happen to everyone’s mode?
  2. What happened to the range? Did this happen to everyone’s range?

ADJUSTMENT

Students complete the activity as a small group or class, with students completing their own frequency distribution table based on their own packets. This data is then collected for the whole class with a class mode and range calculated for jelly bean colours.

ALTERNATE TASK

Give students a table listing contents of a packet of beans, students answer questions based on the information in the table.

Variation - You can use other items other than beans to complete this task.

EXTENSION

Another 10 beans are added to the whole class tally and the change to the mode and range are observed. Students complete the activity a number of times using random samples from the same population and comparing their summary statistics.
TEACHING SEQUENCE FOR FRACTIONS AND DECIMALS POISONOUS POTIONS
Stage 4 - Science

PURPOSE
The purpose of this sequence of activities is to develop numeracy activities across the different Key Learning Areas. Students will learn how numeracy is embedded in different KLAs. Kurri Kurri High School implemented these activities with their Stage 4 students to increase the numeracy skills across various subjects.

KLA - Maths: Poisonous Potions

STRAND AND SUBSTRAND
Number and Algebra - Fractions, Decimals and Percentages - Stage 4

SYLLABUS OUTCOMES
MA3-4NA A student orders, reads and represents integers of any size and describes properties of whole numbers.
MA3-7NA A student compares, orders and calculates with fractions, decimals and percentages.
MA4-5NA A student operates with fractions, decimals and percentages.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.
MA4-2WM A student applies appropriate mathematical techniques to solve problems.
MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, mental computation, numerical reasoning and understanding fractions, decimals, percentages, rates and ratios.

ACTIVITY FOCUS
Multiplies and divides fractions and decimals in context.
Poisonous Potions Activity

PRE-TEST
Students complete pre-test questions that involve multiplying and dividing fractions.

ACTIVITY
Students create their own potion recipe which has four servings. They decide what ingredients (minimum five) go into the potion and in what quantities (measured using typical kitchen measures).
Quantities must include a mixture of whole numbers and fractions.
Students then swap their potion recipe with a peer.

Students now write out the recipe, adjusted for a single serving.
Students swap and adjust a range of serving sizes e.g. 6 serves, 10 serves, 100 serves etc.

ADJUSTMENT AND EXTENSION
The serving sizes to be converted to are adjusted based on the ability of the students.

POST TEST
Students complete pre-test questions that involve multiplying and dividing fractions.

What is the name of your poisonous potion?

List the ingredients for the potion.

Serves 4
1. __________________________
2. __________________________
3. __________________________
4. __________________________

Adjust the ingredients to the potion to:

Serve 1
1. __________________________
2. __________________________
3. __________________________
4. __________________________

Serves 6
1. __________________________
2. __________________________
3. __________________________
4. __________________________
TEACHING SEQUENCE FOR DECIMALS
Stage 4 - Operating with Decimals

PURPOSE
The purpose of this sequence of activities is to develop numeracy activities across the different Key Learning Areas. Students will learn how numeracy is embedded in different KLAs. Kurri Kurri High School implemented these activities with their Stage 4 students to increase the numeracy skills across various subjects.

KLA - Maths: Basic Operations - Decimals

STRAND AND SUBSTRAND
Number and Algebra - Fractions, Decimals and Percentages - Stage 4

SYLLABUS OUTCOMES

MA4-5NA  A student operates with fractions, decimals and percentages.

MA4-1WM  A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM  A student applies appropriate mathematical techniques to solve problems.

MA4-3WM  A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, mental computation and numerical reasoning and understanding fractions, decimals, percentages, rates and ratios, Stage 4.

ACTIVITY FOCUS
Calculate decimals using basic operations (+, −, ×, ÷).
Basic Operations - Decimals

**ACTIVITY**
Prerequisite knowledge is for students to understand and explore the relative size of decimals.

Ordering ragged decimals for students to understand the relative size of decimals is essential. Encourage students to write all the decimals to the same number of decimal points before comparing and ordering.

1. Place the decimals in ascending order and then place them on the number line:
   0.5, 0.42, 0.2, 0.99, 0.25, 0.02, 0.751, 1.5, 1, 1.75, 0.09

2. Ask students to compare the decimals and circle the larger decimal. Ask students to explain why the decimal circled is larger, drawing a diagram or number line to support their answer.
   a) 1.25 or 0.25
   b) 0.452 or 0.5
   c) 0.07 or 0.7
   d) 2.346 or 1.99
   e) 0.001 or 0.75

3. Place the decimals on the number line and explain your thinking.
   0.06, 1.01, 0.5, 2.350, 0.75, 2.6, 1.5, 1.75, 0.25

- Add and Subtract Decimals - Teacher to discuss rules associated with adding and subtracting decimals explicitly explaining strategies to perform these calculations.
- Multiplying Decimals - Teachers explicitly explain the process required to multiply decimals and the importance of the total number of decimals in the question is the total number of decimal places in the answer.
- Dividing Decimals - Teachers to explicitly explain the process required when dividing decimals, simple decimals and whole numbers should be used as the divisor when doing non-calculator questions, more complex decimals can be used when using a calculator.
- Students will be required to have time to practise all skills demonstrated in this lesson.
- Calculators should also be used to perform these calculations.

**ADJUSTMENT**

Common decimals could be used to demonstrate the skills involved in calculating decimals involving all operations.

**EXTENSION**

More complex decimals could be used to demonstrate the skills involved in calculating decimals involving all operations.
TEACHING SEQUENCE FOR FRACTIONS
Stage 4 - Operating with Fractions

PURPOSE
The purpose of this sequence of activities is to develop numeracy activities across the different Key Learning Areas. Students will learn how numeracy is embedded in different KLAs. Kurri Kurri High School implemented these activities with their Stage 4 students to increase the numeracy skills across various subjects.

KLA - Maths: Basic Operations - Fractions

STRAND AND SUBSTRAND
Number and Algebra - Fractions, Decimals and Percentages - Stage 4

SYLLABUS OUTCOMES
MA4-5NA A student operates with fractions, decimals and percentages.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, mental computation and numerical reasoning and understanding fractions, decimals, percentages, rates and ratios, Stage 4.

ACTIVITY FOCUS
Calculate fractions using basic operations (+ − × ÷).
Basic Operations - Fractions

ACTIVITY
Determine the HCF and LCM of numbers - Teacher explanation including definition of terminology.

Generating Equivalent Fractions - Equivalent fractions could be introduced using a fractions chart or three-dimensional aid that enables students to manipulate various fractions to come up with equivalent expressions and then show how each can be formed from the others numerically. Factor trees can be used to assist in student understanding of this concept.

Add and Subtract Fractions - Teacher to discuss rules associated with adding and subtracting fractions explicitly explaining to students that a common denominator is required prior to adding and subtracting.

Multiplying Fractions - Teachers explicitly explain the process required to multiply fractions and the need to simplify answers to the equivalent simplified fraction.

Dividing Fractions - Teachers to explicitly explain the process required to divide fractions, including the need to “invert and multiply” and then take on the same rules as multiplying fractions.

Students will be required to have time to practice all skills demonstrated in this lesson.

ADJUSTMENT
Simpler fractions could be used to demonstrate the skills involved in calculating fractions involving all operations.

EXTENSION
More complex fractions could be used to demonstrate the skills involved in calculating fractions involving all operations.

### ADDING FRACTIONS WITH SAME DENOMINATORS

\[
\frac{1}{4} + \frac{1}{4} = \frac{2}{4}
\]

### ADDING FRACTIONS WITH DIFFERENT DENOMINATORS

\[
\frac{1}{3} + \frac{2}{4} = \frac{4}{12} + \frac{6}{12} = \frac{10}{12}
\]

Let’s turn both into twelfths. We split both bars into twelfths and the diagrams become as per those on the right.

### SUBTRACTING FRACTIONS WITH DIFFERENT DENOMINATORS

\[
\frac{1}{2} - \frac{1}{4} = \frac{2}{4} - \frac{1}{4} = \frac{1}{4}
\]

### MULTIPLYING FRACTIONS WITH DIFFERENT DENOMINATORS

\[
\frac{1}{9} \times \frac{2}{7} = \frac{2}{63}
\]
**TEACHING SEQUENCE FOR MEASUREMENT**

**Stage 4 - Converting Units**

**PURPOSE**

The purpose of this sequence of activities is to develop numeracy activities across the different Key Learning Areas. Students will learn how numeracy is embedded in different KLAs. Kurri Kurri High School implemented these activities with their Stage 4 students to increase the numeracy skills across various subjects.

**KLA - Maths: Basic Operations – Converting Units of Measurement - Area**

**STRAND AND SUBSTRAND**

Measurement and Geometry - Converting Units of Measurement - Stage 4

**SYLLABUS OUTCOMES**

MA4-13MG A student uses formulas to calculate the areas of quadrilaterals and circles, and converts between units of area.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

**MA4-2WM** A student applies appropriate mathematical techniques to solve problems.

**NUMERACY LINKS**

Numeracy Skills Framework, Focus Area 1, mental computation and numerical reasoning and understanding fractions, decimals, percentages, rates and ratios, Stage 4.

**ACTIVITY FOCUS**

Converts between metric units of area.
Basic Operations - Converting Units of Measurement - Area

**PRE-TEST**
Get students to complete an activity involving metric unit equivalents, i.e. 1 cm = 10 mm

**ACTIVITY**
Class discussion of appropriate use of units, for example, it is not practical to measure the area of a desktop using square kilometers or use square centimeters to measure the area of a basketball court.

Class discussion with diagrams on comparing the areas of shapes to calculate larger areas.

Notes and/or a diagram and worked examples to display the method to convert between units, including the ‘Conversion Caterpillar’.

**ADJUSTMENT**
Simpler decimals could be used to demonstrate the skills involved in converting measurements.

**EXTENSION**
More complex decimals could be used to demonstrate the skills involved in converting measurements including difficult area conversions.

**POST TEST**
Students complete measurement conversions for both measurement and area calculations.

### Common Units of Area

<table>
<thead>
<tr>
<th>Unit of Area</th>
<th>Square Side Length</th>
<th>Used to Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 square millimetre (mm²)</td>
<td>1 mm</td>
<td>the area of a desk</td>
</tr>
<tr>
<td>1 square centimetre (cm²)</td>
<td>1 cm</td>
<td>floor areas, suburban land areas</td>
</tr>
<tr>
<td>1 square metre (m²)</td>
<td>1 m</td>
<td>paddocks, farms, cities</td>
</tr>
<tr>
<td>1 hectare (ha)</td>
<td>100 m</td>
<td>huge areas such as states and countries</td>
</tr>
<tr>
<td>1 square kilometre (km²)</td>
<td>1 km</td>
<td></td>
</tr>
</tbody>
</table>

\[
\text{Small Unit} \quad \text{Large Unit} \quad \text{Conversion Caterpillar}
\]

\[
\begin{array}{c}
\text{Area}
\\
\text{x } 10² \quad \text{x } 100² \quad \text{x } 1000²
\\
\text{mm²} \quad \text{cm²} \quad \text{m²} \quad \text{km²}
\end{array}
\]
TEACHING SEQUENCE FOR PERCENTAGES
Stage 4 - Operating with Percentages

PURPOSE
The purpose of this sequence of activities is to develop numeracy activities across the different Key Learning Areas. Students will learn how numeracy is embedded in different KLAs. Kurri Kurri High School implemented these activities with their Stage 4 students to increase the numeracy skills across various subjects.

KLA - Maths: Basic Operations –Percentages

STRAND AND SUBSTRAND
Number and Algebra - Fractions, Decimals and Percentages - Stage 4

SYLLABUS OUTCOMES
MA4-5NA A student operates with fractions, decimals and percentages.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.
MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, mental computation and numerical reasoning and understanding fractions, decimals, percentages, rates and ratios, Stage 4.

ACTIVITY FOCUS
Finds percentages of a quantity.
Basic Operations – Percentages

PRE-TEST
Complete a conversion table of fractions, decimals and percentages with common percentages, i.e. 10%, 20%, 25%, 50% and 75%.

<table>
<thead>
<tr>
<th>FRACTION</th>
<th>DECIMAL</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/8</td>
<td>0.75</td>
<td>25%</td>
</tr>
</tbody>
</table>

ACTIVITY
Check student understanding of what ‘percentage’ means. What symbol is used and how to calculate a percentage from a fraction or a decimal, in particular 10%, 20%, 25%, 50% and 75%.

Get students to then use their knowledge to complete a table that consists of converting percentages, decimal and fractions that are outside the common percentage conversions.

Explicit teaching will need to occur for the percentages involving fractions.

Video - How to Order Fractions, Decimals and Percentages: https://www.youtube.com/watch?v=DhcM-pet1ZyQ. This video also reviews the work on converting between fractions, decimals and percentages.

Finding a Percentage of a Quantity - Discuss with students what the sentence 20% of $100 means mathematically and how to translate the words into a number sentence to be calculated.

Example: Find 20% of 100
means 20 for every 100, the answer is 20.

Find 20% of 400
means 20 for every 100, we have four hundreds so the answer is
20 + 20 + 20 + 20 which is 80.

Decreasing and increasing by a percentage - Students to use the strategies used when finding a percentage of a quantity and adding the extra step of, adding or subtracting to the original quantity.

ADJUSTMENT
• A variety of simpler fractions, decimals and percentages could be used for these activities.
• Students who have difficulty with ordering fractions, decimals and percentages may need to separate these into three skill areas, ordering decimals, ordering fractions and ordering percentages.

EXTENSION
• More complex fractions, decimals and percentages could be used to demonstrate these skills.
• Collect four examples of an original price, a percentage mark-up or mark-down and the new price from a retail outlet. Clothes, jewellery or department store outlets have abundant examples. Calculate the percentage mark-up or mark-down on the original price and compare against the advertised new price. See if you can find any that have been calculated inaccurately.

POST TEST
• Students are asked to complete another table involving converting fractions to percentages and decimals, this time with more complex numbers involved.
• Students will also be asked to calculate the percentage of a quantity, most likely a monetary question and then increase or decrease a quantity by a percentage, again a monetary question is most likely here.
TEACHING SEQUENCE FOR TIME ZONES
Stage 4 - Calculating Time

PURPOSE
The purpose of this sequence of activities is to develop numeracy activities across the different Key Learning Areas. Students will learn how numeracy is embedded in different KLAs. Kurri Kurri High School implemented these activities with their Stage 4 students to increase the numeracy skills across various subjects.

KLA - Maths: Basic Operations – Time

STRAND AND SUBSTRAND
Measurement and Geometry - Converting Units of Measurement - Stage 4

SYLLABUS OUTCOMES
MA4-15MG A student performs calculations of time that involve mixed units, and interprets time zones.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 4, measurement and time calculations, and solves problems involving international time zones.

ACTIVITY FOCUS
Solves problems involving international time zones.
Basic Operations – Time

**PRE-TEST**
Give students some basic time calculations to complete. As a group lead a discussion into time zones and how days, weeks, years etc. are calculated.

**ACTIVITY**
Teacher provides information on units of time, completes examples including finding time differences, adding and subtracting given numbers of hours and minutes.

Teacher demonstrates converting units of time seconds, minutes, hours, days, weeks, months, years.

Discuss with students appropriate mental strategies to improve efficiency of calculations.

As a class, complete several problems involving adding and subtracting time. Introduce a calculator and complete the same questions. Ensure teacher demonstrates a question where the answer will result in a half hour (0.5 h). Discuss why this decimal represents half an hour.

Explicit instructions about how rounding an answer to the nearest minute or hour requires the use of 30 as half.

Teacher introduces the concept of 24-hour time, asking if any students know what it is and where it may be used. Discuss how 24-hour time spans the entire day (2 × 12 hour sessions) and why it is used for accuracy and reduced confusion (not using am or pm).

Teacher gives a brief explanation of international time differences and links to students prior understanding of the earth’s rotation and position of the sun. Students should then work through questions using their skills in adding and subtracting time. Students solve problems involving time zones around the world. Real world problems should be used such as planning for a holiday and utilising timetables and coordinating flight connections etc.

**ADJUSTMENT**
Simpler time calculations could be used to demonstrate each skill. Students could monitor how often they hear or see a reference to time in their day including if it is 24-hour time or am-pm.

**EXTENSION**
Students can look at the effect longitude and latitude has on time zones. Also, what effect daylight savings time has on time zones?

**POST TEST**
Students are to complete more difficult time calculations. Students are also to complete calculations involving time zones and am-pm/24-hour time and rounding off time calculations.
TEACHING SEQUENCE FOR DOT PLOTS
Stage 4 - Analysing and Interpreting Data

PURPOSE
The purpose of this sequence of activities is for students to construct and interpret graphs. The activities also allow students to translate, rotate and reflect points and shapes on a number plane and further to construct algebraic expressions for word problems. Lithgow High School implemented these activities with their Stage 4 students.

Identifies and Creates a Dot Plot
Given a Data Set in Context

STRAND AND SUBSTRAND
Statistics and Probability - Data Collection - Stage 4

SYLLABUS OUTCOMES
MA4-19SP A student collects, represents and interprets single sets of data, using appropriate statistical displays.

MA4-20SP A student collects, represents, analyses, interprets and evaluates data, assign and use probabilities, and make sound judgments.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Aspects of Numeracy Focus Area 5, interpreting and analysing data, Stage 4.

ACTIVITY FOCUS
Constructs and interprets dot plots, stem and leaf pots, divided bar graphs, sector graphs and line graphs, spatial distributions and scatter plots.
Activity 1 - Creating Dot Plots Activities

SMARTIES ACTIVITY
1. Distribute a box of smarties (or M&Ms) to each student and ask them to make a column with each colour.
2. Create a dot plot to display results. Each dot represents the number of smarties per colour. Colours are to be represented across the horizontal axis.

When completed, discuss the following:
• Are the packs the same?
• Who had the most smarties altogether?
• Who had more blue smarties in their packet?
• Which is the least common colour?
• The most common colour?

Activity 2 – Physical Activity

• Students select a number card from two decks of shuffled cards (picture cards removed).
• Students are organised into lines based on the number that they have drawn.
• A line in the playground is used to form the base for the "dot plot" (use a rope to make the line).
• Place nine numbered sheets of A4 paper along the base line, to make a number line from 2 to 10.
• Each student lines up in a row behind their face value number.
• Students return to the classroom to display the results data in a dot plot.

Before they start, discuss the following points:
• Which numbers will be recorded along the horizontal axis (the card number)?
• What does each dot represent?

Variation - Word or Paint could be used to draw a dot plot over the photo on the whiteboard.

When finished, students answer a number of questions from the dot plot, for example:
• How many students had a 4?
• How many students had a number less than 5?
• How many students had a number greater than 7?
• How many students are there altogether?
What is the mode?

Activity 3 – Surveying the Class

Survey the class. Some possibilities are:
• The favourite ice cream flavour.
• The most popular colour they like.
• The preferred team game during sport time, etc.

Tally the data in a frequency table on the whiteboard.
For example: Favourite Fruit

<table>
<thead>
<tr>
<th>FRUIT</th>
<th>TALLY</th>
<th>NUMBER OF STUDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>III</td>
<td>3</td>
</tr>
<tr>
<td>Pear</td>
<td>II</td>
<td>2</td>
</tr>
<tr>
<td>Banana</td>
<td>III  III</td>
<td>10</td>
</tr>
<tr>
<td>Orange</td>
<td>III</td>
<td>3</td>
</tr>
<tr>
<td>Grapes</td>
<td>III</td>
<td>4</td>
</tr>
<tr>
<td>Peach</td>
<td>II</td>
<td>2</td>
</tr>
<tr>
<td>Apricot</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Mango</td>
<td>III  III</td>
<td>8</td>
</tr>
</tbody>
</table>

Students use the data from the table to construct a dot plot.

When students finish their dot plot, they:
• Work in pairs and discuss some facts that can be obtained from the plot.
• Write three questions that could be answered using the information presented in the dot plot.
Activity 4 – Using Collected Data to Create Dot Plots

Students use collections of scores and frequency tables to produce dot plots, particularly those where the horizontal axis has numbers, not categories.

Students could collect data by surveying the class.

Activity 5 – Reading Dot Plots

Students are given a dot plot and asked to use it to represent the information in a table.

The following dot plot shows Paula’s goal scoring in each hockey game of the season.

Each dot represents a different game.

Use the dot plot to complete a data table for Paula’s goal scoring.

Before they start discuss the following points.

• What information is along the horizontal axis? (Number of goals)
• What does each dot represent? (A game)
• How can we find the total number of games Paula played? (Counting the dots)

<table>
<thead>
<tr>
<th>GOALS SCORED</th>
<th>NUMBER OF GAMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Creating Dot Plots

1.

Sam surveyed the things that students like the most. Her results are below:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIKE RIDING</td>
<td>4</td>
</tr>
<tr>
<td>WATCHING MOVIES</td>
<td>3</td>
</tr>
<tr>
<td>SURFING</td>
<td>1</td>
</tr>
<tr>
<td>SKATEBOARDING</td>
<td>2</td>
</tr>
<tr>
<td>SWIMMING</td>
<td>6</td>
</tr>
</tbody>
</table>

Complete her dot plot below, with a dot for each student:

2.

Dylan’s coach recorded the ages of players in his soccer team:
12, 13, 12, 12, 11, 13, 13, 13, 12, 11, 12, 10
Create a dot plot using the data below:
3.

Alex recorded the goals scored by Panthers hockey team in a table, below.

<table>
<thead>
<tr>
<th>2</th>
<th>4</th>
<th>3</th>
<th>1</th>
<th>6</th>
<th>3</th>
<th>2</th>
<th>2</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>8</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>8</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Use the table to draw a dot plot from his results:

![Dot plot illustration]

a) What is the range? _______________

b) What is the mode? _______________

c) What is the mean? _______________

4.

Michael made a list of the foods ordered from the school canteen at recess:

<table>
<thead>
<tr>
<th>Food</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEAT PIE</td>
<td>7</td>
</tr>
<tr>
<td>SAUSAGE ROLL</td>
<td>5</td>
</tr>
<tr>
<td>PIZZA</td>
<td>4</td>
</tr>
<tr>
<td>LASAGNA</td>
<td>1</td>
</tr>
<tr>
<td>NACHOS</td>
<td>5</td>
</tr>
<tr>
<td>VEGETABLE SOUP</td>
<td>0</td>
</tr>
</tbody>
</table>

Show the results in a dot plot:

![Dot plot illustration]
5.

James recorded the number of fish that he caught each day for a week:
4, 6, 3, 6, 5, 5, 5
Show the catches on a dot plot with a dot for each day.

6.

Sienna recorded the time in minutes that it took her to ride to school each day for two weeks:
15, 14, 14, 15, 11, 14, 13, 15, 15, 14
Show her times on a dot plot, with a dot for each bike ride.
Label the dot plot.
Reading Dot Plots

1. Aminah made a dot plot to show how many pets she has. Each dot represents a pet. How many birds does Aminah have?

![Dot Plot of Pets]

<table>
<thead>
<tr>
<th>Types of Pets</th>
<th>Rabbits</th>
<th>Goldfish</th>
<th>Guinea pigs</th>
<th>Budgerigars</th>
<th>Parrots</th>
<th>Dogs</th>
</tr>
</thead>
</table>

2. The dot plot shows the number of students in each line at the canteen. Each dot represents a student. Which lines have 4 students?

![Canteen Line Dot Plot]

<table>
<thead>
<tr>
<th>Canteen Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line 1</td>
</tr>
<tr>
<td>Line 2</td>
</tr>
<tr>
<td>Line 3</td>
</tr>
<tr>
<td>Line 4</td>
</tr>
<tr>
<td>Line 5</td>
</tr>
</tbody>
</table>

3. The dot plot shows the number of students playing handball on the handball courts. Each dot represents a court. How many courts have 5 players?

![Handball Court Dot Plot]

<table>
<thead>
<tr>
<th>Number of Players</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
</tbody>
</table>
4.

Luke drew a dot plot to show the types of Starfighters docked at Endor Base. Each dot represents a Starfighter.

![Starfighters at Endor Base]

a. How many Droid Starfighters are there?
b. How many X-Wing fighters are there?
c. How many space craftes are there altogether?

5.

Seth recorded the number of fish that his family caught in a dot plot. Each dot represents a fish.

![Seth's Family]

a. How many fish did Seth's family catch altogether?
b. Who caught the most fish?
c. Who caught the least fish?
d. How many more fish did Seth catch than Sophie?

6.

The dot plot shows the weight of the rocks in Keisuke's rock collection. Each dot represents a rock.

![Rock Weight (grams)]

a. How many rocks weigh less than 40 grams?
b. What is the mass of the heaviest rock?
7. The dot plot shows the age of the white belt students in Eli’s Tae Kwon Do class. Each dot represents a student.

![Dot plot showing student ages](image)

**a.** How many students are there altogether?
**b.** How many students are 11?
**c.** How many students are 12 or older?

8. Multiple Choice.

The heights, in centimetres, of children on the basketball team are as follows: 122, 119, 127, 127, 122, 117, 128, 124, 127. Select the dot plot that correctly displays the data:

**a.**

![Dot plot option a](image)

**b.**

![Dot plot option b](image)

**c.**

![Dot plot option c](image)
TEACHING SEQUENCE FOR TRANSLATIONS IN THE CARTESIAN PLANE Stage 4

Translations in the Cartesian Plane

STRAND AND SUBSTRAND
Number and Algebra - Linear Relationships - Stage 4

SYLLABUS OUTCOMES
MA4-11NA A student creates and displays number patterns; graph and analyses linear relationships; and performs translations on the Cartesian plane.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS

ACTIVITY FOCUS
Translates, rotates and reflects points and shapes on a number plane.
Different Types of Transformations - Teacher Modelled

Students review types of transformations from Stage 3 through the following interactive activities:

**Slide, flip, turn**

Teacher identifies Slide, Flip and Turn as translation, reflection and rotation respectively, writing definitions on whiteboard.

Points for discussion:

- How can we tell if this shape has been translated or reflected? (Does it flip or maintain orientation?)
- What do you notice about points in a translated shape? (They all move the same distance).
- Identify that the image is reflected in a line perpendicular to the mirror.

### Students write glossary of terms

- transformation, translation, rotation, reflection, right, left, origin, clockwise, anticlockwise

![Transforming plane shapes given a translation or reflection](SLIDING) ![FLIPPING]![TURNING]

### Students describe translations using right, left, up and down.

Give each student a piece of tracing paper and grid paper. Students draw a square on grid paper then trace over it on the tracing paper and cut it out. They then perform a number of translations using the tracing paper square then draw the position of the image on the grid paper.

Students use grid paper to draw the image S' of a shape after a reflection.

Students are shown a number of rotated images and asked to choose the correct image after a given rotation.
Activity 1 - Translations Wordbank

Students write the correct definition or meaning for each word listed in the wordbank. Draw an example of each.

<table>
<thead>
<tr>
<th>Anticlockwise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cartesian</td>
</tr>
<tr>
<td>Coordinate</td>
</tr>
<tr>
<td>Left</td>
</tr>
<tr>
<td>Origin</td>
</tr>
<tr>
<td>Point</td>
</tr>
<tr>
<td>Right</td>
</tr>
<tr>
<td>Symmetry</td>
</tr>
<tr>
<td>Axis</td>
</tr>
<tr>
<td>Clockwise</td>
</tr>
<tr>
<td>Image</td>
</tr>
<tr>
<td>Mirror</td>
</tr>
<tr>
<td>Plane</td>
</tr>
<tr>
<td>Reflection</td>
</tr>
<tr>
<td>Rotation</td>
</tr>
<tr>
<td>Translation</td>
</tr>
</tbody>
</table>
Activity 2 - Transformation Activity

TRANSFORMATIONS

1.

The pale shape S in the diagrams has been translated to the dark shape S'.
Describe the translation, using right, left, up and down:

a. 

b. 

c. 

d. 

A  B  C

A'  B'  C'

A'  B'  C'

A'  B'  C'  D'

A'  B'  C'  D'

A  B  C

A'  B'  C'

A'  B'  C'

A'  B'  C'  D'

A'  B'  C'  D'
2.

Draw the square S on grid paper, make a copy on tracing paper and cut it out. Place the copy on top of the square and translate it using the rules below, then trace the resulting image on the grid paper:

a. 4 units right
b. 3 units down
c. 4 units right and 3 units down
d. 3 units up and 2 units left

3.

Copy each of the following onto grid paper and draw the image after the translation. Label your translation with dashes:

a. 5 units right
b. 5 units left and 3 units down
c. 3 units left and 1 unit down
d. 1 unit right and 2 units down
e. 2 units right and 1 unit up
f. 1 unit left and 2 units down
4.

Draw the new position of the square S after it is reflected in the dashed mirror line. Label the corners of the reflection with dashes:

a. 

b.
5.

The arrow $S$ was reflected in a mirror line to make $S'$. Which mirror line was used, A, B or C?
TRANSFORMATIONS

6. Shape S has been rotated to make shape S'.

Which of these could describe its rotation?

- 45° clockwise
- 45° anticlockwise
- 90° clockwise
- 90° anticlockwise

A DCB

7. Shape S has been rotated to make shape S'.

Which of these could describe its rotation?

- 45° clockwise
- 45° anticlockwise
- 90° clockwise
- 90° anticlockwise

A DCB

8. Shape S has been rotated to make shape S'.

Which of these could describe its rotation?

- 45° clockwise
- 45° anticlockwise
- 90° clockwise
- 90° anticlockwise

A DCB
9. Shape S has been rotated to make shape S'.

Which of these could describe its rotation?

- 45° clockwise
- 45° anticlockwise
- 90° clockwise
- 90° anticlockwise

A  
B  
C  
D

10. The Square S is reflected in the mirror line then rotated 90° clockwise to make the square S'.

Draw square S'.

11. The triangle S is reflected in the mirror line, translated 2 units down then rotated 90° clockwise to make the triangle S'.

Draw triangle S'.
12. The L-shape S has undergone two transformations to become S’. Which of these could describe its transformation?

A reflection in the line A and a translation of 1 unit up
A reflection in the line A and a translation of 2 units up
A translation of 4 units right and 1 unit up
A translation of 10 units right and 1 unit up

13. The arrow S has undergone three transformations to become S’. Describe the transformation that could have taken place.
Activity 3 - Independent Activity

**ROBOT**
Working in pairs, students select an object in the classroom or in the playground without informing their partner. Each student guides their blindfolded partner around the classroom/playground to their secret objects using a combination of transformation movements. (Reflections will need to be excluded from this activity), e.g. translate forward 5 steps, rotate 90 degrees to the right/clockwise etc.

Activity 4 - Teacher Guided Activity

**Translations in the cartesian plane**
Teacher draws a clearly labelled Cartesian plane on the whiteboard.
Using round board magnets to represent points P and P', the teacher demonstrates several different translations and poses the following questions:
- What translation has taken place? (e.g. 2 right, 3 down)
- What are the new coordinates? (e.g. (0,4))

Explicitly discuss the labelling of the image of P as P'.
Students practise drawing a Cartesian plane on grid paper and perform a number of given translations of a point P, stating the coordinates of each image P'.
Note: Teacher can draw P and P' if magnets are not available.

Activity 5 - Teacher Guided Activity

**Reflections in the x and y-axis**
Teacher draws a clearly labelled Cartesian plane on the whiteboard.
Using round board magnets to represent points P and P', the teacher demonstrates a reflection in x-axis (e.g. P (1,4) and P' (1, 7)).

Teacher poses the question:
- What are the new coordinates?
Teacher writes the coordinates on the board, then asks:
- What do you notice about the x-coordinate?
- If a point is reflected in the x-axis what happens to the x-coordinate? (It stays the same)

Students practise drawing a Cartesian plane on grid paper and perform a number of given reflections of a point P, stating the coordinates of each image P'.
Note: Teacher can draw P and P' if magnets are not available.
Constructs an Algebraic Expression to Represent a Word Problem

**STRAND AND SUBSTRAND**
Number and Algebra - Algebraic Techniques 2 - Stage 4

**SYLLABUS OUTCOMES**

**MA4-8NA** A student generalises number properties to operate with algebraic expressions.

**MA4-1WM** A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

**MA4-2WM** A student applies appropriate mathematical techniques to solve problems.

**MA4-3WM** A student recognises and explains mathematical relationships using reasoning.

**NUMERACY LINKS**
Numeracy Skills Framework, Aspects of Numeracy, Focus Area 2, patterning generalisations algebraic reasoning, Stage 4.

**ACTIVITY FOCUS**
Uses letters to represent variables and writes algebraic expressions representing real life situations.
**Activity 1 - Independent Activity**

Teacher provides students with a list of mathematical terms. Students research meanings to produce a glossary. This could be a digital resource in Onenote, which could form part of their mathematics summary. Students can also complete the matching terms worksheet.

**Algebra Glossary of Terms - Matching Game Worksheet**

GLOSSARY
Match the mathematical term with its definition.

<table>
<thead>
<tr>
<th>WORD</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate</td>
<td>The most common value</td>
</tr>
<tr>
<td>Range</td>
<td>The same shape</td>
</tr>
<tr>
<td>Mode</td>
<td>At right angles</td>
</tr>
<tr>
<td>Mean</td>
<td>The total when numbers are added</td>
</tr>
<tr>
<td>Median</td>
<td>Find the answer</td>
</tr>
<tr>
<td>Congruent</td>
<td>The amount of liquid a solid holds</td>
</tr>
<tr>
<td>Similar</td>
<td>Split in two pieces</td>
</tr>
<tr>
<td>Difference</td>
<td>One after another</td>
</tr>
<tr>
<td>Sum</td>
<td>Distance around the outside</td>
</tr>
<tr>
<td>Consecutive</td>
<td>A collection of algebraic terms added or subtracted</td>
</tr>
<tr>
<td>Similar</td>
<td>Average value</td>
</tr>
<tr>
<td>Perimeter</td>
<td>Middle value</td>
</tr>
<tr>
<td>Bisect</td>
<td>The same size and shape</td>
</tr>
<tr>
<td>Dissect</td>
<td>The answer when two numbers are subtracted</td>
</tr>
<tr>
<td>Perpendicular</td>
<td>The maximum value minus the minimum value</td>
</tr>
<tr>
<td>Expression</td>
<td>The quantity of material in a solid</td>
</tr>
<tr>
<td>Equivalent</td>
<td>Split in two equal pieces</td>
</tr>
<tr>
<td>Capacity</td>
<td>Split in two equal pieces</td>
</tr>
<tr>
<td>Volume</td>
<td>The same as</td>
</tr>
</tbody>
</table>
**Activity 2 - Mathematical Operators - Teacher Led Activity**

Teacher draws a table on the white board with add, subtract, multiply and divide.

<table>
<thead>
<tr>
<th>ADD</th>
<th>SUBTRACT</th>
<th>MULTIPLY</th>
<th>DIVIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>sum</td>
<td>minus</td>
<td>times</td>
<td>share</td>
</tr>
<tr>
<td>total</td>
<td>find the difference</td>
<td>product</td>
<td>halve</td>
</tr>
<tr>
<td>increase</td>
<td>take away</td>
<td>double</td>
<td>quarter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>triple</td>
<td></td>
</tr>
</tbody>
</table>

Students form groups and brainstorm different words which mean add, subtract, multiply and divide and complete a Mathematical operations Table on A3 paper, to display on the classroom wall.

**Activity 3 - Teacher Guided Activity**

Students match algebraic expressions to their written meaning (in the table).

(© 2017 Mrs Barlow, used with permission)
### Match the Algebraic Expression With Its Meaning Worksheet

<table>
<thead>
<tr>
<th>Description</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>The sum of x and y</td>
<td>p - q</td>
</tr>
<tr>
<td>The product of a and b</td>
<td>v + 1</td>
</tr>
<tr>
<td>The difference between p and q</td>
<td>q²</td>
</tr>
<tr>
<td>The quotient of m and n</td>
<td>x + y</td>
</tr>
<tr>
<td>The number 4 more than w</td>
<td>2f</td>
</tr>
<tr>
<td>The number 12 less than d</td>
<td>√y</td>
</tr>
<tr>
<td>Double f</td>
<td>ab</td>
</tr>
<tr>
<td>One third of k</td>
<td>w + 4</td>
</tr>
<tr>
<td>The square of q</td>
<td>s²</td>
</tr>
<tr>
<td>Half of s</td>
<td>d - 12</td>
</tr>
<tr>
<td>The square root of y</td>
<td>k/3</td>
</tr>
<tr>
<td>The next consecutive number to v</td>
<td>m/n</td>
</tr>
<tr>
<td>The sum of twice a and b</td>
<td>m + 2/n</td>
</tr>
<tr>
<td>The next consecutive number after M</td>
<td>2(s - t)</td>
</tr>
<tr>
<td>The sum of the squares of q and r</td>
<td>M + 1</td>
</tr>
<tr>
<td>The square root of the sum of w and m</td>
<td>Q² + R²</td>
</tr>
<tr>
<td>Twice the difference between s and t</td>
<td>2a + b</td>
</tr>
<tr>
<td>Half the sum of m and 2</td>
<td>√(w + m)</td>
</tr>
</tbody>
</table>
Activity 5

Teacher writes a numerical expression on the board for example:

54 + 18 with a close statement: ______ had ______ dollars and was given ______ more

• Teacher asks the class “This expression describes this word problem. What should I put in the blanks?”

• Write another number sentence and ask for a scenario. Write them under the number sentence so students can easily relate them to the expression.

• Students could vote on the most creative scenario.

• Encourage the student to think of the order of operations; which happens first?

• Teacher then provides class with a list of numeric expressions.

• Students make up word problems for the given mathematical processes.

For example:

a) 54 + 18: Tom had 54 dollars and was given 18 more
b) 5 x 2
c) 13 - 6
d) 27 ÷ 3
e) \frac{12}{4}
f) 3 x 2 + 7

Particular attention should be given to the order of operation, the correct use of mathematical convention and potential problem areas with the use of language.

Activity 6 - Teacher Modelled

Writing expressions for word problems

Teacher displays a list of word problems on the interactive whiteboard and discusses them for meaning with the class. For example:

The number of toothpicks is equal to 3 times the number of shapes.

• Circle number of toothpicks.

• “Let’s represent the number of toothpicks as n”. Teacher writes n above the phrase number of toothpicks.

• “How do we write is equal to in mathematics?” Teacher writes = above the phrase is equal to.

• “How do we write 3 times in mathematics?” Teacher writes 3 x above the phrase 3 times.

• “What shall we represent number of shapes with?” Teacher writes the classes choice above the phrase number of shapes.

When finished there should be an equivalent algebraic expression above the sentence:

\[ n = 3 \times S \]

The number of toothpicks is equal to 3 times the number of shapes

Teacher could also model a problem of the form:

\[ n = S + 7 \]

The number of matches is equal to the number of shapes plus 7.

where there is a constant term 7.

Students then complete a range of questions, reworking written statements as algebraic expressions. Particular attention should be given to the order of operation, the correct use of mathematical convention and potential problem areas with the use of language.
Writing Algebraic Expressions Worksheet

Replace these written statements describing patterns with equations written in algebraic symbols.

SECTION A
a. The number of toothpicks is equal to 3 times the number of shapes.
b. The number of matches is equal to the number of shapes plus 7.
c. The number of matches is equal to 4 times the number of shapes plus 3.
d. The number of counters is equal to 2 times the number of cups.
e. The number of counters is equal to the number of cups plus eight.
f. The number of counters is equal to the 4 times the number of cups plus 2.
g. The number of blocks is equal to 9 times the number of shapes.
h. The number of blocks is equal to twice the number of shapes plus 5.
i. The number of sheets of paper is 5 times the number of envelopes plus 3.
j. The number of sheets of paper is four times the number of envelopes.

SECTION B
a. The cost in cents of a taxi is 40 times the number of kilometres plus 200.
b. The area of a square is the side length squared.
c. The area of a rectangle is the length times the width.
d. The number of fingers is five times the number of hands.
e. The number of books, given that each carton holds 5 books and there are five extra.
f. The number of pencils if each case holds twenty and there are 12 on the table.
g. The number of people if each car brings 4 people and another 20 people walk.
h. The amount of money if each bag holds $20 and there is an extra $40 in mixed change.

Activity 6 - Making a Formula to a Given Context

Question 1
John is 3 years younger than Mary. Which statement is correct?

a) Mary’s age + John’s age = 3.
b) Mary’s age = John’s age + 3.
c) John’s age − Mary’s age = 3.
d) John’s age = Mary’s age + 3.

Question 2
In 3 years, Michael will be twice as old as Alison. Which one of the following rules represents Michael’s age now in terms of Alison’s age now?

a) Michael’s age now = 2(Alison’s age now + 3).
b) Michael’s age now = (Alison’s age now + 3) ÷ 2.
c) Michael’s age now = 2 Alison’s age now − 3.
d) Michael’s age now = 2 Alison’s age now + 3.
Question 3
The length of a rectangular paddock is 4 times the width of the rectangular paddock.
Which one of the following represents the perimeter and area of a paddock in terms of the width of the paddock?

a) Perimeter = 10 × Width, Area = Length × Width
b) Perimeter = 5 × Width, Area = 4 × (Width)^2

Question 5
Andrew is 5 years younger than Claire. Let a be the age of Andrew and c be the age of Claire. Write an algebraic equation which represents the problem.

Question 6
The length (x cm) of a rectangle is 10 cm more than the width (y cm) of a rectangle. Write an algebraic equation to represent the problem.
**SOLUTIONS**

**Question 1 (forming an equation)**

John's age = Mary's age − 3.

Rearrange the equation.

John's age + 3 = Mary's age.

This shows the statements 'John is 3 years younger than Mary' and 'Mary is 3 years older than John' are equivalent.

Mary's age = John's age + 3. This is option b.

Check the answer for a special case. For example: If John is 10 years old, Mary would be 13 years old.

**Question 2**

In 3 years' time both Michael and Alison will be 3 years older!

Michael's age now + 3 = 2(Alison's age now + 3).

Michael's age now + 3 = 2 × Alison's age now + 6

Michael's age now = 2 Alison's age now + 6 − 3

Michael's age now = 2 Alison's age now + 3.

This is option d.

For example, if Alison is twenty-nine, Michael is 2 × 29 + 3 = 61. So in 3 years' time Alison will be thirty-two and Michael sixty-four, which is double Alison's age.

**Question 3**

Width

Length = 4 × Width

Perimeter = 2(Width + Length).

The Perimeter = 2(Width + 4 × Width)

= 2 × 5 Width

= 10 × Width.

The area = Width × Length

= Width × 4 × Width

= 4 (Width)².

Option c is correct.
PURPOSE
The purpose of this sequence of activities is for students to use rates to compare quantities measured in different units and solve a variety of real-life problems involving rates and Best Buys. Mulwaree High School implemented these activities with their Stage 4.

Unit Pricing

STRAND AND SUBSTRAND
Number - Rates and Ratios - Stage 4

SYLLABUS OUTCOMES
MA4-7NA A student develops efficient strategies for numerical calculation, recognise patterns, describe relationships and apply algebraic techniques and generalisation.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, understanding fractions, decimals, percentages, rates, ratios and understanding money and finance.

ACTIVITY FOCUS
Students use rates to compare quantities measured in different units and solve a variety of real-life problems involving rates.
Unit Pricing Activity

AIM
Students identify then build on their existing knowledge of unit prices by calculating the unit price for one item bought as a set.

INTRODUCTION
Tell the students this lesson is to recall, refresh and progress knowledge on unit pricing. Ask for two or three student suggestions about why we would want to learn and understand unit pricing. Record these responses on the board.

STUDENT ACTIVITY 1
"I can do" (12 minutes)
1. Instruct students that they are to record in their workbooks as much as they can to do with unit pricing in three minutes, individually.
2. Students are to share with the person next to them only, and have another three minutes.
3. Each pair is to share one thing they can do or know about unit pricing with the whole class. Have a nominated student/pair record these responses on the board or use an app.

STUDENT ACTIVITY 2
How much is a Redskin? (10 minutes)
Use the document camera to project the bag of Redskins and the receipt (or project a supermarket web page).

Task
1. Without completing the calculation, ask students how they would find the cost of one Redskin if this packet contains 12 Redskins.
   a) What content do I need? Identify
   b) What steps will I follow? Describe
   Students complete the calculation
   c) Show my working Explain
   d) Interpret the answer Analyse
   e) Justify my answer Critically Analyse
2. Extension - How many Redskins are in the bag? How would we have to change the calculation to accurately find the cost of one Redskin? What number of significant figures is reasonable for this calculation?

STUDENT ACTIVITY
I know... (10 minutes)
1. Students draw a Frayer model in their books/devices to demonstrate their understanding of 'unit price'.
2. Discuss student non-examples with small groups as appropriate.

Frayer model

<table>
<thead>
<tr>
<th>My Definition</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>Non-Example</td>
</tr>
</tbody>
</table>

STUDENT ACTIVITY
Show what you know (10 minutes)
Students complete a multiple-choice quiz on calculating unit prices using Kahoot. (https://kahoot.com/).
Winning Prize: the bag of Redskins!

CONCLUSION
Students reflect on what they wrote on their mini-whiteboards from the first activity.
1. Have they learnt something new?
2. Is there something they understand better?
3. Briefly discuss the versatility of unit pricing, and ways to estimate unit pricing.
4. Exit Slip - Students write one unit price question on a Post-It.
TEACHING SEQUENCE FOR RATES AND RATIOS
Stage 4 - Comparing Units

Comparing Units

STRAND AND SUBSTRAND
Number - Rates and Ratios - Stage 4

SYLLABUS OUTCOMES
MA4-7NA A student develops efficient strategies for numerical calculation, recognise patterns, describe relationships and apply algebraic techniques and generalisation.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, understanding fractions, decimals, percentages, rates, ratios and understanding money and finance.

ACTIVITY FOCUS
Students use rates to compare quantities measured in different units and solve a variety of real-life problems involving rates.
Comparing Units Activity

AIM
Students use unit pricing to compare items and make decisions about best buys.

INTRODUCTION
Students are advised that this lesson is to help them use their knowledge of unit pricing to compare similar items.

STUDENT ACTIVITY 1
Pizza please! (15 minutes)
Students will ideally be able to look at current local prices via websites or coupons ads for prices.
Propose stimulus problem: Yummy Pizza sells large pizzas for $12.95 and small pizzas for $7.95. Small pizza - diameter 20 cm. Medium pizza - diameter 25 cm. Large pizza - diameter 30 cm.

a) Which size gives you more pizza (in square cm) per dollar?
b) Students are invited to suggest ways to solve this. Record methods and strategies (but not solutions) on the board.
c) Students calculate and record in their books.

1. Teacher calculates the cost per square cm for one of the pizzas.
a) Discuss with the class: how is this calculation different?
b) When might this calculation be more appropriate to use as a comparison than unit price?

2. Students work in small groups or pairs to:
a) Calculate the square cm per dollar and dollar per square cm for the other pizzas on offer from their company.
b) Identify the best value pizza for each company.
c) Tabulating the results from all groups, students identify the best value pizza across all companies.

3. Group Discussion: when might this type of unit pricing be useful in your daily life?

Note: Pre-knowledge of areas of shapes including circles is required for this activity.

STUDENT ACTIVITY 2
Brands analysis (20-25 minutes)
1. Students work individually or in small groups to compare unit pricing for a range of items within one category of product using prices available on online stores. e.g. shampoo, tinned corn.
a) Students record information in a table on brand, price, unit price. (Extension - Special price if offered e.g. on sale) for at least 10 unique items. Use of a spreadsheet is recommended so students can arrange and sort the data more readily.
b) Encourage students to use the unit pricing provided by the retailer, but check it using their knowledge of unit pricing (use of a spreadsheet to calculate the unit price using formulae).

2. Students to critically analyse the price difference between items’ unit prices.
a) Why would there be a difference?
b) How is quality affected?
c) What influences consumers to buy more expensive goods?
d) Are there any items whose unit price appears better or worse than its actual price, based on the size of the product?

STUDENT ACTIVITY 3
Supermarket downfalls (15 minutes)
Students examine the advertisements from retailers below (See links), and identify:
a) How the advertised discount or unit price has been miscalculated.
b) … or is falsely stated?

Students calculate the correct discount using any method (unit price, percentage change, addition/subtraction).
a) What content do I need? Identify
b) What steps will I follow? Describe
c) Show my working Explain

Students write a statement about the legitimacy of the advertisement/s.
d) Interpret the answer Analyse
e) Justify my answer Critically Analyse

Links to potential sources
http://profpete.com/k-6-math-in-the-news-supermarket-math-fails/

Extension Possibility - Students use their devices to look up a correct advertised price, and design a ‘new’ advertisement that is a ‘fail’ based on the original.
Consumer Choices - Best Value

**STRAND AND SUBSTRAND**
Number - Multiplication and Division - Stage 4

**SYLLABUS OUTCOMES**
MA4-6NA A student solves financial problems involving purchasing goods.
MA4-7NA A student operates with ratios and rates, and explores their graphical representation.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.
MA4-2WM A student applies appropriate mathematical techniques to solve problems.
MA4-3WM A student recognises and explains mathematical relationships using reasoning.

**NUMERACY LINKS**
Numeracy Skills Framework, Focus Area 1, understanding fractions, decimals, percentages, rates, ratios and understanding money and finance, Stage 4.

**ACTIVITY FOCUS**
Best buys.
Consumer Choices - Best Value Activity

STUDENT ACTIVITY 1

a) Brainstorm what does best value mean?

b) What criteria will be used to determine best buy? (Revise concept of pricing per unit)

<table>
<thead>
<tr>
<th>TERM</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special offers</td>
<td></td>
</tr>
<tr>
<td>Two for the price of one</td>
<td></td>
</tr>
<tr>
<td>Buy 1 get another $\frac{1}{2}$ price</td>
<td></td>
</tr>
<tr>
<td>Bulk buys</td>
<td></td>
</tr>
<tr>
<td>% Off</td>
<td></td>
</tr>
<tr>
<td>Shipping</td>
<td></td>
</tr>
<tr>
<td>Best buy</td>
<td></td>
</tr>
</tbody>
</table>
### STUDENT ACTIVITY 2
Using the examples below outline what type of "best value" type is being used and calculate the price per unit for each example.

#### EXAMPLE 1  
<table>
<thead>
<tr>
<th>BEST VALUE TYPE</th>
<th>PRICE PER UNIT</th>
<th>BEST BUY</th>
</tr>
</thead>
</table>
| **a) HEINZ BEANZ**  
420 g  
$2.09  
$0.50/100 g | | A |
| **b) HEINZ BEANZ**  
12 × 420 g  
$10.59  
$0.21/100 h | | B |

#### EXAMPLE 2  
<table>
<thead>
<tr>
<th>BEST VALUE TYPE</th>
<th>PRICE FOR 1 SHIRT</th>
<th>PRICE FOR 2 SHIRTS</th>
</tr>
</thead>
</table>
| T-shirt  
$25.00 AUD  
Buy 1, Get 1 50% off | | |

#### EXAMPLE 3  
<table>
<thead>
<tr>
<th>BEST VALUE TYPE</th>
<th>PRICE FOR A AFTER DISCOUNT</th>
<th>PRICE FOR B AFTER DISCOUNT</th>
<th>PRICE FOR C AFTER DISCOUNT</th>
</tr>
</thead>
</table>
| Christmas Sale - Day 1  
Take an extra 10% off  
Hair Care  
**a) Giftpack** $79.45  
**b) Trio Shampoo** $120  
**c) Soft Hair Pack** $27.96 | | |

#### EXAMPLE 4  
<table>
<thead>
<tr>
<th>BEST VALUE TYPE</th>
<th>PRICE FOR 1 BON BON</th>
<th>PRICE FOR SHIPPING</th>
</tr>
</thead>
</table>
| Christmas Bon Bon  
$10.95 AUD  
Free Shipping  
Limited Offer | | |
FURTHER ACTIVITY
Collect another 3 “best value” buy examples and calculate the price per unit in the different scenarios.

<table>
<thead>
<tr>
<th>EXAMPLES</th>
<th>PRICE PER UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

STUDENT ACTIVITY 3
To link the concepts to a literacy component, students will need to research different products without special offers and that same product with special offers. Students will then have to create sentences using the following sentence joiners. To incorporate technology, students could create a document or take photos of this to display in the room.

- Is cheaper than
- Is more expensive than
- Is better than value than
- Does not offer better value than

Website Link: Choice

STUDENT ACTIVITY 4
The syllabus asks students to use price comparison websites to make informed decisions related to purchases under given conditions (Problem solving)

Discuss the following website to introduce the idea that different stores can sell similar products but there can be a difference in the cost of the products.

Website Link: Webjet

Print off the information with the list of different flights available and highlight the option you have chosen based on price only. Was it the best price for a return flight?
STUDENT ACTIVITY 6
The syllabus expects to be able to recognise that in practical situations there are considerations other than just the ‘best buy’, e.g. the amount required, waste due to spoilage (Reasoning).

Show a comparison picture with calculations and working out to indicate the cheaper option.

<table>
<thead>
<tr>
<th>HEINZ Tomato Ketchup</th>
<th>HEINZ Tomato Ketchup</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 × 1 L</td>
<td>1 L $5.00</td>
</tr>
<tr>
<td>$7.89</td>
<td></td>
</tr>
<tr>
<td>1 L $7.89 ÷ 2 = $3.95</td>
<td></td>
</tr>
</tbody>
</table>

Discuss how long it would take their family to get through the 2 bottles of Tomato sauce.

Raise how many people are in different families. Introduce how long it takes compared to the use-by-date.

Introduce the idea that although it is a cheaper price per unit there may be wastage due to not being able to consume the product by the use-by-date.

Also have a discussion as to why people who didn’t put on a shopping list to buy 2 of a certain product end up spending more money than the cost of 1 product when they did not need/want the second product.

For example, you ended up spending $2.89 more on Tomato Ketchup but may end up throwing it out due to not being able to use it.
TEACHING SEQUENCE FOR MONEY
Stage 3 - Money Addition and Subtraction

PURPOSE
The purpose of this sequence of activities is for students to solve addition and subtraction problems using dollars and cents. They will learn how to solve various problems involving dollars and cents. Nareena High School implemented these activities with Stage 4 students.

Canteen Sales

STRAND AND SUBSTRAND
Number - Addition and Subtraction - Stage 3

SYLLABUS OUTCOMES
MA3-6NA A student selects and applies appropriate strategies for addition and subtraction, and applies the order of operations to calculations involving more than one operation.

MA3-7NA A student compares, orders and calculates with fractions, decimals and percentages.

MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, applying addition, subtraction, multiplication and division, early in Stage 3.

ACTIVITY FOCUS
Solves addition and subtraction problems using dollars and cents.
Canteen Sales Activity

TASK
Using the canteen menu, students work in pairs “buying” treats from the canteen menu. One student acts as the customer and one as the sales person. Students use the count on strategy to calculate the correct change.

The student buying starts with a specified budget and calculates the remainder of money after each purchase. Students create a running tally of money spent and money remaining.

The student selling calculates the cost of purchasing the food and creates the receipts. Students show the counting methods and strategies used to find the amount to be paid for purchasing the food and the change to be given back to the student customer. The student purchasing shows the strategy used to work out how much money they have left after each purchase. Students take turns to be a customer or a sales person.

Party Budget

STRAND AND SUBSTRAND
Number - Multiplication and Division, Addition and Subtraction - Stage 3

SYLLABUS OUTCOMES
MA3-6NA A student selects and applies appropriate strategies for addition and subtraction, and applies the order of operations to calculations involving more than one operation.
MA3-7NA A student compares, orders and calculates with fractions, decimals and percentages.
MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, applying addition, subtraction, multiplication and division, early in Stage 3.

ACTIVITY FOCUS
Solves addition and subtraction problems using dollars and cents.

Party Budget Activity 4

TASK
Students plan for a class end of term party on a budget of $100.00. The students will research the costs of different products and record their budget in a Google Sheet. They then present their budget to the class justifying their decisions and processes. Was there any change?
TEACHING SEQUENCE FOR FRACTIONS
Stage 3 and 4 - Understanding Fractions

PURPOSE
The purpose of this sequence of activities is for students to develop an understanding of partitioning fractions, establish formulas for right prisms and cylinders and understand ratios. Taree High School implemented these activities with their Stage 4 students to develop their understanding of a range of mathematical concepts.

Comparing Parts to a Whole - Partitioning

STRAND AND SUBSTRAND
Number and Algebra – Fractions, Decimals and Percentages – Stage 3

SYLLABUS OUTCOMES
MA3-7NA A student compares, orders and calculates with fractions, decimals and percentage.

MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-2WM A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

MA3-3WM A student gives a valid reason for supporting one possible solution over another.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, understanding fractions, decimals, percentages, Stage 3.

ACTIVITY FOCUS
Coordinates composition of partitioning.
Comparing Parts to a Whole – Partitioning Activity

PRE-READING
Watch the following link before you begin the activity:
Part-whole model for fractions

Resources
Transparency film
Marker pens

AIM
The aim of this lesson is to compare parts to a whole and represent them with diagrams, mathematical language and notation.

ACTIVITY 1
Consolidate the idea of partitions being equal parts of the whole.

- How many ways can you partition this square into two partitions?

ACTIVITY 2
Using transparency film, ask the students to partition a square to represent:

a) a quarter
b) a third
c) a fifth

ACTIVITY 3
By the method of overlaying the partitions from Activity 2, ask students to generate representations for:

a) a sixth
b) an eighth
c) a tenth, etc.

Consolidate fractional notation with the denominator denoting the number of partitions and the numerator denoting the number of parts.
Comparing Parts to a Whole – Equivalent Fractions

**AIM**
The aim of this lesson is to develop concrete experiences of equivalent fractions by using partitioning representations.

**ACTIVITY 1**
Creating equivalent fractions
- Students are to use the partitions developed in the previous lesson to overlay over fractions and list equivalent fractions.

**ACTIVITY 2**
Simplifying equivalent fractions
In this activity students are challenged to visualise the removal of an overlaying partition to represent the fraction in its simplest form.

- Challenge students to develop the relationships between the overlaying partition and its effect on the equivalent fraction.

i.e. If I use an overlay of sixths, what would be the equivalent fraction?

**NUMERACY LINKS**
Numeracy Skills Framework, Focus Area 1, understanding fractions, decimals, percentages, Stage 3.

**ACTIVITY FOCUS**
Coordinates composition of partitioning.
Fractions as an Operator

**STRAND AND SUBSTRAND**
Number and Algebra - Fractions, Decimals and Percentages - Stage 3

**SYLLABUS OUTCOMES**

MA3-7NA  A student compares, orders and calculates with fractions, decimals and percentage.

MA3-1WM  A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

MA3-2WM  A student selects and applies appropriate problem solving strategies, including the use of digital technologies, in undertaking investigations.

**NUMERACY LINKS**
Numeracy Skills Framework, Focus Area 1, understanding fractions, decimals, percentages, Stage 3.

**ACTIVITY FOCUS**
Fractions as numbers.

---

Fractions as an Operator Activity 1

**PRE-READING**
Watch and read the following link before you begin the activity:

Fractions as operators

**Resources**
Transparency film
Partition overlays from Lesson 1
Counters

**ACTIVITY 1**
Finding fractions of quantities (whole number answer)
- Use counters to model the quantity.

$\frac{3}{5}$ of 10

- Create a rectangle with 5 equal rows.

$\frac{3}{5}$ of 10 = 6

**ACTIVITY 2**
Finding fractions of fractions
- Represent each fraction using partitions one in rows and one in columns.

$\frac{2}{5}$ of $\frac{3}{4}$

- Overlap the partitions to create partitions of 20.

$\frac{2}{5}$ of $\frac{3}{4}$

- Identify the overlap to give the answer of 6 out of 20 or $\frac{6}{20}$. 
TEACHING SEQUENCE FOR VOLUMES
Stage 3 - Investigating Volume of Prisms

Investigating the Volume of Rectangular Prisms

STRAND AND SUBSTRAND
Measurement - Capacity and Volume - Stage 4

SYLLABUS OUTCOMES
MA4-14MG A student uses formulas to calculate the volumes of prisms and cylinders, and converts between units of volume.
MA4-8NA A student generalises number properties to operate with algebraic expressions.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 3, applying concepts of 3D objects, end of Stage 3.
Numeracy Skills Framework, Focus Area 4, understanding mass, volume and capacity, end of Stage 4.

ACTIVITY FOCUS
Establishes and uses formulas to find volumes of right prisms and cylinders.
Investigating the Volume of Rectangular Prisms Activity

**AIM**
The aim of the lesson is for students to develop concrete experiences with rectangular prisms of different dimensions through active experimentation; and to explain methods for calculating the volume of rectangular prisms by investigating the links between the width, length and height to the volume.
The investigation starts with discrete quantities for volumes of prisms constructed with 1 cm³ blocks, and the aim is to lead students to develop methods for measured values (continuous quantities).

**Resources**
1 centimetre cubes
Cylindrical measuring flasks

**ACTIVITY 1**
Students are to construct rectangular prisms with centimetre cubes from the dimensions given in a table (below). Students are to complete the table below by firstly representing the rectangular prism as a sketch; and secondly measure the volume by submerging the prism in a cylindrical measuring flask.

### Investigating Rectangular Prisms

<table>
<thead>
<tr>
<th>SKETCH</th>
<th>WIDTH</th>
<th>LENGTH</th>
<th>HEIGHT</th>
<th>VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 centimetre cubes</td>
<td>4 centimetre cubes</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 centimetre cubes</td>
<td>5 centimetre cubes</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 centimetre cubes</td>
<td>3 centimetre cubes</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
**ACTIVITY 2**

Students are to investigate the volumes of various prisms from a 2D drawing. Students need to complete the table below to by interpreting the information represented in the drawing; and then measure the volume of the prism by submerging the prism in a cylindrical measuring flask.

<table>
<thead>
<tr>
<th>WIDTH</th>
<th>LENGTH</th>
<th>HEIGHT</th>
<th>VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 centimetre cubes</td>
<td>2 centimetre cubes</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3 centimetre cubes</td>
<td>2 centimetre cubes</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Students need take up time to explain their understanding, for example students may complete the sentence

• “The volume of a rectangular prism may be calculated by ____________”

• “Each layer contains ____ cubes. There are ____ layers. Therefore the volume can be calculated by __________”

**ACTIVITY 3**

Students are asked to construct 3 examples of rectangular prisms all of which have a volume of 72 cubes. Students are asked to represent each with a sketch and justify their answers with mathematical reasoning.

<table>
<thead>
<tr>
<th>SKETCH</th>
<th>WIDTH</th>
<th>LENGTH</th>
<th>HEIGHT</th>
<th>VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>72cm³</td>
</tr>
</tbody>
</table>
ACTIVITY 4
Identifying width, length and height
Students are to work in pairs. They will be given a rectangular prism in the form of a box or something similar and different coloured marker pens. The aim of the activity is to measure and mark the width, length and height. How many combinations can they find? They are to mark each combination with a different coloured marker.

Resources
- Rulers
- Marker pens
- Cylindrical measuring flask
- Various rectangular prisms

ACTIVITY 5
Calculating volume
Students are to work in pairs. They will be given various sized rectangular prisms. The activity requires them to measure the width, length and height of the rectangular prism prior to calculating the volume using their understanding of the concepts developed in the previous lesson. They are to record all measurements and calculations in the table below.

<table>
<thead>
<tr>
<th>SKETCH</th>
<th>WIDTH</th>
<th>LENGTH</th>
<th>HEIGHT</th>
<th>VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
</tbody>
</table>

EXTENSION ACTIVITY
Students are then asked to submerge the rectangular prism in a cylindrical measuring flask to measure the displacement to cement their mathematical ideas through demonstration and confirmation. Discrepancies in their answers may lead to discussion regarding accuracy of measurement.
ACTIVITY 6
Estimating and calculating volume
Using boxes and/or rectangular prisms of different sizes, students are asked to order them in ascending volume. Ask students to communicate the reasons for their choices. Discuss the purpose of this activity is to discover which box has the biggest volume.

Students are to work in pairs. The activity requires them to estimate width, length and height of each rectangular prism; then measure the width, length and height prior to calculating the volume. They are to record all measurements and calculations in the table below.

<table>
<thead>
<tr>
<th>SKETCH</th>
<th>WIDTH</th>
<th>LENGTH</th>
<th>HEIGHT</th>
<th>VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>Measure</td>
<td>Estimate</td>
<td>Measure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EXTENSION ACTIVITY
Challenge students to describe what would happen to the volume if you double the width/length or height of a rectangular prism? Describe what would happen to the volume if you doubled the width, length and height? Links to the effect of scale factor on volume can be established here.
TEACHING SEQUENCE FOR RATIO
Stage 3 and 4 - Proportional Thinking

Ratios – Multiplicative v Additive Thinking

STRAND AND SUBSTRAND
Number - Fractions, Decimals and Percentages - Stage 4

SYLLABUS OUTCOMES
MA4-5NA A student operates with fractions, decimals and percentages.
MA4-7NA A student operates with ratios and rates, and explores their graphical representation.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.
MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, understanding fractions, decimals, percentages, Stage 3.

ACTIVITY FOCUS
Multiplication and division as operators, operates with simple ratios.
**AIM**
The aim of this lesson is to apply ratios to represent a comparison between similar quantities. The underlying aim is to move students away from Additive Thinking towards Multiplicative Thinking.

**ACTIVITY**
Introduce ratios as a method for comparing similar quantities which are related. In the example below the mass of the blue marble is connected to the mass of the yellow marbles in such a way that 1 blue marble balances 3 yellow marbles.

1 Blue Marble : 3 Purple Marbles

OR

1 : 3

**• Challenge students to consider what would happen if a blue marble is added to left hand side. Students will respond initially using terminology that describes adding another 3 yellow marbles to the right-hand side to balance the scales.**

**• Challenge the students to represent this new scenario using the ratio notation from earlier. Cement the understanding that this new ratio represents the same relationship as before and therefore the ratios of 1 : 3 and 2 : 6 are equivalent.**

<table>
<thead>
<tr>
<th>BLUE MARBLES</th>
<th>YELLOW MARBLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>24</td>
</tr>
<tr>
<td>12</td>
<td>42</td>
</tr>
</tbody>
</table>

**• Consider what would happen if I keep adding a blue marble to the left-hand side. Try to lead students into developing the language “For each blue marble I add to the left-hand side, I need to add 3 yellow marbles to the right hand side to balance the scales.”**

**• Consolidate the relationship within equivalent ratios, where the left-hand side is a multiple of the right-hand side.**

**• Consolidate the relationship across equivalent ratios, where the left-hand sides use the same multiple as the right-hand side.**
TEACHING SEQUENCE FOR DECIMALS
Stage 4 - Decimal Relay

PURPOSE
The purpose of this sequence of activities is for students to solve a range of problems involving addition, subtraction, multiplication, division and percentages. They will also learn to calculate the mean and understand the concept of Translation, Rotation and reflection through an activity. Wingham High School implemented these activities with their Stage 4 students.

Dividing Decimals Relay

STRAND AND SUBSTRAND
Number - Fractions, Decimals and Percentages - Stage 4

SYLLABUS OUTCOMES
MA4-5NA A student operates with fractions, decimals and percentages.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skill Framework, Focus Area 1, applying addition, subtraction, division and multiplication.

ACTIVITY FOCUS
Solves problems using division of a decimal.
Dividing Decimals Relay Activity

**ACTIVITY**

Explain that students will be doing a relay race to solve decimal division problems.

- Students will be divided into groups of four. Each student will get a different task: divide, multiply, bring down, or subtract. You can assign students groups and tasks, or allow them to choose their own groups and tasks.

- Explain that you will give the class a division decimal problem. The "divide" person will begin by writing the problem on the whiteboard or chart paper. The rest of the group will line up behind him in order of their tasks.

- When you say “go,” the person dividing will complete the first step of the problem. He will then hand the marker to the next person, who will complete her task. This will continue until the problem is solved. The entire group will sit down when the problem is complete to show the teacher they are finished.

- Tell students that they are allowed to help their teammates, but they cannot leave the line or yell. Remind students that they don’t want to talk too loudly, or another group may hear them!

- Remind students that in order to win, they must not only finish first, but also have the correct answer.

- Start the game.
TEACHING SEQUENCE FOR DATA
Stage 4 - Calculating Mean

Land the Cup

STRAND AND SUBSTRAND
Statistics and Probability - Single Variable Analysis - Stage 4

SYLLABUS OUTCOMES
MA4-20SP A student analyses single sets of data using measures of location, and range.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.
MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, represents and interprets data in graphs, tables and diagrams and analysing data.

ACTIVITY FOCUS
Collecting data to calculate the mean.
Land the Cup Activity

**ACTIVITY**

- Students break up into pairs.

- Each student gets 10 shots to attempt to bounce ping pong balls into a cup that their partner is holding. The ping pong ball must bounce only once before it can land in the cup.

- The student's score is recorded as data. E.g. if a student gets 6 out of 10 shots in the cup, their score will be recorded as 6.

- This is repeated until all pairs of students have had an attempt.

- Students now calculate the mean using this data. Students can also calculate the median, mode and range.
TEACHING SEQUENCE FOR PERCENTAGES
Stage 4 - Calculating Price Increase and Decrease

Prices and Percentages Shopping

STRAND AND SUBSTRAND
Number - Multiplication and Division, Fractions, Decimals and Percentages - Stage 4

SYLLABUS OUTCOMES

MA4-5NA A student operates with fractions, decimals and percentages.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, understanding fractions, decimals, percentages and understanding money and finance, Stage 3.

ACTIVITY FOCUS
Solves problems by increasing and decreasing percentages.
Prices and Percentages Shopping Activity

**ACTIVITY FOCUS**

Explain the assignment to the students, and "give" each student their spending money.

- All food products are 15% off (or other discount), clothing is 35% off (or another discount).
- Tax is 6% on food and 8% on clothing (or other %).
- Students will begin “purchasing” items and listing them on the worksheet, calculating the final cost for each item.
- Remind students of the starting amount of money and they cannot spend more than they have.
- Throughout the class period(s) have specials and distribute coupons or special discounts students can use for a limited time only on certain products, surprise students with % mark-ups.
- Encourage students to buy as many different products as possible, do not allow large quantity purchases of a single item.
- Give students approximately one full class period to shop and calculate the discounts, taxes, and grand totals.
- Collect all completed worksheets.

<table>
<thead>
<tr>
<th>FOOD</th>
<th>ITEM</th>
<th>DISCOUNT</th>
<th>TAX</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOOD TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CLOTHING</th>
<th>ITEM</th>
<th>DISCOUNT</th>
<th>TAX</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLOTHING TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRAND TOTAL FOOD AND CLOTHING</th>
<th></th>
</tr>
</thead>
</table>
TEACHING SEQUENCE FOR GEOMETRIC FIGURES
Stage 4 - Reflection, Rotation and Translation

Outdoor Grid

STRAND AND SUBSTRAND
Measurement and Geometry - Properties of Geometrical Figures - Stage 4

SYLLABUS OUTCOMES
MA4-17MG A student classifies, describes and uses the properties of triangles and quadrilaterals, and determines congruent triangles to find unknown side lengths and angles.

MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

MA4-2WM A student applies appropriate mathematical techniques to solve problems.

MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 3, apply concepts of 2D shapes.

ACTIVITY FOCUS
Reflection, rotation and translation.
Outdoor Grid Activity

**ACTIVITY**

- Grid is made in outdoor area with coloured tape.
- Students are given a list of instructions to follow to move a set of shapes in a variety of ways (rotation, reflection, translation) using coordinates.
- Students will move each shape to correct position, eventually getting to the end of the instructions.
- Students will have the shape placed in correct final position if successful.
- This activity could be a competition between students by teaming up.
- First team to final position wins.
NUMERACY GUIDE 1
Stage 4 - Fractions, Decimal and Percentage

PURPOSE
The purpose of this sequence of activities is to provide numeracy key ideas and activities which can be used across different Key Learning Areas. Numeracy guides of different mathematical concepts have also been designed for all Key Learning Areas to reference. Staff implemented the numeracy guides within the teaching of each subject area and students applied the numeracy skills and understandings in many contexts. Galston High School implemented these activities with their Stage 4 and Stage 5 students.
### FRACTIONS, DECIMALS, PERCENTAGES

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Whole Number</th>
<th>Decimal</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>one-half</td>
<td>0.5</td>
<td>50%</td>
</tr>
<tr>
<td>1/4</td>
<td>one-quarter</td>
<td>0.25</td>
<td>25%</td>
</tr>
<tr>
<td>3/4</td>
<td>three-quarters</td>
<td>0.75</td>
<td>75%</td>
</tr>
<tr>
<td>1/5</td>
<td>one-fifth</td>
<td>0.2</td>
<td>20%</td>
</tr>
<tr>
<td>1/10</td>
<td>one-tenth</td>
<td>0.1</td>
<td>10%</td>
</tr>
<tr>
<td>1/3</td>
<td>one-third</td>
<td>0.3</td>
<td>33 1/3%</td>
</tr>
</tbody>
</table>

Numeracy Guide - Galston High School
NUMERACY GUIDE 2 Stage 2 - Examples of Fractions, Decimal and Percentage

Understanding

- Information in texts
- Estimating and problem solving
- Addition, subtraction, multiplication and division
- Money and finance
- Ratios and rates

Understanding

- Time
- Estimating and probability
- Interpreting and analysing data
- Representing data in graphs and timelines

Applying

- Concepts of 2D shapes
- Concepts of 3D objects
- Angles and geometry
- Patterns, generalisations and algebraic reasoning

Understanding

- Fractions, decimals, percentages, rates and ratios
- Money and finance
- Probability
- Chance, events and outcomes

Understanding

- Position, maps and grids
- Mass, volume and capacity
- Area
- Time
- Length
### Everyday Examples of Fractions, Decimals, Percentages

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Decimal</th>
<th>Percentage</th>
<th>Word</th>
<th>Time</th>
<th>Money</th>
<th>Calendar</th>
<th>Music</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>100%</td>
<td>one-whole</td>
<td><img src="image" alt="Clock" /></td>
<td><img src="image" alt="Money" /></td>
<td>1 year</td>
<td><img src="image" alt="Music" /></td>
</tr>
<tr>
<td>(\frac{1}{2})</td>
<td>0.5</td>
<td>50%</td>
<td>one-half</td>
<td><img src="image" alt="Clock" /></td>
<td><img src="image" alt="Money" /></td>
<td>6 months</td>
<td><img src="image" alt="Music" /></td>
</tr>
<tr>
<td>(\frac{1}{4})</td>
<td>0.25</td>
<td>25%</td>
<td>one-quarter</td>
<td><img src="image" alt="Clock" /></td>
<td><img src="image" alt="Money" /></td>
<td>3 months</td>
<td><img src="image" alt="Music" /></td>
</tr>
<tr>
<td>(\frac{3}{4})</td>
<td>0.75</td>
<td>75%</td>
<td>three-quarters</td>
<td><img src="image" alt="Clock" /></td>
<td><img src="image" alt="Money" /></td>
<td>9 months</td>
<td></td>
</tr>
<tr>
<td>(\frac{1}{5})</td>
<td>0.2</td>
<td>20%</td>
<td>one-fifth</td>
<td><img src="image" alt="Money" /></td>
<td><img src="image" alt="Money" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\frac{1}{10})</td>
<td>0.1</td>
<td>10%</td>
<td>one-tenth</td>
<td><img src="image" alt="Money" /></td>
<td><img src="image" alt="Money" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\frac{1}{3})</td>
<td>0.3</td>
<td>(\frac{3}{3})</td>
<td>one-third</td>
<td><img src="image" alt="Clock" /></td>
<td><img src="image" alt="Money" /></td>
<td>4 months</td>
<td></td>
</tr>
</tbody>
</table>

Galston High School: Numeracy Guide 3

**VOCABULARY**

**Congruent**
Two shapes are congruent if matching sides and angles are identical.

**Vertex**
A vertex (vertices plural) is a point where two or more lines meet.

**Quadrilaterals**
A quadrilateral is a 2D shape with 4 straight sides and 4 angles. The interior angles of a quadrilateral add to 360°.
<table>
<thead>
<tr>
<th>QUADRILATERAL</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| Square (regular quadrilateral)| 4 equal sides  
4 equal angles = 90°  
Equal diagonals bisect at right angles |
| Rectangle                     | 2 pairs of equal opposite sides  
4 equal angles = 90°  
Equal diagonals bisect each other |
| Rhombus                       | 4 equal sides  
Opposite angles are equal  
Opposite sides are parallel |
| Parallelogram                 | 2 pairs of equal opposite sides which are parallel  
Opposite angles are equal |
| Trapezium                     | One pair of parallel sides                                    |
| Kite                          | Two pairs of equal adjacent sides                             |
**TRIANGLES**
A triangle is a 2D shape with 3 sides and 3 angles.
The angles of a triangle add to 180°

<table>
<thead>
<tr>
<th>TRIANGLE</th>
<th>FEATURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equilateral</td>
<td><img src="image" alt="Equilateral Triangle" /></td>
</tr>
<tr>
<td></td>
<td>3 equal sides</td>
</tr>
<tr>
<td></td>
<td>3 equal angles = 60°</td>
</tr>
<tr>
<td>Isosceles</td>
<td><img src="image" alt="Isosceles Triangle" /></td>
</tr>
<tr>
<td></td>
<td>2 equal sides</td>
</tr>
<tr>
<td></td>
<td>2 equal angles</td>
</tr>
<tr>
<td>Scalene</td>
<td><img src="image" alt="Scalene Triangle" /></td>
</tr>
<tr>
<td></td>
<td>No equal sides</td>
</tr>
<tr>
<td></td>
<td>No equal angles</td>
</tr>
<tr>
<td>Acute angled</td>
<td><img src="image" alt="Acute angled Triangle" /></td>
</tr>
<tr>
<td></td>
<td>All angles less than 90°</td>
</tr>
<tr>
<td>Right angled</td>
<td><img src="image" alt="Right angled Triangle" /></td>
</tr>
<tr>
<td></td>
<td>One angle that is 90°</td>
</tr>
<tr>
<td>Obtuse angled</td>
<td><img src="image" alt="Obtuse angled Triangle" /></td>
</tr>
<tr>
<td></td>
<td>One angle great than 90°</td>
</tr>
</tbody>
</table>
### PRISMS
A prism is a 3D object with flat faces and identical parallel ends (base). It is named for the shape of the uniform cross-section (or base).

<table>
<thead>
<tr>
<th>PRISM</th>
<th>FEATURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cube</td>
<td>![Cube Image]</td>
</tr>
<tr>
<td></td>
<td>6 identical faces</td>
</tr>
<tr>
<td></td>
<td>Each face is a square</td>
</tr>
<tr>
<td></td>
<td>8 vertices</td>
</tr>
<tr>
<td></td>
<td>12 edges</td>
</tr>
<tr>
<td>Rectangular prism (cuboid)</td>
<td>![Rectangular Prism Image]</td>
</tr>
<tr>
<td></td>
<td>3 pairs of congruent, opposite faces</td>
</tr>
<tr>
<td></td>
<td>8 vertices</td>
</tr>
<tr>
<td></td>
<td>12 edges</td>
</tr>
<tr>
<td>Triangular prism</td>
<td>![Triangular Prism Image]</td>
</tr>
<tr>
<td></td>
<td>1 pair of congruent triangular faces</td>
</tr>
<tr>
<td></td>
<td>3 rectangular faces</td>
</tr>
<tr>
<td></td>
<td>6 vertices</td>
</tr>
<tr>
<td></td>
<td>9 edges</td>
</tr>
</tbody>
</table>

Note: A cylinder is not a prism as it has a curved face.

### PYRAMID
A pyramid is a 3D object made up of flat faces. It is named for the shape of the base. The remaining sides are triangular.

<table>
<thead>
<tr>
<th>PYRAMID</th>
<th>FEATURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectangular based pyramid</td>
<td>![Rectangular Based Pyramid Image]</td>
</tr>
<tr>
<td></td>
<td>Rectangular based</td>
</tr>
<tr>
<td></td>
<td>5 vertices</td>
</tr>
<tr>
<td></td>
<td>4 triangular faces</td>
</tr>
<tr>
<td>Square based pyramid</td>
<td>![Square Based Pyramid Image]</td>
</tr>
<tr>
<td></td>
<td>Square base</td>
</tr>
<tr>
<td></td>
<td>5 vertices</td>
</tr>
<tr>
<td></td>
<td>4 congruent triangular faces</td>
</tr>
<tr>
<td>Triangular based pyramid</td>
<td>![Triangular Based Pyramid Image]</td>
</tr>
<tr>
<td></td>
<td>4 triangular faces</td>
</tr>
<tr>
<td></td>
<td>4 vertices</td>
</tr>
<tr>
<td></td>
<td>A triangular pyramid constructed from 4 equilateral triangles is called a</td>
</tr>
<tr>
<td></td>
<td>tetrahedron and is one of the platonic solids</td>
</tr>
</tbody>
</table>
### NETS OF SOLIDS

A net is a pattern that you can fold to make a 3D shape.

<table>
<thead>
<tr>
<th>SOLID</th>
<th>NET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cube</td>
<td><img src="image" alt="Cube Net" /></td>
</tr>
<tr>
<td>Rectangular prism</td>
<td><img src="image" alt="Rectangular Prism Net" /></td>
</tr>
<tr>
<td>Triangular prism</td>
<td><img src="image" alt="Triangular Prism Net" /></td>
</tr>
<tr>
<td>Square based pyramid</td>
<td><img src="image" alt="Square Based Pyramid Net" /></td>
</tr>
</tbody>
</table>

**Note:** There is more than one configuration for each net of a solid.

**TEACHING STRATEGIES**

- Discuss the vocabulary, use the correct geometrical terms e.g. angles, vertices (not corners), rhombus (not diamond).
- Use examples of 2D and 3D shapes in differing orientations.
- Use real-life examples of the properties of geometric shapes in your KLA. E.g. pyramids in HSIE, pencil boxes in TAS.
- Help students identify the number of faces, vertices and edges in 3D objects.
- Investigate different nets of relevant 3D objects including open and closed solids. Templates for nets are available online. [http://www.senteacher.org/worksheet/12/NetsPolyhedra.html](http://www.senteacher.org/worksheet/12/NetsPolyhedra.html)
VOCABULARY

Students struggle with converting between units, usually because they forget the factor for conversion. However, the factor is described in the words.

Milli means a thousandth of. A millimetre is a thousandth of a metre. There are 1000 millimetres in a metre.

Centi means a hundredth of. A centimetre is a hundredth of a metre. There are 100 centimetres in a metre.

Kilo means 1000 wholes. A kilometre equals 1000 metres.

METRIC FACTS

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>UNIT</th>
<th>SYMBOL</th>
<th>CONVERTING BETWEEN UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>millimetre</td>
<td>mm</td>
<td>1 cm = 10 mm</td>
</tr>
<tr>
<td></td>
<td>centimetre</td>
<td>cm</td>
<td>1 m = 100 cm = 1000 mm</td>
</tr>
<tr>
<td></td>
<td>metre</td>
<td>m</td>
<td>1 km = 1000 m</td>
</tr>
<tr>
<td></td>
<td>kilometre</td>
<td>km</td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>milligram</td>
<td>mg</td>
<td>1 g = 1000 mg</td>
</tr>
<tr>
<td></td>
<td>gram</td>
<td>g</td>
<td>1 kg = 1000 g</td>
</tr>
<tr>
<td></td>
<td>kilogram</td>
<td>kg</td>
<td>1 t = 1000 kg</td>
</tr>
<tr>
<td></td>
<td>tonne</td>
<td>t</td>
<td></td>
</tr>
</tbody>
</table>
MULTIPLYING AND DIVIDING BY 10, 100, 1000 ETC...

When a number is multiplied by 10 it becomes 10 times bigger.
Take the number 1.314:

\[
\begin{align*}
1.314 \times 10 & = 13.14 \\
1.314 \times 100 & = 131.4 \\
1.314 \times 1000 & = 1314 \\
1.314 \times 10000 & = 13140
\end{align*}
\]

When a number is divided by 10 it becomes 10 times smaller.
Take the number 131.4:

\[
\begin{align*}
131.4 \div 10 & = 13.14 \\
131.4 \div 100 & = 1.314 \\
131.4 \div 1000 & = 0.314 \\
131.4 \div 10000 & = 0.0314
\end{align*}
\]

UNIT CONVERSIONS

Capacity

\[
\begin{align*}
\div 1000 & \quad \div 1000 & \quad \div 1000 \\
mL & \quad L & \quad kL \\
\times 1000 & \quad \times 1000 & \quad \times 1000 \\
1 \text{ cm}^3 & = 1 \text{ mL} & \quad 1 \text{ m}^3 & = 1000 \text{ L} = 1 \text{ kL}
\end{align*}
\]

Length

\[
\begin{align*}
\div 10 & \quad \div 100 & \quad \div 1000 \\
mm & \quad cm & \quad m & \quad km \\
\times 10 & \quad \times 100 & \quad \times 1000 \\
\end{align*}
\]
### Time

- **Sec**: \( \div 60 \times 60 \times 24 \)
- **Min**: \( \div 60 \times 60 \times 24 \)
- **Hrs**: \( \div 60 \times 60 \times 24 \)
- **Days**: \( \times 60 \times 60 \times 24 \)

### Volume

- **mm\(^3\)**: \( \div 10^3 \times 10^3 \times 10^3 \)
- **cm\(^3\)**: \( \div 10^3 \times 10^3 \times 10^3 \)
- **m\(^3\)**: \( \div 10^3 \times 10^3 \times 10^3 \)
- **km\(^3\)**: \( \times 10^3 \times 10^3 \times 10^3 \)

### Area

- **mm\(^2\)**: \( \div 10^2 \times 10^2 \times 10^2 \)
- **cm\(^2\)**: \( \div 10^2 \times 10^2 \times 10^2 \)
- **m\(^2\)**: \( \div 10^2 \times 10^2 \times 10^2 \)
- **km\(^2\)**: \( \times 10^2 \times 10^2 \times 10^2 \)

### Reading Scales

Help students read scales on measuring devices.
**PERIMETER**

The distance around the outside of a two-dimensional shape is called the perimeter. The perimeter is calculated by adding the lengths of all sides.

The perimeter of each shape below is 12 cm.

---

**AREA**

Area is measured in square units. Area is the amount of space contained inside a flat (i.e. plane) shape.

1 cm × 1 cm = 1 square centimetre (1 cm²)

---

**COMMON UNITS OF AREA**

<table>
<thead>
<tr>
<th>UNIT OF AREA</th>
<th>SQUARE SIDE LENGTH</th>
<th>USED TO MEASURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 square millimetre (mm²)</td>
<td>1 mm</td>
<td></td>
</tr>
<tr>
<td>1 square centimetre (cm²)</td>
<td>1 cm</td>
<td>the area of a desk</td>
</tr>
<tr>
<td>1 square metre (m²)</td>
<td>1 m</td>
<td>floor areas, suburban land areas</td>
</tr>
<tr>
<td>1 hectare (ha)</td>
<td>100 m</td>
<td>paddocks, farms, cities</td>
</tr>
<tr>
<td>1 square kilometre (km²)</td>
<td>1 km</td>
<td>huge areas such as states and countries</td>
</tr>
</tbody>
</table>
RECTANGLES
The area of a rectangle is given by the number of rows multiplied by the number of columns. Written as a formula, this looks like $A = l \times b$, where $l$ is the length and $b$ is the breadth (or width).

The area for the shapes above are:

$\begin{array}{ccc}
8 \text{ cm}^2 & 9 \text{ cm}^2 & 8 \text{ cm}^2 \\
5 \text{ cm}^2 & & 5 \text{ cm}^2
\end{array}$

COMPOSITE SHAPES
A composite shape is a figure reducible to simpler plane shapes.

$\begin{array}{cccc}
P= 12 \text{ cm} & P= 12 \text{ cm} & P= 12 \text{ cm} & P= 12 \text{ cm} \\
A = 6 \text{ cm}^2 & A = 5 \text{ cm}^2 & A = 5 \text{ cm}^2 & A = 5 \text{ cm}^2
\end{array}$

TRIANGLES
The area of a triangle is half the area of the rectangle that fits around it.

$\begin{array}{ccc}
A = l \times b & A = l \times b & A = \frac{1}{2} \times b \times h
\end{array}$
SURFACE AREA
The surface area of a solid is the sum of the areas of its faces.

The surface area of a rectangular prism consists of 3 pairs of rectangles. To calculate the surface area, sum the areas of the faces of the rectangular prism.

TEACHING STRATEGIES
• Discuss the vocabulary.
• When dealing with measurement, try to use questions with a variety of units.
• Use the real-life examples in your KLA to discuss units of measurement.
• Use formal language, “perimeter” and “area”, instead of informal terms.
• Make a point of choosing appropriate units for measurement perimeter or area.
• Use the real-life examples in your KLA to discuss applications of perimeter and area.
• Find perimeter and area in the context of projects and creative works.
VOCABULARY

Sum: Addition
Product: Multiplication
Quotient: Division
Difference: Subtraction
Percentage: Per one hundred
Prime Number: A prime number only has 2 factors - itself and 1. E.g. 5 is a prime

RATES

A rate is a comparison of unlike quantities.
For example: 60 km/h is used to describe speed
To simplify rates we can multiply or divide both sides by the same number.
For example: 6000 mL for 10 bottles = 600 mL per 1 bottle.

RATIOS

A ratio is a comparison of numbers in a definite order.
The numbers are expressed in the same units and are called terms of the ratio.
Ratios can be written in the form $a : b$ or $\frac{a}{b}$ or $a$ to $b$.
Ratios can be used to compare more than two numbers e.g. $a : b : c$.
To simplify ratios we can multiply or divide both sides by the same number.
To divide something into a given ratio find the total number of parts then how much one part is worth.
For example: Two business partners divide profits in the same ratio of their investments. John invests $9000 and Lisa invests $5000, how much should Lisa receive if John receives $3600?
John : Lisa = 9000 : 5000 = 9 : 5  
(simplify by dividing both sides by 1000)  
9 shares = 3600  
1 share = 3600 ÷ 9 = $400  
5 shares = $400 × 5  
= $2000  
∴ Lisa’s share = $2000.

MONEY AND FINANCE
Problem solving and calculations involving money and finance requires students to understand rates, ratios, time, decimals, fractions and percentages.

Note: Do not assume that students know how many days are in different months or how many weeks there are in a year or days in one year.

PERCENTAGES
To find a percentage of a quantity first write your percentage as a decimal (÷ 100), then multiply your result by the quantity you wish to find the percentage of.

For example: 6.8% of males in Australia are smokers. If the population of Australia is 23.13 Million, how many Australian males smoke?

6.8 ÷ 100 = 0.068  
0.068 × 23.13 = 1.57284 Million  
≈ 1.57 Million to 2 decimal places

ROUNDING DECIMALS
Students are often asked to give their answer to a certain number of decimal places. If a question doesn’t state the number of decimal places then the level of accuracy should be no greater than in the question. In the example above the population was quoted to 2 decimal places and so the student’s answer should be expected to no greater than 2 decimal places.

When rounding decimals ask yourself “Is it closer to the current number or one greater?”

For Example: Round 7.1356 to 2 decimal places.

7.1356

Count the required number of decimal places and look at the next digit. If that digit is 5 or larger “round up”.

7.1356 = 7.14 correct to 2 decimal places.

NON-CALCULATOR NUMBER STRATEGIES
• Estimating Adding and Subtracting Decimals: Round numbers to the nearest whole number.
• When dividing by 4, halve and halve again.
• When dividing by 5, divide by 10 then double.
• A number is divisible by 3 if the digits in that number add to 3. Example: 819 is divisible by 3 as 8 + 1 + 9 = 18 and 18 is divisible by 3.
• A number is divisible by 2 if it ends in the digits 0, 2, 4, 6 or 8.
• A number is divisible by 5 if it ends in the digits 0 or 5.
• A number is divisible by 10 if it ends in a 0.
• For mental addition of numbers look for ways to make ‘10’s’ or ‘100’s’ to simplify.
• When calculating with percentages use 1% or 10% as your starting point.

Example: To calculate 6% of $150.

10% = $15 (divide by 10)  
∴ 5% = $7.50 (halve)  
1% = $1.50 (divide by 100)  
∴ 6% = $9.00 (add 5% and 1%)
Example: $27.3 \times 0.3$
\[= 273 \times 3\]
\[= 819\]

3 tenths multiplied by 3 tenths equals 9 hundredths, so we would expect 2 decimal places in the answer.
\[\therefore 27.3 \times 0.3 = 8.19\]

Example: $2574 \div 4$

• When dividing by a decimal multiply both numbers by a multiple of 10 (10, 100, 1000 etc.) to remove the decimal places from the divisor.

Multiply both numbers by 10 then do the division
\[25740 \div 4 =\]

**TEACHING STRATEGIES**

• If you need students to be able to calculate with time then explicitly teach them the quantities and units they need to calculate with.

• Clarify that there are not 4 weeks in a month. This is the most common misconception.

• Use appropriate KLA examples when teaching the skills of rates and ratios to assist students in understanding in a wide range of contexts. Example: the rate per hour someone is paid.

• When estimating, or calculating with decimals use money as your examples. E.g. Estimating how much a trolley of groceries will cost at the checkout.

• Encourage students to use mental computation strategies instead of reaching for their phone or calculator immediately.

• Demonstrate the mental computation strategies you are using by saying them aloud to the class.

• Using fingers is a perfectly acceptable strategy. It is particularly helpful when calculating with time.
FITNESS TESTING – GRAPHICAL REPRESENTATION AND DATA ANALYSIS
Stage 4 - PDHPE

KLA - PDHPE: Fitness Testing

STAGE
Stage 4

SYLLABUS OUTCOMES
PDHPE
Demonstrates movement skills in a range of contexts and environments.

STAGE
Stage 4

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, graphical representation and data analysis and representing data in graphs and timelines.

ACTIVITY FOCUS
Demonstrates movement skills in a range of contexts and environments.

KLA - PDHPE: Fitness Testing

Students engage in a variety of fitness tests encompassing cardio, strength, power, agility, speed and flexibility. Beginning in Year 7, students plot their results on a graph and compare data to norms. Fitness testing is undertaken at the beginning of each subsequent year, with students graphing their results in a variety of ways – students monitor their progress over Years 7-10 and:

1. Give reasons for improvement or otherwise.
2. Discuss how improvements can be made if required.
<table>
<thead>
<tr>
<th>FITNESS TEST</th>
<th>YEAR 7</th>
<th>YEAR 8</th>
<th>YEAR 9</th>
<th>YEAR 10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start</td>
<td>End</td>
<td>Start</td>
<td>End</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardio</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strength</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Agility</td>
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</tr>
<tr>
<td>Speed</td>
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<td></td>
</tr>
<tr>
<td>Flexibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE IMPROVEMENTS - GIVE REASONS ON HOW FURTHER IMPROVEMENTS CAN BE MADE**
SMOKING CALCULATIONS – APPLYING ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION Stage 4 - PDHPE

KLA - PDHPE: Smoking Calculation - How Many Years?

STAGE
Stage 4-5

SYLLABUS OUTCOMES
PDHPE
Describes and understands the effects of smoking.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, mental computation and numerical reasoning and applying addition, subtraction, multiplication and division.

ACTIVITY FOCUS
Describes and understands the effects of smoking.
SMOKING CALCULATION - HOW MANY YEARS?

Activity has been differentiated to allow for all abilities.

HOW MANY YEARS?
Experts say that every cigarette a person smokes reduces his/her life by approximately five minutes. Solve the following problems. Use 365 days = 1 year, 15 cigarettes cost $15.

Justin quit smoking when he turned 20. He thought it was the best birthday present he could give himself. He started smoking when he was 15 years old, smoking on average 15 cigarettes a day.

a) Approximately how many days has Justin subtracted from his life? ______________________________________

b) How much money did Justin spend on cigarettes in the time he was a smoker?

________________________________________________________________________

________________________________________________________________________

c) What could Justin have spent his money on instead?

________________________________________________________________________

________________________________________________________________________

d) In the three months since quitting what other benefits would Justin have experienced?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Now use the following, 1 year = 365 days, 1 packet = 20 cigarettes, 1 packet costs $20.

Sally’s grandmother is 60 years old. She started to smoke when she was 15 years old. For five years, she smoked half a packet a day, but when she was 20 she started smoking a packet a day. Sally’s grandmother has now been told that her right leg will have to be amputated if she doesn’t quit.

a) By approximately how many years has Sally’s grandmother reduced her lifespan? ______________________

b) How much money has she spent on cigarettes in her lifetime?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
ATHLETICS – UNDERSTANDING AND APPLYING LENGTH CONCEPTS Stage 4 - PDHPE

KLA - PDHPE: Athletics

STAGE
Stage 4-5

SYLLABUS OUTCOMES

PDHPE
4.4 Stage 4 Demonstrates and refines movement skills in a range of contexts and environments.

5.5 Stage 5 Composes, performs and appraises movement in a variety of challenging contexts.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 4, measurement and time calculations and understanding and applying length concepts.

ACTIVITY FOCUS
Athletics.
**Athletics Activity**

Throwing events in athletics unit: shotput, javelin, discus.

1. After instruction and practice throws, students estimate length of their throw.
2. Cones are then placed at 5 m intervals in throwing sector – students again estimate the distance they have thrown.

3. In pairs students measure actual throw.
   a) Students collate their data in the table:
   b) Discussion and reflection on estimates compared to measured distances. Class data can be collated and average throwing distance calculated. The range and mode can also be calculated.

<table>
<thead>
<tr>
<th>SPORT EVENT</th>
<th>ESTIMATE YOUR THROW DISTANCE</th>
<th>ESTIMATE DISTANCE WITH CONES AT 5 M INTERVALS</th>
<th>MEASURED DISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shotput</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Javelin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discuss</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RISKY SITUATIONS - UNDERSTANDING AND APPLYING LENGTH CONCEPTS Stage 4 - PDHPE

KLA - PDHPE: Risky Situation - 2

STAGE
Stage 4

SYLLABUS OUTCOMES
A student identifies and explains the consequences of risk behaviours and provides strategies to minimise harm.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 4, measurement and time calculations and understanding and applying length concepts.

ACTIVITY FOCUS
Risky situation 2.
PDHPE: Risky Situation - 2

RISKY SITUATION – 2

Jenny is 16 years old and is at a party with her friend Sam and people they do not know. She left her bag (containing alcohol) at the front door which was 8 metres from where she stopped to talk to her friends. Sam asks Jenny for some alcohol. Jenny walks back to pick up her bag from the front door and walked 48 metres outside with Sam to drink the alcohol behind a bush. The girls realise they do not have cups to drink with so Jenny volunteers to go back to the party to get some leaving Sam on her own. The cups were located 17 metres inside the house.

Identify the risks of this situation.

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

Identify the potential outcome/s in this situation?

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

How far has Jenny travelled since she arrived at the party to bringing the cups back to Sam?

_________________________________________________________________________________

_________________________________________________________________________________
HEALTHY EATING PLAN - INTERPRETING AND ANALYSING DATA Stage 4 - PDHPE

KLA - PDHPE: Healthy Eating Plan

STAGE
Stage 4

SYLLABUS OUTCOMES
Describes the nature and effect of cannabis, alcohol and nutrition on young people.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, graphical representation and data analysis and interpreting and analysing data.

ACTIVITY FOCUS
Healthy eating plan.

PDHPE: Healthy Eating Plan

The activity is half of the Year 8 Semester two assessment task.

PART 2
Healthy eating plan for one week – 20 marks
You are to design a healthy eating plan for 1 week (7 days) for a person your age.
The plan needs to be broken up into:

• Breakfast
• Snack
• Lunch
• Snack
• Dinner

Each of the above sections needs to have the food to be eaten, the calories for that food and total calories at the end of each day.
<table>
<thead>
<tr>
<th></th>
<th>BREAKFAST</th>
<th>SNACK</th>
<th>LUNCH</th>
<th>SNACK</th>
<th>DINNER</th>
<th>TOTAL DAILY CALORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food:</td>
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<td></td>
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<tr>
<td>Calories:</td>
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<tr>
<td>Day 2</td>
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<td>Food:</td>
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<td>Calories:</td>
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<td>Day 3</td>
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<td>Food:</td>
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<td>Calories:</td>
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<td>Day 4</td>
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<td>Food:</td>
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<td>Calories:</td>
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<td>Day 5</td>
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<tr>
<td>Food:</td>
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<td>Calories:</td>
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<td>Day 6</td>
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<tr>
<td>Food:</td>
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<tr>
<td>Calories:</td>
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<tr>
<td>Day 7</td>
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<tr>
<td>Food:</td>
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<td></td>
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<tr>
<td>Calories:</td>
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</tr>
</tbody>
</table>

TOTAL WEEKLY CALORIES
PARTICIPATION IN SPORT AND RECREATION
INTERPRETING AND ANALYSING DATA
Stage 4 - PDHPE

KLA - PDHPE: Participation in Sport and Recreation

STAGE
Stage 4

SYLLABUS OUTCOMES
Demonstrates proficiency in fitness activities.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 5, graphical representation and data analysis and interpreting and analysing data.

ACTIVITY FOCUS
Participation in sport and recreation.
Answer the questions below for the above graph.

1. What percentage of 18-24 year old play:
   a) Organised sport? ____________________________
   b) Non-organised sport? ____________________________
   c) No sport? ____________________________

2. What percentage of 15-17 year old participate in:
   a) Organised sport? ____________________________
   b) Non-organised sport? ____________________________
   c) No sport? ____________________________

In what way does the level of participation of 15-17 year old differ from that of 18-24 year old? Can you suggest reasons for this?

________________________________________________

________________________________________________

________________________________________________
KLA - TAS: Application of Correct Units of Measurement

STAGE
Stage 5

SYLLABUS OUTCOMES

TAS
4.3.2 A student demonstrates responsible and safe use of a range of tools, materials, and techniques in each design project.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 4, measurements and time calculations.

ACTIVITY FOCUS
Using the key provided, students are to fill in blanks of all units of measurement.
Converting Measurements

UNITS OF MEASUREMENT

Key
1 kilometre = 1000 metres
1 metre = 100 centimetres
1 centimetre = 10 millimetres

Complete the following in all units of measurement

1. 10 metres (m) = _______ centimetres (cm) = _______ millimetres (mm)
2. 35 metres (m) = _______ centimetres (cm) = _______ millimetre (mm)
3. _______ metres (m) = 250 centimetres (cm) = _______ millimetres (mm)
4. _______ metres (m) = 80 centimetres (cm) = _______ millimetres (mm)
5. _______ metres (m) = _______ centimetres (cm) = 18000 millimetres (mm)
6. _______ metres (m) = _______ centimetres (cm) = 85000 millimetres (m)
7. _______ kilometres (km) = _______ metres (m) = 560000 centimetres (cm)

REAL LIFE MEASUREMENT SITUATIONS

In the table below list the most appropriate or suitable measurement type:
Choices could include: litres, millimetres, centimetres, linear metres, millilitres, metres, kilometres, hectares, acres
You can put more than one answer from above:

<table>
<thead>
<tr>
<th>The length of a 2B pencil</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The height of the ceiling in the school workshop</td>
<td></td>
</tr>
<tr>
<td>Length of a house brick</td>
<td></td>
</tr>
<tr>
<td>A tin of lacquer</td>
<td></td>
</tr>
<tr>
<td>A bottle of PVA glue</td>
<td></td>
</tr>
<tr>
<td>Length of timber</td>
<td></td>
</tr>
<tr>
<td>Height of a workshop stool</td>
<td></td>
</tr>
<tr>
<td>The length of a nail punch</td>
<td></td>
</tr>
<tr>
<td>Size of A4 paper</td>
<td></td>
</tr>
<tr>
<td>The size of an avocado farm</td>
<td></td>
</tr>
<tr>
<td>The distance from Dural McDonalds to Galston High School</td>
<td></td>
</tr>
<tr>
<td>Length of Galston Road</td>
<td></td>
</tr>
<tr>
<td>A small local hobby farm</td>
<td></td>
</tr>
</tbody>
</table>
PENCIL BOX - APPLYING CONCEPTS OF ANGLES, GEOMETRY AND 2D SHAPES
Stage 4 - TAS

KLA - TAS: Pencil Box Assembly

STAGE
Stage 4

SYLLABUS OUTCOMES
TAS
4.3.2 Demonstrates responsible and safe use of a range of tools, materials, and techniques in each design project.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 3, spatial visualisation, geometric reasoning, and mapping, applying concepts of angles and geometry and applying concepts of angles and 2D shapes (Trigonometry).

ACTIVITY FOCUS
Using numeracy guide, student’s prior knowledge of properties of 2 dimensional shapes is revised, determined, or developed prior to practical work.
Pencil Box Assembly Activity

Recap
Numeracy Guide 3: Quadrilaterals

**ACTIVITY**

**Applying knowledge of 2-dimensional shape properties in a TAS context**

As part of the gluing and assembly process of student pencil boxes, students check diagonals of their framework/carcase and apply knowledge of the properties of 2 dimensional shapes to achieve “square (90°)”

![Diagram of a rectangle with diagonals drawn](image)

Students are quizzed to the ramifications of framework/carcase not having equal diagonals, i.e. sides not being parallel, affecting the function of the sliding lid.
TAS: Chicken Sausage Rolls - Year 7
Numeracy Task

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, mental computation and numerical reasoning, applying addition, subtraction, multiplication and division and understanding fractions and decimals.
INGREDIENTS

<table>
<thead>
<tr>
<th>QUANTITY FOR ONE PERSON</th>
<th>QUANTITY FOR FOUR PEOPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 g chicken breast mince</td>
<td></td>
</tr>
<tr>
<td>1 onion, finely chopped</td>
<td></td>
</tr>
<tr>
<td>1 carrot, finely grated</td>
<td></td>
</tr>
<tr>
<td>1 clove garlic, crushed</td>
<td></td>
</tr>
<tr>
<td>2 zucchini, finely grated</td>
<td></td>
</tr>
<tr>
<td>2 cups fresh bread crumbs</td>
<td></td>
</tr>
<tr>
<td>Salt and pepper</td>
<td></td>
</tr>
<tr>
<td>3 sheets ready rolled frozen puff pastry</td>
<td></td>
</tr>
<tr>
<td>1 egg, lightly beaten</td>
<td></td>
</tr>
<tr>
<td>(\frac{1}{3}) cup milk</td>
<td></td>
</tr>
<tr>
<td>2 tbs sesame seeds</td>
<td></td>
</tr>
</tbody>
</table>

METHOD

1. Preheat oven to 190°C.
2. Line 2 baking trays with baking paper and set aside.
3. Lay pastry sheets out to defrost.
4. Place the chicken mince, onion, carrot, zucchini and bread crumbs, garlic, salt and pepper into a food processor and process until fully combined.
5. Cut pastry sheets in half and evenly distribute the chicken mix between the 6 pieces.
6. Mix the egg with the milk.
7. Roll the chicken mix in the pastry and use the egg/milk wash to seal.
8. Cut each log into 3 for large sausage rolls or 6 for party sausage rolls.
9. Lay onto baking trays and brush egg wash over the tops and sprinkle with sesame seeds.

QUESTIONS

a) Convert 500 g of chicken breast mince to kg. ____________________________
   Convert 1500 g of chicken breast to kg, how many people would that serve? ____________________________

b) If you were to cut 2 onions into eighths, how many pieces would you have? ____________________________

c) How much milk would you need if you make the recipe for two people? ____________________________

d) 2 tbs = 40 ml, 1 tsp = 5 ml. How many tsps are needed to make 2 tbs? ____________________________

e) Complete the table above working out quantities for four people. ____________________________
JAPAN UNDER THE SHOGUNS – CONSTRUCTING TIMELINES Stage 4 - HSIE

KLA - HSIE: Japan Under the Shoguns - Constructing Timelines

STAGE
Stage 4

SYLLABUS OUTCOMES
HSIE
HT4-2 A student describes major periods of historical time and sequences events, people and societies from the past.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 4, measurement and time calculations.

ACTIVITY FOCUS
Constructing a timeline.
Japan Under the Shoguns - Constructing Timelines Activity

JAPAN UNDER THE SHOGUNS TIMELINE
Let’s remind ourselves how to read measurements.

What is the unit of measurement in the above image? __________________________________________
What are the two measurements? __________________________________________________________

Chronological Order: The arrangement of things following one after another in time.

ACTIVITY
Create a timeline from information gathered about the events that occurred of when Japan was under the Shoguns.

Steps
1. Draw a 20 cm line in your book.
2. Mark out every centimetre on the line.
3. Starting at the beginning of the line mark the year 1400 CE.
4. Every centimetre mark another 25 years. (The timeline should finish at 1900 CE).
5. Using the information in the table below, select the six (6) most important events from the period.
6. Then plot the different events in chronological order on to your timeline.
7. Give your timeline an appropriate title and write the scale somewhere on the page. (e.g. 1 cm = ? years).
UNDERSTANDING CONTOUR LINES – SPATIAL VISUALISATION, GEOMETRIC REASONING AND MAPPING Stage 4 - HSIE

KLA - HSIE: Understanding Contour Lines Activity

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 3, spatial visualisation, geometric reasoning, and mapping.

UNDERSTANDING CONTOUR LINES
Key concepts to be understood
• Topography – The shape of the earth’s surface including different landform features such as hills, valleys, ridges, cliffs and saddles.

- Topographic map – A type of 2-dimensional map that uses contour lines to represent a 3-dimensional landscape.
- Contour line – An imaginary line joining places of equal height above sea level.
- Contour interval – The vertical difference in height between 2 contour lines.
Step 1
Introduce the lesson.
Introduce the idea of topography and how it varies across different landscapes and by different landforms.
Students describe the topography of different images provided – flat, undulating and mountainous landscapes. Last slide is an aerial view of Mt Everest. Question: Describe the shape of the landscape in the image. Next slide is a ground view of Mt Everest. Question: How do geographers represent the shape of the landscape (3 Dimension’s) on a 2-dimensional surface? Contour Lines. Start with definition and samples.

Step 2
Demonstrate using Lego the concept of contour lines by building a basic hill using different colours for each level. Students can then see the ground level view (side on) and can see the vertical view (aerial) with the shape of the hill represented by the different coloured Lego bricks.

Step 3
Students are given different sets of Lego bricks with an example of a landform to create using them e.g. A hill with one steep side, a cliff, a winding river valley, a saddle (2 high points on a ridge), students will be given an image of each landform to help them create their model.

Step 4
Students are to complete an aerial drawing of their landform by viewing the 3D model from directly above. They need to draw in the contour lines created by their Lego landform onto the paper provided.

Step 5
Students to complete matching activity sheet of different landforms to their contour line map extracts.
TESTING REACTION TIME – INTERPRETING AND ANALYSING DATA, CALCULATING MEAN AND INVESTIGATING OUTLIERS Stage 5 - Science

KLA - Science: Testing Reaction Time

STAGE
Stage 5

SYLLABUS OUTCOMES
Science
A student undertakes first-hand investigations to collect valid and reliable data and information, individually and collaboratively.

A student processes, analyses and evaluates data from first-hand investigations and secondary sources to develop evidence-based arguments and conclusions.

A student analyses interaction between components and processes within biological systems.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, mental computation and numerical reasoning, understanding mathematical information in texts and tasks, applying whole number concepts and applying addition, subtraction, multiplication and division.

ACTIVITY FOCUS
Calculating mean and removing outliers.
KLA - Science: Testing Reaction Time

Revise student knowledge of:
• Identifying and removing outliers.
• Calculating the mean of a series of numbers.

Investigation to compare the reaction time of the left and right hand (See attached worksheet).

REACTION TIME

Aim
To compare the reaction time of the left and right hand.

Equipment
• 30 cm ruler
• Graph paper

Procedure
1. Hold the top of a 30 cm ruler so that the end with the zero on it is lined up between the thumb and forefinger of your partner.
2. Drop the ruler.
3. Record the catch distance.
4. Repeat ten times for each hand.
5. Use the table to convert the catch distance (cm) into reaction time (s or ms).
6. Remove any results that involved the ruler being dropped (these are your outliers).
7. Calculate mean reaction time for each hand and compare to class results.
8. Graph reaction time for mean class results.

Results

<table>
<thead>
<tr>
<th>ATTEMPT</th>
<th>LEFT HAND</th>
<th>RIGHT HAND</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Catch distance (cm)</td>
<td>Reaction time (ms)</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
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<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
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<tr>
<td>7</td>
<td></td>
<td></td>
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<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Class

<table>
<thead>
<tr>
<th>STUDENT</th>
<th>LEFT HAND Average reaction time (ms)</th>
<th>RIGHT HAND Average reaction time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Discussion questions

Which hand had the fastest mean reaction time?
Which hand had the slowest mean reaction time?
Why was it important to remove any outliers before calculating the mean result?
What is the difference in time between the fastest and slowest reaction times for both the left and right hand?
How many of your class group were male/female? Did gender have an impact on your results?
What things do you think would affect your reaction time?
Why is it important that people have fast reaction times when using their hands like they have been used in this investigation?
### REACTION TIME

<table>
<thead>
<tr>
<th>Catch distance (cm)</th>
<th>Seconds (s)</th>
<th>Milliseconds (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.072</td>
<td>72</td>
</tr>
<tr>
<td>2</td>
<td>0.079</td>
<td>79</td>
</tr>
<tr>
<td>3</td>
<td>0.086</td>
<td>86</td>
</tr>
<tr>
<td>4</td>
<td>0.093</td>
<td>93</td>
</tr>
<tr>
<td>5</td>
<td>0.100</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>0.107</td>
<td>107</td>
</tr>
<tr>
<td>7</td>
<td>0.114</td>
<td>114</td>
</tr>
<tr>
<td>8</td>
<td>0.121</td>
<td>121</td>
</tr>
<tr>
<td>9</td>
<td>0.128</td>
<td>128</td>
</tr>
<tr>
<td>10</td>
<td>0.135</td>
<td>135</td>
</tr>
<tr>
<td>11</td>
<td>0.142</td>
<td>142</td>
</tr>
<tr>
<td>12</td>
<td>0.149</td>
<td>149</td>
</tr>
<tr>
<td>13</td>
<td>0.156</td>
<td>156</td>
</tr>
<tr>
<td>14</td>
<td>0.163</td>
<td>163</td>
</tr>
<tr>
<td>15</td>
<td>0.170</td>
<td>170</td>
</tr>
<tr>
<td>16</td>
<td>0.177</td>
<td>177</td>
</tr>
<tr>
<td>17</td>
<td>0.184</td>
<td>184</td>
</tr>
<tr>
<td>18</td>
<td>0.191</td>
<td>191</td>
</tr>
<tr>
<td>19</td>
<td>0.198</td>
<td>198</td>
</tr>
<tr>
<td>20</td>
<td>0.205</td>
<td>205</td>
</tr>
<tr>
<td>21</td>
<td>0.212</td>
<td>212</td>
</tr>
<tr>
<td>22</td>
<td>0.219</td>
<td>219</td>
</tr>
<tr>
<td>23</td>
<td>0.226</td>
<td>226</td>
</tr>
<tr>
<td>24</td>
<td>0.233</td>
<td>233</td>
</tr>
<tr>
<td>25</td>
<td>0.240</td>
<td>240</td>
</tr>
<tr>
<td>26</td>
<td>0.247</td>
<td>247</td>
</tr>
<tr>
<td>27</td>
<td>0.254</td>
<td>254</td>
</tr>
<tr>
<td>28</td>
<td>0.261</td>
<td>261</td>
</tr>
<tr>
<td>29</td>
<td>0.268</td>
<td>268</td>
</tr>
<tr>
<td>30 or dropped</td>
<td>0.275</td>
<td>275</td>
</tr>
</tbody>
</table>
CALCULATING DOSAGE – MASS VOLUME, RATES AND RATIO Stage 4 - Science and Agriculture

KLA - Science and Agriculture: Calculating Dosage

STAGE
Stage 4

SYLLABUS OUTCOMES
Agricultural Technology
4.3.1 A student implements responsible production of plant and animal products.

4.3.3 A student identifies and uses skills to manage the interactions within plant production enterprises.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 4, measurement and time calculations, understanding mass, volume and capacity, reading a table of data and calculations involving ratios.

ACTIVITY FOCUS
Using numeracy guide, student’s prior knowledge of measuring mass is revised, determined, or developed prior to practical work: Calculates Mass and Volume.
Science and Agriculture: Calculating Dosage Activity

MASS AND VOLUME
The units and symbols for mass and volume are revised.

State that ‘kg’ is an appropriate unit of mass for a sheep and ‘ml’ is an appropriate unit of volume for a drench. Mention that 1 ml is \( \frac{1}{1000} \) of a litre.

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>UNIT</th>
<th>SYMBOL</th>
<th>CONVERTING BETWEEN UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>milligram</td>
<td>mg</td>
<td>1 g = 1 000 mg</td>
</tr>
<tr>
<td></td>
<td>gram</td>
<td>g</td>
<td>1 kg = 1 000 g</td>
</tr>
<tr>
<td></td>
<td>kilogram</td>
<td>kg</td>
<td>1 t = 1 000 kg</td>
</tr>
<tr>
<td></td>
<td>tonne</td>
<td>t</td>
<td></td>
</tr>
<tr>
<td>Capacity</td>
<td>millilitre</td>
<td>mL</td>
<td></td>
</tr>
<tr>
<td>‘How much can it hold’</td>
<td>litre</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td></td>
<td>kilolitre</td>
<td>kL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>megalitre</td>
<td>ML</td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>cubic centimetres</td>
<td>cm(^3)</td>
<td></td>
</tr>
<tr>
<td>‘How much space a liquid takes up’</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ACTIVITY
• Prior to moving to the farm, the students are shown a copy of the dosage chart on the chemical label.
• Students read from the chart to determine the appropriate dose rate for various weights of sheep.
• Students practice calculating the drench volume required for sheep weights that cannot be read directly from the table. This is a straight-forward calculation.

\[
\text{Dose required (ml)} = \text{Dose rate (}\frac{\text{ml}}{\text{kg}}\text{)} \times \text{Sheep mass (kg)}
\]

• Students have the opportunity to draw up water to the volume needed for the sheep weight. Teacher checks that the student is able to manipulate the drench gun and correctly read the gradations on the scale.
• Students round up the sheep and move the scales to near the sheep yard.
• Students check that the sheep scales are tared (zeroed).
• Each sheep is weighed, and the mass is noted.
• The volume of drench required is determined from the table if possible.
• The volume of drench is calculated based on the mass of the sheep if it cannot be read directly from the table.
• The meaning of, and importance of, ‘rounding up’ are discussed.
• Sheep are drenched with the appropriate volume of drench.
• The date, rate and batch number are noted in stock records.
Feeding and Growing Pigs; Slaughter and Selling – Displaying and Interpreting Data Stage 5 – Science and Agriculture

KLA - Science and Agriculture: Feeding and Growing Pigs; Slaughter and Selling

**SYLLABUS OUTCOMES**

**Agricultural technology**

5.2.1 A student explains the interactions within and between the agricultural sector and Australia’s economy, culture and society.

5.3.2 A student investigates and applies responsible marketing principles and processes.

5.3.4 A student explains and evaluates the impact of management decisions on animal production enterprises.

5.4.2 A student evaluates management practices in terms of profitability, technology, sustainability, social issues and ethics.

**NUMERACY LINKS**

Numeracy Skills Framework, Focus Area 1, mental computation and numerical reasoning, understands mathematical information in texts and tasks, estimating and problem solving, applying addition, subtraction, multiplication and division, understanding fractions, decimals, percentages, rates, ratios and understanding money and finance.

**ACTIVITY FOCUS**

Constructs data displays, including tables, column graphs, dot plots and line graphs as appropriate for the data type, calculates with money, solves problems involving money and predicts cost.
Feeding and Growing Pigs; Slaughter and Selling Activity

ACTIVITY
Collect and display data on duration of trial, feed consumed, weight gains and cost to feed.
Calculate the feed conversion ratio.
Calculate the overall cost of producing pig meat.
Calculate the desired sale price to make a profit.
Sell pig meat to staff.
Using numeracy guide, student’s prior knowledge of calculating ratios is revised, determined, or developed prior to practical work.

RATIOS
A ratio is a comparison of numbers in a definite order.
The numbers are expressed in the same units and are called terms of the ratio.
Ratios can be written in the form $a : b$ or $\frac{a}{b}$ or $a$ to $b$.
Ratios can be used to compare more than two numbers e.g. $a : b : c$.
To simplify ratios, we can multiply or divide both sides by the same number.
To divide something into a given ratio find the total number of parts then how much one part is worth.

For example
The increase in mass for a chicken over a 6 week period is 1.6 kg. Over the same period of time, the chicken consumes 5.12 kg. Calculate the feed conversion ratio of the chicken.

Feed Conversion Ratio (FCR) = \( \frac{\text{feed intake (kg)}}{\text{gain (kg)}} \)

\[
FCR = \frac{5.12}{1.6} \\
= 3.2
\]
Year 10 Agriculture Numeracy Exercise - Feeding and Growing Pigs

The pigs arrived at Galston High School on Monday 25/7/2016 and were taken to slaughter on 24/10/2016. How long did we have the pigs (in weeks)?

In this time, we fed the pigs 4 bags/week of 25 kg pig grower pellets. How many bags of pig feed did we purchase?

How many kilograms of pig feed did we purchase?

If each bag of pig grower pellets costs us $21.10, how much did it cost us to feed the pigs?

What was the increase in mass for each pig? Complete the table below.

<table>
<thead>
<tr>
<th>PIG</th>
<th>MASS (KG)</th>
<th>TOTAL GAIN OF MASS (KG)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>29/07/16</td>
<td>03/08/16</td>
</tr>
<tr>
<td>F</td>
<td>6  8   11</td>
<td>11  14  14</td>
</tr>
<tr>
<td>M1</td>
<td>6  7   9</td>
<td>15  15  21</td>
</tr>
<tr>
<td>M2</td>
<td>7  7   9</td>
<td>12  14  20</td>
</tr>
<tr>
<td>M3</td>
<td>6  8   10.5</td>
<td>11  11  15</td>
</tr>
</tbody>
</table>

What was the total gain in pig meat mass for all four pigs?

If it takes 5.5 kg of feed to product 1 kg of pig meat, how did we compare with our pigs? Why do you think our ratio value differs from the expected?
The cost for the slaughter of the four pigs was $200.
The cost to butcher the pigs was $2.50/kg. The masses of the pork carcasses were 51 kg, 48 kg, 35 kg and 25 kg. What was the total mass of pork butchered?

How much did it cost to butcher the pork?

What was the total cost for slaughter and butchering of the pork?

The following teachers purchased the pork for $8 per kilo. Work out the cost for each teacher, and the total of the money made from the sale of the pork?

<table>
<thead>
<tr>
<th>TEACHER</th>
<th>MASS OF PORK PURCHASED (KG)</th>
<th>TOTAL COST $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petrulis</td>
<td>25.5</td>
<td></td>
</tr>
<tr>
<td>Van Baarle</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Wagschall</td>
<td>25.5</td>
<td></td>
</tr>
<tr>
<td>Norrie</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Groth</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Bunn</td>
<td>17.5</td>
<td></td>
</tr>
<tr>
<td>Al Mogawish</td>
<td>17.5</td>
<td></td>
</tr>
<tr>
<td>Gage</td>
<td>12.5</td>
<td></td>
</tr>
<tr>
<td>Tazwell &amp; Graice</td>
<td>12.5</td>
<td></td>
</tr>
<tr>
<td>Total from sale of pork</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Calculate the profit or loss made by the school for selling the pork. Make sure you include the expenses of feeding, slaughtering and butchering the pigs in your calculations.

How much should we have charged for the sale of the pork to cover all our costs?
KLA - ART: Oil Burner

STAGE
Stage 4

SYLLABUS OUTCOMES
Visual Arts
4.6 A student selects different materials and techniques to make artworks.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 4, measurement, applying concepts of measurement and converting units, applying concepts of volume and applying concepts of area.

ACTIVITY FOCUS
Understanding and applying the concepts of length, area, mass, volume and capacity cost.
Oil Burner Activity

Students will complete the following activity in the preparation of their oil burner. Students will need to measure and convert these figures and have a basic understanding of volume and its contribution to the functionality of the object.

Ceramic Work Planning

Complete the following activities in preparation to the creation of your ceramic piece.

Use this circle to answer the following questions:
This circle’s radius is ________________, the diameter of this circle is ________________

Use a ruler and measure the radius. Use a compass to draw a circle this size on the card provided. This will be the template you use to create the base for your oil burner.

What do we mean when we talk about the volume of an object?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Why is volume of the internal space important when constructing an oil burner?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
When building our oil burner, we need to construct the object by building layers. We do this by rolling coils and layering them on top of each other.

Looking at examples in the classroom circle the correct answers.

The coils will need to get (longer, thicker, shorter, thinner) as the oil burner gets taller.

When losing mass from the coils during smoothing I will need to make sure the coils are (thick, thin, weak).

We will also be using a pinch pot to form the oil bowl on our burner. When thinking of the volume of liquid it will need to hold what are the three things you will need to satisfy for the best result:

1. 
2. 
3. 

What is the ideal diameter of the pinch pot portion of your oil burner in mm?
CALCULATING DISTANCE USING RATIO SCALE ON A MAP – MAPPING, SCALE AND RATIO
Stage 4 - HSIE

KLA - HSIE: Calculating Distance Using Ratio Scale on a Map

STRAND AND SUBSTRAND
Geography - Stage 4

SYLLABUS OUTCOMES
HSIE
4.1 A student identifies and gathers geographical information.
4.2 A student organises and interprets geographical information.
4.4 A student uses a range of geographical tools.

NUMERACY LINKS
Numeracy Skills Framework, Focus Area 1, mental computation and numerical reasoning, understanding fractions, decimals, percentage, rates and ratios and applying addition, subtraction, multiplication and division.

ACTIVITY FOCUS
How to measure distance on a map to calculate the actual distance using the scale on a map.
### Calculating Distance Using Ratio Scale on a Map Activity

**ACTIVITY**

Students will gain a better understanding of how to find the distance from one place to another by measuring the distance on a map and calculating the actual distance in real life by using the map's ratio scale.

**MATERIALS**

- Large poster maps
- Whiteboard and markers
- Student note books and pens
- Worksheet “Scales Again”

**METHOD**

1. Revise how to find distances from one place to another, by measuring the distance on a map (using a ruler/paper/string/divider) then convert this to the actual distance using the scale.
2. Look at maps that have scale shown in a number of ways – statement, ratio, linear scale.
3. Explain that the **ratio scale** is more accurate to use when finding distances and why.
4. Have students complete the **worksheet** “Distances” cloze for notes.
5. Provide a number of examples of how to convert the distance on a map to the actual distance using a **ratio scale**.

**Example:** 1 : 100 000

Explain that with a ratio the units must be the same on each side. The units used to measure a distance on a map are usually cm's (using a ruler). Therefore, the units in a ratio scale should be cm's.

1 cm on the map = 100 000 cm in real life

We would not give a distance from GHS to Galston shops as 100 000 cm's. How would we give this distance? (1 km). We should always convert the scale of 1 cm on the map to metres or kilometres in real life.

1 cm = 100 000 cm

= 1 000 m (to convert to m we need to know how many cm in a m = 100, so we need to divide by 100 which means moving the decimal point 2 places to the left)

= 1 km (1000 metres in a km, so divide by 1000 – move the decimal point 3 places to the left)

**FURTHER ACTIVITY**

If the distance on the map is 5 cm, to calculate the actual distance you need to multiply this by the answer above (that 1 cm on the map = 1 km for actual distance). Therefore, the actual distance is 5 kms.

a) 1 : 1 500 000 (this could be from a map on a wall, etc.)

1 cm on map = 1 500 000 cm in real life

= 15 000 m

= 15 km

Therefore, if the distance on the map = 2.5 cm the actual distance would be 37.5 km (2.5 × 15 = 37.5 km)

### DISTANCES

The distance between two points can be found by measuring the distance on a map with the following methods:

1. Statement - one centimetre represents one kilometre
2. Ratio - 1 : 100 000 or fraction - \( \frac{1}{100 \ 000} \)
3. Linear scale - 0 1 2 3

Scale may be expressed as a:

- **Statement** - one centimetre represents one kilometre
- **Ratio** - 1 : 100 000 or fraction - \( \frac{1}{100 \ 000} \)
- **Linear scale** - 0 1 2 3

<table>
<thead>
<tr>
<th>RATIO SCALE</th>
<th>DISTANCE ON MAP (CM)</th>
<th>ACTUAL DISTANCE (CM)</th>
<th>ACTUAL DISTANCE (M)</th>
<th>ACTUAL DISTANCE (KM)</th>
<th>CONVERT THESE MAP DISTANCES TO ACTUAL DISTANCES (SHOW WORKING)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 : 100 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.2 cm on map =</td>
</tr>
<tr>
<td>1 : 250 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 cm on map =</td>
</tr>
<tr>
<td>1 : 2 000 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.6 cm on map =</td>
</tr>
<tr>
<td>1 : 4 670 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.5 cm on map =</td>
</tr>
</tbody>
</table>
PURPOSE

The purpose of this sequence of activities is so that students become familiar with and understand equivalent fractions. They will learn how to rename fractions, identify equivalent fractions and find the Highest Common Factor and Lowest Common Multiple. They will also learn to express fractions in simplest form and express quantities of a fraction of another. Crookwell High School created these numeracy resources as part of the ISNIP program at their school and implemented these activities with their Stage 4 students to develop their understanding of how to understand equivalent fractions.
Equivalent Fractions Module - Multi Stages

STRAND AND SUBSTRAND
Number and Algebra - Fractions, Decimals and Percentages - Stage 2, 3 and 4

SYLLABUS OUTCOME
MA2-7NA A student represents, models and compares commonly used fractions and decimals.
MA3-7NA A student compares, orders and calculates with fractions, decimals and percentages.
MA4-5NA A student operates with fractions, decimals and percentages.
MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.
MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.
MA3-1WM A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.
MA3-2WM A student selects and applies appropriate problem solving strategies, including use of digital technologies, in undertaking investigations.
MA3-3WM A student gives a valid reason for supporting one possible solution over another.
MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.
MA4-2WM A student applies appropriate mathematical techniques to solve problems.
MA4-3WM A student recognises and explains mathematical relationships using reasoning.

NUMERACY LINKS
Numeracy Skills Framework, Aspects of Numeracy, Focus Area 1, understanding fractions, decimals, percentages, rates, ratios, end of Stage 2, 3 and 4

ACTIVITY FOCUS
In this module, students learn to identify and create equivalent fractions through 6 mini lessons.

Equivalent Fractions Module: Mini Lessons Activities

Students to complete 6 mini lessons
Lesson 1: Renaming fractions, intro to equivalent fractions
Lesson 2: Generating equivalent fractions
Lesson 3: Highest common factor
Lesson 4: Writing fractions in simplest form
Lesson 5: Equivalent fractions and time
Lesson 6: Expressing a quantity as a fraction of another
Lesson 1 Activity

MODULE
Equivalent fractions

LESSON 1

Learning objectives
Students learn to:

• Rename fractions as one whole.
• Record equivalent fractions using diagrams and numerals.
• Model, compare and represent fractions with denominators of 2, 4, 8 and 3, 6 and 5, 10, 100 using diagrams, concrete materials and number lines.

We could re-write each of these fractions as 1.

\[
\begin{align*}
\frac{3}{3} & \quad \frac{4}{4} & \quad \frac{7}{7} \\
\end{align*}
\]

What do you notice about the fractions and the number of parts shaded in each shape above?

These fractions all represent the same amount as each other.

\[
\begin{align*}
\frac{1}{2} & \quad \frac{2}{4} & \quad \frac{4}{8} \\
\end{align*}
\]

The shapes have been divided into different amounts and the number of parts shaded is different but the same amount of each shape is shaded, that is half the shape.

Remember

Renaming fractions as a whole

When the numerator (the number on the top of a fraction) and the denominator (the number on the bottom of the fraction) are the same the fraction can be written as 1.

Equivalent fractions

Fractions can be written in many different ways but still represent the same amount.
**ACTIVITY**

**Equipment**
Fraction cards

Put the cards in groups showing equivalent fractions.
For each fraction given below, draw 2 diagrams showing equivalent fractions. Write the fraction below each diagram.

<table>
<thead>
<tr>
<th>FRACTIONS</th>
<th>DIAGRAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) $\frac{1}{3}$</td>
<td></td>
</tr>
<tr>
<td>b) $\frac{1}{5}$</td>
<td></td>
</tr>
<tr>
<td>c) $\frac{1}{2}$</td>
<td></td>
</tr>
<tr>
<td>d) $\frac{2}{3}$</td>
<td></td>
</tr>
<tr>
<td>e) $\frac{3}{4}$</td>
<td></td>
</tr>
</tbody>
</table>
Templates to Model Fractions
These fractions all represent the same amount.

What do you notice about the numerators (the numbers on the top of the fractions) as you look across from left to right?

What do you notice about the denominators (the numbers on the bottom of the fraction) as you look across from left to right?

These shaded fractions also represent the same amounts.

What do you notice about the numerators and denominators?
Remember
When finding equivalent fractions
• Multiply or divide both the numerator and denominator by the same number.

**ACTIVITY**
For each fraction in the table, write 5 equivalent fractions by multiplying the numerator and denominator by the number indicated:

<table>
<thead>
<tr>
<th></th>
<th>×2</th>
<th>×3</th>
<th>×4</th>
<th>×5</th>
<th>×6</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>$\frac{1}{2}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>$\frac{1}{5}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c)</td>
<td>$\frac{1}{3}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d)</td>
<td>$\frac{3}{4}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e)</td>
<td>$\frac{2}{3}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lesson 3 Activity

MODULE
Equivalent fractions

LESSON 3

Learning objectives
Gain an understanding of highest common factor.

When finding the highest common factor
• List all the factors of both numbers.
• Identify the factors common to both numbers.
• Identify the highest of these factors which is common to both numbers. This is the Highest Common Factor (HCF).

ACTIVITY

Equipment
Counters, or a 100’s chart or a times table chart, black pen, green pen, red pen.

1. List all the factors for each pair of numbers below.
2. Circle all the common factors in green pen.
3. Circle the highest common factor in red pen, then write your answer in the space provided.

1.

<table>
<thead>
<tr>
<th>FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
</tr>
<tr>
<td>15</td>
</tr>
</tbody>
</table>

HCF = ____________

2.

<table>
<thead>
<tr>
<th>FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
</tr>
<tr>
<td>12</td>
</tr>
</tbody>
</table>

HCF = ____________

3.

<table>
<thead>
<tr>
<th>FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
</tr>
<tr>
<td>12</td>
</tr>
</tbody>
</table>

HCF = ____________

Cutting Through Numeracy Problems
<table>
<thead>
<tr>
<th>FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCF =</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>25</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>HCF =</td>
</tr>
<tr>
<td>14</td>
</tr>
<tr>
<td>21</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>HCF =</td>
</tr>
<tr>
<td>36</td>
</tr>
<tr>
<td>48</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>HCF =</td>
</tr>
<tr>
<td>108</td>
</tr>
<tr>
<td>63</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Lesson 4 Activity

MODULE
Equivalent fractions

LESSON 4
Learning objectives
Students learn to write fractions in simplest form.

Fractions are in simplest form when we write the equivalent fraction with the ___________ denominator.

All these fractions represent the same amount. They are equivalent fractions. The simplest form of these fractions is __________, because it is the equivalent fraction with the smallest denominator.

To find these equivalent fractions we will __________ the numerator and denominator by the HCF or ________________________________ .

TASK
Write $\frac{6}{12}$ in its simplest form.

1.
What is the HCF, or highest common factor of 6 and 12?

<table>
<thead>
<tr>
<th></th>
<th>FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>HCF = ___________</td>
</tr>
</tbody>
</table>

2.
Now, we will divide both the numerator and denominator by this HCF.

$$\frac{6}{12} \div \frac{\Box}{\Box} = \frac{\Box}{\Box}$$

Remember
When simplifying fractions
• A fraction in its simplest form is the equivalent fraction with the smallest denominator.
• Identify the highest common factor of the numerator and denominator.
• Divide both the numerator and denominator by this highest common factor.
ACTIVITY

Re-write each fraction in its simplest form. Use the tables to help identify the highest common factors (HCF). Divide both the numerator and denominator by this highest common factor to get the simplified fraction.

<table>
<thead>
<tr>
<th>FRACTION</th>
<th>FACTORS</th>
<th>HCF</th>
<th>SIMPLIFIED FRACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/15</td>
<td>10:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8/12</td>
<td>8:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9/12</td>
<td>9:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15/25</td>
<td>15:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lesson 5 Activity

MODULE
Equivalent fractions

LESSON 5

Learning objectives
Students learn to apply equivalent fractions to units of time.

TASK
Model the following time fractions to students with a clock:

<table>
<thead>
<tr>
<th>MINUTES</th>
<th>FRACTION OF AN HOUR 1 HOUR = 60 MINUTES</th>
<th>SIMPLIFIED FRACTION OF AN HOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 min</td>
<td>60/60</td>
<td>1 hour</td>
</tr>
<tr>
<td>30 min</td>
<td>30/60</td>
<td>1/2 hour</td>
</tr>
<tr>
<td>15 min</td>
<td>15/60</td>
<td>1/4 hour</td>
</tr>
<tr>
<td>10 min</td>
<td>10/60</td>
<td>1/6 hour</td>
</tr>
<tr>
<td>45 min</td>
<td>45/60</td>
<td>3/4 hour</td>
</tr>
<tr>
<td>20 min</td>
<td>20/60</td>
<td>1/3 hour</td>
</tr>
<tr>
<td>5 min</td>
<td>5/60</td>
<td>1/12 hour</td>
</tr>
<tr>
<td>1 min</td>
<td>1/60</td>
<td>1/60 hour</td>
</tr>
<tr>
<td>40 min</td>
<td>40/60</td>
<td>2/3 hour</td>
</tr>
</tbody>
</table>

When telling time with fractions
• The small hand indicates the hour and the large hand indicates the minutes.
• Instead of using $\frac{3}{4}$ past the hour, we can say $\frac{1}{4}$ to the next hour.
• Apply knowledge of equivalent fractions to convert between units of time, e.g. 15 minutes is the same as $\frac{15}{60}$ of an hour, which is the same as $\frac{1}{4}$ of an hour.
ACTIVITY

Equipment
• Time flash cards with clocks showing times in quarter hours
• Time flash cards with words in quarter hours
• Clock with moveable hands

TASK
Choose 6 clock cards and write the time on each, in words.

Card 1:  Card 2:

Card 3:  Card 4:

Card 5:  Card 6:

Choose 6 time cards and show the time on the clock by moving the hands.
Lesson 6 Activity

MODULE
Equivalent fractions

LESSON 6

Learning objectives
Students learn to express a quantity as a fraction of another.

Expressing one quantity as a fraction of another
When expressing one quantity as a fraction of another, the quantities must be in the same units.

To express 15 minutes as a fraction of 1 hour. We must consider 1 hour as 60 minutes. And then, we would express 15 minutes as a fraction of 60 minutes.

\[
\frac{15 \text{ minutes}}{1 \text{ hour}} = \frac{15 \text{ minutes}}{60 \text{ minutes}} = \frac{15}{60} = \frac{\square}{\square}
\]

Remember
When expressing one quantity as fractions of another
- Both quantities must be in the same units.
- The first quantity becomes the numerator.
- The second quantity becomes the denominator.

ACTIVITY
Complete the following activities.

1. Express 10 as a fraction of 15, giving your answer in its simplest form.

\[
\frac{\square}{\square} = \frac{\square}{\square}
\]

2. Express 9 as a fraction of 12, giving your answer in its simplest form.

\[
\frac{\square}{\square} = \frac{\square}{\square}
\]

3. Express 15 as a fraction of 25, giving your answer in its simplest form.

\[
\frac{\square}{\square} = \frac{\square}{\square}
\]
4. Express 14 as a fraction of 21, giving your answer in its simplest form.

\[
\frac{\square}{\square} = \frac{\square}{\square}
\]

5. Express 20 minutes as a fraction of 1 hour, giving your answer in its simplest form.

\[
\frac{\square}{\square} = \frac{\square}{\square}
\]

6. Express 50 cents as a fraction of 1 dollar, giving your answer in its simplest form.

\[
\frac{\square}{\square} = \frac{\square}{\square}
\]

7. Express 25 centimetres as a fraction of 1 metre, giving your answer in its simplest form.

\[
\frac{\square}{\square} = \frac{\square}{\square}
\]
Multiplying and Dividing Fractions and Fractions of Quantities

**STRAND AND SUBSTRAND**
Number and Algebra - Fractions, Decimals and Percentages - Stage 2, 3 and 4

**SYLLABUS OUTCOME**

MA2-7NA  A student represents, models and compares commonly used fractions and decimals.

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**NUMERACY LINKS**
Numeracy Skills Framework, Aspects of Numeracy, Focus Area 1, understanding fractions, decimals, percentages, rates and ratios, end of Stage 2, 3 and 4.

**ACTIVITY FOCUS**
In this module, students learn to:

- Multiply fractions by a whole by using repeated addition.
- Find fractions of quantities (unit fractions only) leading to simple questions like two-fifths of 30.
- Multiplying fractions, and simplifying answers.
- Dividing fractions and simplifying answers.

---

**Multiplying and Dividing Fractions Module: Mini Lessons Activities**

**Students to complete 4 mini lessons**
Lesson 1: Multiplying fractions by a whole
Lesson 2: Fractions of quantities
Lesson 3: Multiplying fractions
Lesson 4: Dividing fractions
Lesson 1 Activity

MODULE
Multiplying and dividing fractions and fractions of quantities

LESSON 1

Learning objectives
Students learn to multiply fractions by a whole by using repeated addition.

1.

Use diagrams to assist with the following:

a) \[ 5 \times \frac{1}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \]

b) \[ 3 \times \frac{1}{4} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \]

c) \[ 4 \times \frac{1}{5} = \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} = \]

d) \[ 3 \times \frac{1}{2} = \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = \]

Remember
When multiplying fractions
• We can treat it as a repeated addition of fractions.
1. Using the diagrams to assist if needed, complete each question. Try to write the fraction in its simplest form.

   a) \(3 \times \frac{1}{5} = \frac{\square}{\square}\)
   b) \(\frac{1}{7} \times 6 = \frac{\square}{\square}\)
   c) \(4 \times \frac{1}{8} = \frac{\square}{\square}\)
   d) \(2 \times \frac{2}{5} = \frac{\square}{\square}\)

2. For the following: Divide the shape into the number of parts needed.

   a) \(2 \times \frac{1}{4} = \frac{\square}{\square}\)
   b) \(2 \times \frac{1}{5} = \frac{\square}{\square}\)
   c) \(3 \times \frac{2}{8} = \frac{\square}{\square}\)
Lesson 2 Activity

MODULE
Multiplying and dividing fractions and fractions of quantities

LESSON 2

Learning objectives
Students learn to calculate fraction of quantities (unit fractions only) leading to simple questions like two-fifths of 30 (including solving word problems).

Remember
When finding fractions of quantities
• We can divide the quantity by the denominator and then multiply by the numerator.

ACTIVITY

Equipment
25 counters

1.
Use the counters to represent one whole group. Then divide them into parts as necessary, and count the number of parts.

\[
\begin{align*}
\text{a)} & \quad \frac{1}{5} \times 25 = \quad \quad \\
\text{b)} & \quad \frac{1}{7} \times 14 = \\
\text{c)} & \quad \frac{5}{6} \times 12 = \\
\text{d)} & \quad \frac{2}{5} \times 20 = \\
\text{e)} & \quad \frac{2}{3} \times 18 = \\
\end{align*}
\]

f) There are 25 students in a class and \(\frac{3}{5}\) of these students play hockey. How many students play hockey?

\[
\text{students play hockey.}
\]

g) If you had 24 jelly beans in a bag and \(\frac{3}{4}\) fell out through a hole, how many jelly beans did you lose?

\[
\text{jelly beans were lost through the hole in the bag.}
\]
Lesson 3 Activity

MODULE
Multiplying and dividing fractions and fractions of quantities

LESSON 3
Learning objectives
Students learn to multiply fractions, and simplify answers.

Remember
When finding fractions of fractions
• We can multiply the denominators and then the numerators. Simplify if necessary.

ACTIVITY

1. Answer the questions below.

a) \[
\frac{1}{3} \times \frac{1}{5} = \frac{}{}
\]

b) \[
\frac{3}{5} \times \frac{2}{7} = \frac{}{}
\]

c) \[
\frac{2}{3} \times \frac{1}{4} = \frac{}{} = \frac{}{}
\]

d) \[
\frac{3}{4} \times \frac{5}{8} = \frac{}{} = \frac{}{}
\]

e) \[
\frac{3}{2} \times \frac{1}{4} = \frac{}{}
\]

f) \[
\frac{4}{5} \times \frac{1}{4} = \frac{}{} = \frac{}{}
\]

This one is a bit harder, but if you have been doing the other ones without the diagrams have a go.

g) \[
\frac{3}{2} \times \frac{5}{4} = \frac{}{} = \frac{}{}
\]

2. Rebecca has a piece of cake which was a quarter of the birthday cake. She cuts it into halves and gives Sandee a piece. How much of the original cake does Sandee have?
Lesson 4 Activity

MODULE
Multiplying and dividing fractions and fractions of quantities

LESSON 4

Learning objectives
Students learn to divide fractions, and simplify answers.

We can divide fractions by multiplying the first fraction by the reciprocal of the second fraction, which is the fraction that is flipped over.

\[
\frac{3}{4} \div \frac{1}{2} = \frac{3}{4} \times \frac{2}{1} = \frac{3 \times 2}{4 \times 1} = \frac{6}{4} = \frac{3}{2}
\]

Remember
When dividing fractions
• We “leave, times, flip” and complete the operation as a multiplication.

ACTIVITY

1. Answer the questions below. Simplify your answers where necessary, if you can.

a) \[\frac{1}{3} \div \frac{1}{5} = \frac{1}{3} \times \frac{5}{1} = \frac{1 \times 5}{3 \times 1} = \frac{5}{3}\]

b) \[\frac{3}{5} \div \frac{2}{7} = \frac{3}{5} \times \frac{7}{2} = \frac{3 \times 7}{5 \times 2} = \frac{21}{10}\]

c) \[\frac{2}{3} \div \frac{1}{4} = \frac{2}{3} \times \frac{4}{1} = \frac{2 \times 4}{3 \times 1} = \frac{8}{3}\]

d) \[\frac{3}{4} \div \frac{5}{8} = \frac{3}{4} \times \frac{8}{5} = \frac{3 \times 8}{4 \times 5} = \frac{24}{20} = \frac{6}{5}\]

2. Write the mixed numerals as improper fractions first to complete the questions.

a) \[\frac{1}{2} \div \frac{1}{4} = \frac{1}{2} \div \frac{1}{4} = \frac{1}{2} \times \frac{4}{1} = \frac{1 \times 4}{2 \times 1} = \frac{4}{2} = 2\]

b) \[\frac{3}{4} \div \frac{1}{2} = \frac{3}{4} \times \frac{2}{1} = \frac{3 \times 2}{4 \times 1} = \frac{6}{4} = \frac{3}{2}\]

3. Brian and his friends decide to take turns playing a computer game. Each person plays for \[2 \frac{1}{2}\] minutes. If altogether they played for \[37 \frac{1}{2}\] minutes, how many people had a turn?
Ordering Fractions

**STRAND AND SUBSTRAND**
Number and Algebra - Fractions, Decimals and Percentages - Stage 2, 3 and 4

**SYLLABUS OUTCOME**

**MA2-7NA** A student represents, models and compares commonly used fractions and decimals.

**MA3-7NA** A student compares, orders and calculates with fractions, decimals and percentages.

**MA4-5NA** A student operates with fractions, decimals and percentages.

**MA2-1WM** A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

**MA2-3WM** A student checks the accuracy of a statement and explains the reasoning used.

**MA3-1WM** A student describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions.

**MA3-2WM** A student selects and applies appropriate problem solving strategies, including use of digital technologies, in undertaking investigations.

**MA3-3WM** A student gives a valid reason for supporting one possible solution over another.

**MA4-1WM** A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols.

**MA4-2WM** A student applies appropriate mathematical techniques to solve problems.

**MA4-3WM** A student recognises and explains mathematical relationships using reasoning.

**NUMERACY LINKS**
Numeracy Skills Framework, Aspects of Numeracy, Focus Area 1, understanding fractions, decimals, percentages, rates, ratios, end of Stage 2, 3 and 4.

**ACTIVITY FOCUS**
In this module, students learn to:

- Place halves, quarters, eighths and thirds on a number line between 0 and 1 (one type of denominator at a time).
- Place halves, thirds and quarters on number lines that extend beyond 1 (one type of denominator at a time).
- Compare fractions using diagrams, number lines and by referring to the denominator (unit fractions only).
- Compare and order fractions with easy denominators, one denominator at a time.
- Place fractions on a number line between 0 and 1.
- Order fractions with related denominators.
- Order fractions negative and positive fractions, first with the same denominator/numerator and then random fractions.
- Order mixed numerals, proper fraction and improper fractions.

**Ordering Fractions Module: Mini Lessons Activities**

**Students to complete 7 mini lessons**
Lesson 1: Ordering fractions with the same denominator.

Lesson 2: Students are introduced to ordering fractions with a mixed numeral

Lesson 3: Compare fractions

Lesson 4: Order and compare fractions

Lesson 5: Order fractions with related denominators

Lesson 6: Order positive and negative fractions

Lesson 7: Order mixed numerals, proper fraction and improper fractions
Lesson 1 Activity

MODULE
Ordering fractions

LESSON 1
Learning objectives
Students learn to order fractions with the same denominator.

Each shape above is divided into the same number of parts. The number of parts in each shape is shown with the number on the bottom of the fraction, the denominator.

The number of parts shaded in each shape above is getting bigger.

What do you notice about the fractions written below each box?

Remember
Ordering fractions with the same denominator
• As the numerator gets bigger the fraction is getting bigger.
## Lesson 2 Activity

### MODULE
Ordering fractions

### LESSON 2

#### Learning objectives
Students are introduced to ordering fractions with a mixed numeral.

#### Remember
Ordering fractions from 0 to more than 1

- Look first at the whole number then if the whole numbers are the same, look at the proper fraction. As the numerator gets bigger the fraction is getting bigger.

<table>
<thead>
<tr>
<th>DIAGRAM</th>
<th>FRACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram" /></td>
<td>$1 \frac{1}{3}$</td>
</tr>
<tr>
<td><img src="image2" alt="Diagram" /></td>
<td>$1 \frac{2}{3}$</td>
</tr>
<tr>
<td><img src="image3" alt="Diagram" /></td>
<td>2</td>
</tr>
<tr>
<td><img src="image4" alt="Diagram" /></td>
<td>$2 \frac{1}{3}$</td>
</tr>
<tr>
<td><img src="image5" alt="Diagram" /></td>
<td>$2 \frac{2}{3}$</td>
</tr>
<tr>
<td><img src="image6" alt="Diagram" /></td>
<td>3</td>
</tr>
</tbody>
</table>
Lesson 3 Activity

MODULE
Ordering fractions

LESSON 3
Learning objectives
Students learn to order unit fractions of any denominator.

What do you notice about the size of the shaded section in each box as the denominator gets bigger?

Remember
Ordering fractions with a numerator of 1
• As the denominator gets bigger the size of the fraction gets smaller.
**Lesson 4 Activity**

**MODULE**
Ordering fractions

**LESSON 4**

**Learning objectives**
Students learn to compare and order fractions with easy denominators, one denominator at a time.

**Remember**

Ordering fractions with the same denominator

• As the numerator gets bigger the size of the fraction gets bigger.

**ACTIVITY**
Order each set of fractions from smallest to biggest.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>(\frac{2}{3}, \frac{1}{3})</td>
</tr>
<tr>
<td>b)</td>
<td>(\frac{5}{8}, \frac{3}{8}, \frac{6}{8}, \frac{2}{8}, \frac{4}{8}, \frac{1}{8}, \frac{7}{8})</td>
</tr>
<tr>
<td>c)</td>
<td>(\frac{3}{4}, \frac{1}{4}, \frac{2}{4})</td>
</tr>
</tbody>
</table>

Remember that if the numerator is 0, we can write the fraction as 0, for example \(0,\frac{2}{3}\) can be written as 0. If the numerator is the same as the denominator, we can write the fraction as 1, for example \(\frac{2}{3}\) can be written as 1.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>d)</td>
<td>(\frac{2}{3}, 0, \frac{1}{3}, \frac{3}{3})</td>
</tr>
<tr>
<td>e)</td>
<td>(\frac{1}{2}, 0, 1)</td>
</tr>
<tr>
<td>f)</td>
<td>(1, \frac{3}{8}, \frac{7}{8}, 0, \frac{2}{8}, \frac{5}{8}, \frac{4}{8}, \frac{1}{8}, \frac{6}{8})</td>
</tr>
</tbody>
</table>
Lesson 5 Activity

MODULE
Ordering fractions

LESSON 5

Learning objectives
Students learn to:

• Place fractions on a number line between 0 and 1.
• Order fractions with related denominators.

These fractions all represent the same amount as each other.

• These fractions represent the same amount as each other.
• The shapes have been divided into different amounts and the number of parts shaded is different but the same amount of each shape is shaded.
• We can use this information to decide where different fractions lie on a number line.
• We can also compare fractions with different denominators, and then place these fractions on a number line also.

Remember
Placing fractions on a number line

• Decide where one fraction goes on the number line and then work your way through other fractions deciding where they are located on the number line, as well as in comparison to the other fractions.

Ordering fractions with related denominators

• Decide which fraction is the smallest (if writing in ascending order, from smallest to biggest) and write it. Decide which fraction is the smallest of those left over, and write it. Keep repeating this process until there are no fractions left.
**ACTIVITY**

Place the following fractions on a number line between 0 and 1, then re-write each set of fractions in ascending order (from smallest to biggest).

<table>
<thead>
<tr>
<th>a)</th>
<th>( \frac{1}{2} ), ( \frac{3}{8} ), ( \frac{2}{4} ), ( \frac{3}{8} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>\hline 0 \quad \quad \quad \quad \quad \quad \quad \quad \quad 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b)</th>
<th>( \frac{1}{3} ), ( \frac{1}{5} ), ( \frac{5}{2} ), ( \frac{2}{3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>\hline 0 \quad \quad \quad \quad \quad \quad \quad \quad \quad 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>c)</th>
<th>( \frac{1}{5} ), ( \frac{2}{7} ), ( \frac{2}{3} ), ( \frac{3}{4} ), ( \frac{2}{5} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>\hline 0 \quad \quad \quad \quad \quad \quad \quad \quad \quad 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>d)</th>
<th>( \frac{3}{5} ), ( \frac{1}{7} ), ( \frac{2}{3} ), ( \frac{1}{5} ), ( \frac{3}{8} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>\hline 0 \quad \quad \quad \quad \quad \quad \quad \quad \quad 1</td>
</tr>
</tbody>
</table>

Place the following fractions on a number line between 0 and 1, then re-write each set of fractions in descending order (from biggest to smallest).

<table>
<thead>
<tr>
<th>a)</th>
<th>( \frac{1}{2} ), ( \frac{1}{8} ), ( \frac{3}{4} ), ( \frac{1}{4} ), ( \frac{7}{8} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>\hline 0 \quad \quad \quad \quad \quad \quad \quad \quad \quad 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b)</th>
<th>( \frac{1}{5} ), ( \frac{1}{7} ), ( \frac{2}{3} ), ( \frac{3}{4} ), ( \frac{2}{5} ), ( \frac{8}{6} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>\hline 0 \quad \quad \quad \quad \quad \quad \quad \quad \quad 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>c)</th>
<th>( \frac{1}{2} ), ( \frac{3}{7} ), ( \frac{2}{3} ), ( \frac{3}{4} ), ( \frac{1}{2} ), ( \frac{5}{6} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>\hline 0 \quad \quad \quad \quad \quad \quad \quad \quad \quad 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>d)</th>
<th>( \frac{0}{5} ), ( \frac{4}{6} ), ( \frac{2}{3} ), ( \frac{2}{4} ), ( \frac{7}{8} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>\hline 0 \quad \quad \quad \quad \quad \quad \quad \quad \quad 1</td>
</tr>
</tbody>
</table>
Lesson 6 Ordering Fractions

MODULE
Ordering fractions

LESSON 6
Learning objectives
Students learn to order negative and positive fractions, first with the same denominator/numerator and then random fractions.

As the fractions get bigger they move further away from zero. The negative sign or positive sign shows us which side of zero the fraction is located. Negative fractions lie left of the zero and positive fractions lie right of the zero.

Remember
Ordering positive and negative fractions
• As the fraction gets bigger it moves further away from zero. Fractions with a negative sign in front of them are on the left hand side of the zero on a number line.

Re-write each set of fractions in as they would appear from left to right on a number line. In other words in ascending order.

<table>
<thead>
<tr>
<th>a)</th>
<th>( \frac{1}{5}, -\frac{3}{5}, \frac{3}{5}, \frac{2}{5}, 0 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>b)</td>
<td>( \frac{1}{4}, \frac{1}{4}, \frac{3}{4}, -\frac{3}{4}, -1, 0, 1 )</td>
</tr>
<tr>
<td>c)</td>
<td>( \frac{1}{5}, 1, -\frac{1}{7}, -\frac{1}{9}, \frac{1}{8}, \frac{1}{6}, \frac{1}{2}, 0, -1, -\frac{1}{2} )</td>
</tr>
<tr>
<td>d)</td>
<td>( \frac{1}{2}, 0, \frac{3}{8}, 1, \frac{1}{7}, \frac{1}{4}, \frac{5}{8}, -1, \frac{7}{8} )</td>
</tr>
<tr>
<td>e)</td>
<td>( \frac{1}{2}, 0, \frac{3}{4}, 1, -\frac{3}{7}, -\frac{1}{4}, -\frac{5}{8}, -1, -\frac{5}{6} )</td>
</tr>
</tbody>
</table>
**Lesson 7 Activity**

**MODULE**  
Ordering fractions

**LESSON 7**

**Learning objectives**  
Students learn to order mixed numerals, proper fractions and improper fractions.

**Proper fractions** are fractions less than _______.  
The numerator (the number on the top of the fraction) is _____________ than the denominator (the number on the bottom of the fraction).

**Improper fractions** are fractions greater than _______.  
The numerator (the number on the top of the fraction) is _____________ than the denominator (the number on the bottom of the fraction).

**Mixed numerals** have a whole number and a ________________ together.

**Remember**  
Ordering proper fractions, improper fractions and mixed numerals  
• Re-write all the improper fractions as mixed numerals, or re-write all the mixed numerals as improper fractions to make them easier to compare.

**ACTIVITY**  
Re-write each set of fractions in ascending order (from smallest to largest).

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>1 5 1 4 1 3 1 2 1 1 0 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
<td>1 5 7 7 4 0 1</td>
</tr>
<tr>
<td>3</td>
<td>1 5 1 8 6 0 1 1 5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1 4 3 1 7 1 2 0 1 7 4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0 1 1 3 1 5 1 8 1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1 8 0 1 3 1 1 1 2</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1 6 1 5 5 1 4 0 1</td>
<td></td>
</tr>
</tbody>
</table>
What Are Fractions?

**STRAND AND SUBSTRAND**
Number and Algebra - Fractions, Decimals and Percentages - Stage 2 and 3

**SYLLABUS OUTCOME**
MA2-7NA A student represents, models and compares commonly used fractions and decimals.
MA3-7NA A student compares, orders and calculates with fractions, decimals and percentages.
MA2-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.
MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.
MA3-1WM A student uses appropriate terminology to describe, and symbols to represent, mathematical ideas.
MA2-3WM A student checks the accuracy of a statement and explains the reasoning used.

**NUMERACY LINKS**
Numeracy Skills Framework, Aspects of Numeracy, Focus Area 1, understanding fractions, decimals, percentages, rates, ratios, end of Stage 2, 3 and 4.

**ACTIVITY FOCUS**
In this module, students learn about fractions and what they represent.

---

**Lesson 1 Activity**

**MODULE**
What are fractions?

**LESSON 1**

**Learning objectives**
Students learn to model, identify and name fractions.

**ACTIVITY**
Modelling, naming and identifying fractions.

A fraction represents a portion of a whole. Diagrams can represent fractions but it is more time effective to be able to use numbers to represent a fraction.

How many parts are shaded in the diagram?

How many parts are there in total in the diagram?

We can use these numbers to write the fraction numerically.

We write the fraction using the following:

\[
\frac{\text{number of shaded parts}}{\text{total number of parts}} = \frac{3}{4}
\]

The number on the top of the fraction is known as the numerator. The number on the bottom is the denominator.
We can also use a fraction to draw a diagram. When drawing a diagram, we need to ensure that the whole is broken up into equal parts.

**Let's try**

![Fraction diagrams](image)

**ACTIVITY**

1. Identify the numerator and the denominator in the following fractions:

<table>
<thead>
<tr>
<th>FRACTION</th>
<th>NUMERATOR</th>
<th>DENOMINATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\frac{3}{4})</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>(\frac{1}{3})</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>(\frac{2}{5})</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>(\frac{7}{10})</td>
<td>7</td>
<td>10</td>
</tr>
</tbody>
</table>

2. Draw a diagram to match each of the following fractions. Remember all of the parts should be equal in size.

<table>
<thead>
<tr>
<th>FRACTION</th>
<th>DIAGRAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\frac{1}{2})</td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>(\frac{3}{4})</td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>(\frac{3}{8})</td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>(\frac{2}{3})</td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>(\frac{2}{5})</td>
<td><img src="image" alt="Diagram" /></td>
</tr>
</tbody>
</table>

When naming a fraction, we also need to consider how many equal parts are shaded (or the numerator).

- \(\frac{1}{4}\) When reading it we say *one-quarter*
- \(\frac{2}{5}\) When reading it we say *two-fifths*
- \(\frac{3}{8}\) When reading it we say *three-eighths*
Adding and Subtracting Module: Mini Lessons Activities

**Students to complete 6 mini lessons**

Lesson 1: Adding and subtracting fractions with common denominators using diagrams
Lesson 2: Adding mixed numerals using diagrams
Lesson 3: Adding and subtracting fractions with common and related denominators
Lesson 4: Lowest common multiple
Lesson 5: Adding and subtracting numerically
Lesson 6: Adding and subtracting mixed numerals numerically
Lesson 1 Activity

MODULE
Adding and subtracting fractions

LESSON 1
Learning objectives
Students learn to use diagrams to add and subtract fractions with the same denominator.

Number lines and diagrams can help us to add fractions together and also to subtract one fraction from another.

Using number lines:

0 1 2 3 4 5 6 7 8 9 10

a) \( \frac{1}{4} + \frac{2}{4} = \)

b) \( \frac{3}{4} + \frac{3}{4} = \)

c) \( 1\frac{1}{4} - \frac{3}{4} = \)

Using diagrams:

\[ \text{Diagram 1} + \text{Diagram 2} = \text{Resulting Diagram} \]

\[ \text{Diagram 1} - \text{Diagram 2} = \text{Resulting Diagram} \]

ACTIVITY

1.
Use the number line to add/subtract the fractions below.

\[ \frac{4}{12} + \frac{5}{12} = \]

\[ \frac{7}{12} + \frac{3}{12} = \]

\[ \frac{1}{12} + \frac{6}{12} = \]

\[ \frac{9}{12} - \frac{5}{12} = \]

\[ \frac{4}{12} - \frac{1}{12} = \]

\[ \frac{8}{12} - \frac{5}{12} = \]

2.
Use the number line to add/subtract the fractions below. Note some answers may be larger than one whole.

\[ \frac{4}{5} + \frac{2}{5} = \]

\[ \frac{3}{5} + \frac{4}{5} = \]

\[ \frac{4}{5} + \frac{1}{5} = \]

\[ 1\frac{4}{5} - \frac{3}{5} = \]

\[ 1\frac{1}{5} + \frac{3}{5} = \]

\[ 2 - \frac{1}{5} = \]
3.

Use the diagrams below to add/subtract the fractions.

\[ \frac{3}{8} + \frac{4}{8} = \]
\[ \text{Diagram A} \]

\[ \frac{1}{6} + \frac{4}{6} = \]
\[ \text{Diagram B} \]

\[ \frac{3}{10} + \frac{6}{10} = \]
\[ \text{Diagram C} \]

\[ \frac{1}{4} + \frac{2}{4} = \]
\[ \text{Diagram D} \]

\[ \frac{1}{8} + \frac{4}{8} = \]
\[ \text{Diagram E} \]

\[ \frac{5}{10} + \frac{2}{10} = \]
\[ \text{Diagram F} \]

\[ \frac{5}{6} - \frac{2}{6} = \]
\[ \text{Diagram G} \]

\[ \frac{4}{4} - \frac{1}{4} = \]
\[ \text{Diagram H} \]

\[ \frac{6}{8} - \frac{2}{8} = \]
\[ \text{Diagram I} \]

\[ \frac{7}{10} - \frac{4}{10} = \]
\[ \text{Diagram J} \]
Lesson 2 Activity

MODULE
Adding and subtracting fractions

LESSON 2
Learning objectives
Students learn to:
• Use diagrams to add whole numbers to proper fractions.
• Use diagrams to add mixed numerals with the same denominator.

ACTIVITY
1. Add the following mixed numerals, you may draw diagrams to assist you.

   a) \[ 1 + \frac{3}{4} = \]
   b) \[ 2 + \frac{1}{4} = \]
   
   c) \[ \frac{1}{4} + 3 = \]
   d) \[ \frac{3}{4} + 2 = \]

   e) \[ 2 \frac{1}{4} + \frac{1}{4} = \]
   f) \[ 3 \frac{1}{4} + \frac{2}{4} = \]

   g) \[ 2 \frac{1}{4} + 1 \frac{1}{4} = \]
   h) \[ 1 \frac{2}{4} + 1 \frac{1}{4} = \]

2. Add the following mixed numerals, you may use a number line to assist:

   a) \[ 1 \frac{2}{5} + 3 \frac{1}{5} = \]
   b) \[ 2 \frac{4}{5} + 1 = \]

   c) \[ 2 \frac{1}{5} + 1 \frac{3}{5} = \]
   d) \[ 1 \frac{2}{5} + 1 \frac{2}{5} = \]

3. Add the following mixed numerals. You may draw your own diagrams to assist you.

   a) \[ 2 \frac{1}{5} + 1 \frac{2}{5} = \]
   b) \[ 3 \frac{1}{3} + 2 \frac{1}{3} = \]

   c) \[ 1 \frac{3}{6} + 2 \frac{1}{6} = \]
   d) \[ 4 \frac{3}{10} + 2 \frac{5}{10} = \]

4. Create a question that has the answer \( 2 \frac{3}{5} \).
Lesson 3 Activity

MODULE
Adding and subtracting fractions

LESSON 3
Learning objectives
Students learn to:
• Add and subtract fractions with common denominators numerically.
• Add and subtract fractions with related denominators numerically.

Consider:

\( \frac{1}{4} + \frac{2}{4} = \)

\[ \begin{array}{c}
\square + \square = \square \\
\end{array} \]

\( \frac{3}{4} - \frac{2}{4} = \)

\[ \begin{array}{c}
\square - \square = \square \\
\end{array} \]

There is a way to add or subtract fractions without drawing diagrams or using number lines.

To add or subtract fractions we:

\[ \frac{2}{6} + \frac{3}{6} = \]

\[ \frac{5}{7} + \frac{1}{7} = \]

This makes the process much quicker and easier...

We can also use our knowledge of equivalent fractions to help us add fractions with different denominators.

Consider:

\[ \frac{1}{4} + \frac{1}{2} \]

\[ \frac{2}{5} + \frac{3}{10} \]

We can add or subtract fractions with different denominators, by making the denominators the same before we add/subtract. To do this we multiply the ________ and ________, of one fraction by the same number, to get both denominators the ________________.
**ACTIVITY**

1. Answer the following fractions using numerical methods.

   a) \( \frac{2}{5} + \frac{1}{5} = \)
   b) \( \frac{3}{10} + \frac{4}{10} = \)
   c) \( \frac{2}{7} + \frac{4}{7} = \)

   d) \( \frac{5}{12} - \frac{3}{12} = \)
   e) \( \frac{9}{11} - \frac{7}{11} = \)
   f) \( \frac{17}{20} + \frac{12}{20} = \)

2. Complete the following, by ensuring both denominators are the same first. Make sure you show your working out!

   a) \( \frac{2}{5} + \frac{1}{10} = \)
   b) \( \frac{1}{4} + \frac{3}{8} = \)
   c) \( \frac{2}{3} + \frac{1}{6} = \)

   d) \( \frac{3}{4} - \frac{1}{2} = \)
   e) \( \frac{5}{6} - \frac{1}{2} = \)
   f) \( \frac{11}{15} - \frac{2}{5} = \)

3. Complete the following. If your answer is an improper fraction, change it to a mixed numeral.

   a) \( \frac{4}{5} + \frac{3}{10} = \)
   b) \( \frac{3}{4} + \frac{5}{8} = \)
   c) \( \frac{2}{3} + \frac{5}{6} = \)

   d) \( \frac{3}{4} + \frac{1}{2} = \)
   e) \( \frac{4}{6} + \frac{1}{2} = \)
   f) \( \frac{11}{15} + \frac{4}{5} = \)
Lesson 4 Activity

MODULE
Adding and subtracting fractions

LESSON 4

Learning objectives
Students learn to identify the lowest common multiple of two numbers.

Let’s look at a times table chart.

What do you notice?

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</tbody>
</table>

a) Multiples of 2 are: ____________________________

b) Multiples of 3 are: ____________________________

c) Common multiples of 2 and 3 are: ____________________________

d) The lowest common multiple of 2 and 3 is: ____________________________

e) Multiples of 4 are: ____________________________

f) Multiples of 12 are: ____________________________

g) Common multiples of 4 and 12 are: ____________________________

h) The lowest common multiple of 4 and 12 is: ____________________________

Finding the lowest common multiple (LCM) of two numbers can help us add or subtract fractions with different denominators.
ACTIVITY
Use the times table on the previous page (or your knowledge of multiples) to answer the following questions:

1. List the multiples of 5: __________________________________________
   List the multiples of 7: __________________________________________
   Common multiples of 5 and 7 are: _________________________________
   The lowest common multiple of 5 and 7 is: _________________________

2. List the multiples of 3: __________________________________________
   List the multiples of 9: __________________________________________
   Common multiples of 3 and 9 are: _________________________________
   The lowest common multiple of 3 and 9 is: _________________________

3. Common multiples of 2 and 6 are: _________________________________
   The lowest common multiple of 2 and 6 is: _________________________

4. Common multiples of 4 and 10 are: ________________________________
   The lowest common multiple of 4 and 10 is: _________________________

5. The lowest common multiple of 4 and 9 is: __________________________

6. The lowest common multiple of 5 and 8 is: __________________________
Lesson 5 Activity

MODULE
Adding and subtracting fractions

LESSON 5

Learning objectives
Students learn to add and subtract fractions with different denominators numerically.

We can use our knowledge of lowest common multiples and equivalent fractions to help us add fractions with different denominators.

a) Consider \( \frac{2}{5} + \frac{1}{3} \)

To add these two fractions together, we need them to have a common denominator. To find a common denominator, we need to find the lowest common multiple (LCM) of the two denominators.

The LCM of 5 and 3 is ________________

\[
\frac{2}{5} + \frac{1}{3} = \frac{\boxed{6}}{\boxed{15}} + \frac{\boxed{5}}{\boxed{15}}
\]

\[
= \frac{\boxed{11}}{\boxed{15}}
\]

b) Let's now consider \( \frac{3}{10} + \frac{1}{2} \)

The LCM of 10 and 2 is ________________

\[
\frac{3}{10} + \frac{1}{2} = \frac{\boxed{6}}{\boxed{20}} + \frac{\boxed{10}}{\boxed{20}}
\]

\[
= \frac{\boxed{16}}{\boxed{20}}
\]

It is a very similar process for subtracting fractions ...

The LCM of 6 and 4 is ________________

\[
c) \frac{5}{6} - \frac{3}{4} = \frac{\boxed{10}}{\boxed{24}} - \frac{\boxed{18}}{\boxed{24}}
\]

\[
= \frac{\boxed{2}}{\boxed{24}}
\]
ACTIVITY
Adding and subtracting fractions

1. \( \frac{4}{7} + \frac{2}{5} \) The lowest common multiple of 7 and 5 is \( \underline{\hspace{2cm}} \)

\[ \begin{align*}
\frac{4}{7} &+ \frac{2}{5} = \frac{}{} + \frac{}{}\\
\frac{}{} &+ \frac{}{}\\
\frac{}{} &+
\end{align*} \]

2. \( \frac{2}{9} + \frac{1}{6} \) The lowest common multiple of 9 and 6 is \( \underline{\hspace{2cm}} \)

\[ \begin{align*}
\frac{2}{9} &+ \frac{1}{6} = \frac{}{} + \frac{}{}\\
\frac{}{} &+ \frac{}{}\\
\frac{}{} &+
\end{align*} \]

3. \( \frac{7}{10} - \frac{2}{5} \) The lowest common multiple of 10 and 5 is \( \underline{\hspace{2cm}} \)

\[ \begin{align*}
\frac{7}{10} &- \frac{2}{5} = \frac{}{} - \frac{}{}\\
\frac{}{} &- \frac{}{}\\
\frac{}{} &-
\end{align*} \]

4. \( \frac{1}{4} \) of the plants in Gary's garden are roses, and \( \frac{2}{3} \) are natives. What portion of the garden are roses or natives?

5. Which of the following fractions is closer to zero: \( \frac{7}{8} \) or \( \frac{13}{16} \)?
Lesson 5 Activity

MODULE
Adding and subtracting fractions

LESSON 6
Learning objectives
Students learn to add and subtract mixed numerals with common or different denominators numerically.

To add or subtract mixed numerals, we need to remember our work on converting mixed numerals to improper fractions. From there, the rest of our working out is the same as the previous exercise ...

Consider:

a) \[2 \frac{1}{5} + 1 \frac{3}{5} = \]

\[= \]

\[= \]

b) \[3 \frac{1}{3} + 2 \frac{1}{2} = \]

\[= \]

\[= \]

c) \[4 - 2 \frac{1}{3} = \]

\[= \]

\[= \]
ACTIVITY
Find the following:

1. \(1 \dfrac{1}{3} + 2 \dfrac{1}{5}\)

2. \(3 \dfrac{1}{4} - 2 \dfrac{1}{2}\)

3. \(3 \dfrac{7}{8} - 1 \dfrac{2}{5}\)

4. \(2 \dfrac{2}{3} + 4 \dfrac{1}{4}\)