Welcome Back!

This edition of The Mathematical Bridge focuses on teaching and learning programs. We explore ideas for scope and sequences, as well as essential features of a mathematics program. In addition, we review resources to support the development and strengthening of mathematical concepts. We will discuss how students learn through addressing Vygotsky’s definition of Zone of Proximal Development and investigate the importance of allowing opportunities in programs for identifying students’ prior knowledge before teaching new concepts. We hope you find this issue useful and we welcome any feedback and/or suggestions.

Planning and Programming in Mathematics

The intent of teaching and learning programs in mathematics is to design a sequence of lessons and activities to develop students understanding and fluency with mathematical concepts and ideas. Students develop understanding and fluency in mathematics through inquiry, exploring and connecting concepts, choosing and applying problem-solving skills and mathematical techniques. Programs typically show the development of an idea or concept. They have a clear development of tasks and strengthening of a concept through problem solving which involves communicating and reasoning.

Effective teachers develop programs that cater for all students, allowing for differentiation of content and utilising effective resources to support student learning. In the classroom, teachers establish challenging learning goals, making explicit the learning intentions for each lesson and success criteria for students to monitor their own learning.

Effective teachers also know their students and where they need to take them to next in their learning. This is especially important when programming, to ensure that teachers make informed decisions about the sequence and content to be taught.

For further reading on what effective mathematics teachers think and do, we recommend reading: Effective Pedagogy in Mathematics by Glenda Anthony and Margaret Walshaw.

Planning and programming happens at a number of levels in a school -whole school -stage / year / faculty -unit or topic -lesson

Scope and sequencing in mathematics

Teachers need to plan teaching programs that reflect where your students are at in regard to the stage content. Scope and sequences should be seen as flexible, fluid documents that may need to change and be adapted as you gather more information on students’ knowledge and understanding through ongoing assessment practices. You may plan your school, stage or grade scope and sequence prior to teaching. However, you may prefer to keep your scope and sequence brief, writing a more detailed version at the end of each teaching and learning cycle as a reflective and evaluative process. Teachers should make connections where relevant across substrands to assist students in seeing the connections between concepts and their real life applications. Examples of scope and sequences for both Stage 3 and Stage 4 can be found later in this document.
Programming in Mathematics

When programming, schools devise teaching and learning programs (encompassing units of learning) and scope and sequences to support the implementation of syllabus documents. As we program, we need to spend time identifying our students’ individual differences and taking into consideration their learning needs.


Planning lessons in mathematics

When planning explicit lessons or a sequence of lessons, teachers plan ‘a range of teaching, learning and assessment activities to provide students with opportunities to demonstrate achievement of outcomes …’ (BOSTES NSW Mathematics K-10 Syllabus support materials).

When planning lessons our focus in on answering the question how will my students get there? from the teaching and learning cycle. Teachers plan a sequence of lessons that reflect where the students are at now and what content students need to explore and develop knowledge, skills and understanding in to meet the outcomes.

Structuring lesson in mathematics

The structure of your lessons and the strategies you use will influence student engagement, depth of understanding and the quality of the learning environment. One process for explicit teaching that is used frequently in primary classrooms is the Modelled, Guided and Independent process. This process is included in our DEC literacy policy and is easily transferred to the mathematics classroom.

Guided teaching involves supported 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 your 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.


Teachers may also focus on concept development in their lessons. Beginning with setting the scene or introduction of the concept, developing the concept, extending the concept and a conclusion involving application. Problem solving lessons often follow this process. (See the flowchart below)
Building the field in mathematics

To begin the programming and planning process, teachers need to have an understanding of how students learn and the prior knowledge they bring to the classroom. Vygotsky’s Zone of Proximal Development assists teachers in seeing how to prepare the way for students to guide them on their learning journey. The story below helps paint the picture for us.

If students do not know something or cannot process the information, this should be cues for teacher action, in particular teaching in a different way...“the first time did not work”, a new strategy is required.

One powerful idea in evidence based models of teaching & learning is Vygotsky’s work. Let’s start by introducing the story Fish is Fish, the storyline goes like this:

- There are two friends, a fish and a tadpole that grow up together in a pond. The tadpole slowly becomes a frog, and eventually is able to hop out of the pond, leaving the fish behind. When he returns, he describes to the fish the wondrous things he has seen, like birds, cows, and people. Using prior knowledge the fish began to imagine …

- The Birds …

- The Humans …

- The fish, naturally, imagines these things as fish with wings, fish with udders, fish in clothing, and so on. With an inability to imagine a totally different reality, the fish simply superimposes the new on the old.
Prior knowledge in mathematics

Prior knowledge is the foundation on which students build new knowledge, diagnostic testing and pre-assessments are used to identify students’ prior knowledge. Effective programs contain opportunities to identify prior knowledge and skills before the introduction of new concepts.

Students bring existing skills and knowledge to the top to actively interpret your 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 – 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.

Through working mathematically students learn mathematics, gaining knowledge and developing the skills required to use mathematics flexibly in the world. Below are the implications for programming:

<table>
<thead>
<tr>
<th>Fluency</th>
<th>Students demonstrating fluency typically:</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does it look like when students are developing fluency?</td>
<td>- use efficient methods for producing answers</td>
</tr>
<tr>
<td></td>
<td>- find solutions to problems using robust and appropriate methods is developing fluency</td>
</tr>
<tr>
<td></td>
<td>- recall facts, use definitions, manipulate information and processes when solving problems.</td>
</tr>
<tr>
<td>Implication for programming:</td>
<td>Programs can be structured to show a flow of lessons and activities for developing fluency, from activities for developing the concept leading to activities for strengthening and applying the concept.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Understanding</th>
<th>Students demonstrating understanding typically:</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does it look like when students are developing understanding?</td>
<td>- make connections between related concepts</td>
</tr>
<tr>
<td></td>
<td>- represent concepts in different ways</td>
</tr>
<tr>
<td></td>
<td>- identify similarities and differences between aspects of content</td>
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<td></td>
<td>- describe their thinking.</td>
</tr>
<tr>
<td>Implication for programming:</td>
<td>Activities selected for programs provide students with various opportunities to demonstrate their understanding in a range of ways. Activities encourage students to think individually, think in pairs and share ideas. To apply concepts in various contexts and to new areas.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communicating</th>
<th>Students demonstrating communicating mathematically typically:</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does it look like when students are communicating mathematically?</td>
<td>- use a variety of representations, in written, oral or graphical form to express mathematical ideas</td>
</tr>
<tr>
<td></td>
<td>- describe represent and explain mathematical concepts</td>
</tr>
<tr>
<td></td>
<td>- use mathematical language, symbols, notation and conventions appropriately.</td>
</tr>
<tr>
<td>Implication for programming:</td>
<td>Activities selected encourage communication between peers and generate discussions in the class. Students are required to communicate their ideas and provide mathematical explanations.</td>
</tr>
</tbody>
</table>
Problem solving
What does it look like when students problem solve?

Students problem solve as they:
- develop the ability to make choices, interpret, model, formulate and investigate problem
- find solutions in familiar and unfamiliar contexts
- design investigations and plan approaches before applying strategies verify answers.

Implication for programming:
Activities selected provide students with familiar and unfamiliar contexts where they make choices, interpret, model and investigate as well as communicate their solutions.

Reasoning
What does it look like when students problem solve?

Students demonstrating reasoning typically:
- develop the ability to analyse, evaluate and justify
- infer, generalise and prove results
- develop the capacity for logical thought and actions.

Implication for programming:
Activities selected provide students with the opportunity for increasingly sophisticated logical thought and actions. Tasks focus on students explaining their thinking, justifying strategies and conclusions, deducing strategies, proving if something is true or false, transferring learning from one context to another and comparing ideas.

Scope and sequencing

At the start of every good program is a well thought out scope and sequence, which takes into consideration a range of sub-strands and time allocation where students will be engaged and motivated about their learning. Include assessment time, assessing prior knowledge and delivery of lessons with time for students to successfully engage with activities and task to develop, reinforce and strengthen concepts. The following pages include sample scope and sequences for Stage 3 and Stage 4. We have also included a sample unit of learning (Stage 3: Early Term 2 Focusing on: Multiplication and Division, Patterns and Algebra, Stage 4: Year 7 Term 2 weeks 7-10 Focusing on: Calculating Percentages, Financial Mathematics) that aligns to the scope and sequence examples provided.

Further examples of K-6 scope and sequences can be found here http://www.curriculumsupport.education.nsw.gov.au/primary/mathematics/k6/programming/index.htm

BOSTES NSW also has some example scope and sequences for both K-6 and 7-10 and can be found here http://syllabus.bos.nsw.edu.au/mathematics/mathematics-k10/programming/
## S3 Mathematics Scope & Sequence

This scope and sequence is an example only, schools will need to make modifications as necessary dependent on school context and student needs. The same scope and sequence can be used in Year 5 and Year 6. Each term is organised into two parts – Early Term (the first half of term) and Later Term (the second half of term) to provide opportunities to develop deep knowledge and understanding.

<table>
<thead>
<tr>
<th>Term</th>
<th>Number and Algebra</th>
<th>Measurement and Geometry</th>
<th>Statistics and Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Early Term 1</strong></td>
<td>Whole Numbers Addition and Subtraction Multiplication and Division Fractions and Decimals (relate to Length) Patterns and Algebra (relate to Fractions and Decimals)</td>
<td>Length 3D Space Angles Data (relate to Whole Numbers)</td>
<td></td>
</tr>
<tr>
<td><strong>Later Term 1</strong></td>
<td>Whole Numbers (relate to Multiplication and Division) Addition and Subtraction Multiplication and Division Fractions and Decimals (relate to Addition and Subtraction)</td>
<td>Area (relate to Multiplication and Division) Time 2D Space (relate to Area) Position Data</td>
<td></td>
</tr>
<tr>
<td><strong>Early Term 2</strong></td>
<td>Addition and Subtraction Multiplication and Division Fractions and Decimals (relate to Length) Patterns and Algebra (relate to Multiplication and Division)</td>
<td>Length Volume and Capacity (relate to Multiplication and Division) 3D Space 2D Space (relate to 3D Space)</td>
<td></td>
</tr>
<tr>
<td><strong>Later Term 2</strong></td>
<td>Whole Numbers Addition and Subtraction Multiplication and Division Fractions and Decimals (relate to Addition and Subtraction)</td>
<td>Mass (relate to Fractions and Decimals) 2D Space Angles Data Chance</td>
<td></td>
</tr>
<tr>
<td><strong>Early Term 3</strong></td>
<td>Whole Numbers (relate to Multiplication and Division) Addition and Subtraction Multiplication and Division Fractions and Decimals (relate to Length) Patterns and Algebra</td>
<td>Length Time (relate to Whole Numbers) 2D Space (relate to Angles) Angles Chance (relate to Fractions and Decimals)</td>
<td></td>
</tr>
<tr>
<td><strong>Later Term 3</strong></td>
<td>Addition and Subtraction Multiplication and Division Fractions and Decimals (relate to Multiplication and Division) Patterns and Algebra (relate to Whole Numbers)</td>
<td>Area (relate to Fractions and Decimals) Position Data</td>
<td></td>
</tr>
<tr>
<td><strong>Early Term 4</strong></td>
<td>Whole Numbers Multiplication and Division Fractions and Decimals (relate to Addition and Subtraction)</td>
<td>Volume and Capacity (relate to Fractions and Decimals) Time 3D Space</td>
<td></td>
</tr>
<tr>
<td><strong>Later Term 4</strong></td>
<td>Addition and Subtraction Multiplication and Division Fractions and Decimals Patterns and Algebra</td>
<td>Mass (relate to Fractions and Decimals) 2D Space Angles (relate to 3D Space) Data Chance (relate to Fractions and Decimals)</td>
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</tr>
</tbody>
</table>

Note: The concept of percentages first appears in Part 2 of Fractions and Decimals in Stage Three.

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NEALS
# Stage 3 Mathematics Scope & Sequence of Key Ideas

<table>
<thead>
<tr>
<th>Early Term 2</th>
<th>Number and Algebra</th>
<th>Measurement and Geometry</th>
<th>Statistics and Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Addition and Subtraction</strong></td>
<td>Select and apply efficient mental, written and calculator strategies for addition and subtraction of numbers of any size</td>
<td>Length</td>
<td>Find perimeters of common two-dimensional shapes and record the strategy</td>
</tr>
<tr>
<td></td>
<td>Use estimation to check answers to calculations</td>
<td></td>
<td>Record lengths and distances using decimal notation to three decimal places</td>
</tr>
<tr>
<td><strong>Multiplication and Division</strong></td>
<td>Use and record a range of mental and written strategies to divide numbers with three or more digits by a one-digit operator, including problems that result in a remainder</td>
<td><strong>Volume and Capacity (relate to Multiplication and Division)</strong></td>
<td>Use cubic centimetres and cubic metres to measure and estimate volumes</td>
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<tr>
<td></td>
<td>Use the formal algorithm for multiplication by one- and two-digit operators</td>
<td></td>
<td>Select and use appropriate units to measure volume</td>
</tr>
<tr>
<td><strong>Fractions and Decimals (relate to Length)</strong></td>
<td>Apply the place value system to represent thousandths as decimals</td>
<td><strong>3D Space</strong></td>
<td>Connect three-dimensional objects with their nets</td>
</tr>
<tr>
<td></td>
<td>Compare, order and represent decimals with up to three decimal places</td>
<td></td>
<td><strong>2D Space (relate to 3D Space)</strong></td>
</tr>
<tr>
<td><strong>Patterns and Algebra (relate to Multiplication and Division)</strong></td>
<td>Find missing numbers in number sentences involving multiplication or division on one or both sides of the equals sign</td>
<td></td>
<td>Identify, name and draw right-angled, equilateral, isosceles and scalene triangles</td>
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<td></td>
<td>Explore angle properties of the special quadrilaterals and special triangles</td>
</tr>
</tbody>
</table>
**Year 5/6**  
**Multiplication and Division, Patterns and Algebra**  
**MA3-2WM, MA3-3WM, MA3-6NA, MA3-8NA**

**Time allocated:** 1 1/2 weeks approximately

**Key Ideas:**
- Use and record a range of mental and written strategies to divide numbers with three or more digits by a one-digit operator, including problems that result in a remainder.
- Find missing numbers in number sentences involving multiplication or division on one or both sides of the equals sign.

**Outcomes, a student:**
Selects and applies appropriate problem-solving strategies, including the use of digital technologies, in undertaking investigations **MA3-2WM**

- Gives a valid reason for supporting one possible solution over another **MA3-3WM**

Selects and applies appropriate strategies for multiplication and division, and applies the order of operations to calculations involving more than one operation **MA3-6NA**

- Analyses and creates geometric and number patterns, constructs and completes number sentences, and locates points on the Cartesian plane **MA3-8NA**

**Resources and Texts:**

**Vocabulary**
- multiply, multiplied by, product, multiplication, multiplication facts, area, thousands, hundreds, tens, ones, double, multiple, factor, divide, divided by, quotient, division, halve, remainder, fraction, decimal, equals, strategy, digit, estimate, round to, pattern, increase, decrease, missing number, number sentence, number line.

**Websites, Apps**
- Red Dragonfly Mathematics app  
- Nrich.maths.org  
  [http://nrich.maths.org/5450](http://nrich.maths.org/5450)

**Teaching content:**
**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, eg 5×□=4×10, 5×□=30–10
  - 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, eg 125÷5=□ becomes □×5=125
  - Describe how inverse

**Teaching and Learning activities:**

**Pre-assess student’s skills in patterns and algebra and multiplication and division**

Write on the board or provide questions written on paper

\[
5 \times \square = 30 - 10
\]

225 ÷ 5 = □  
*can you use this to work out*

□ × 5 = 225  
*Why? Explain your solution*

*Can you now use this number sentence to easily work out this*

227 ÷ 5 = □  
*Explain your reasoning*

**(Assessing prior knowledge and skills)**
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, eg $7 \times \square = 7.7$
  - 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, eg 'I am thinking of a number that when I double it and add 5, the answer is 13. What is the number?' ☐

Solve problems involving division by a one-digit number, including those that result in a remainder (ACMNA101)

- use the term 'quotient' to describe the result of a division calculation, eg 'The quotient when 30 is divided by 6 is 5'
- recognise and use different notations to indicate division, eg $25 \div 4, 4 \frac{1}{2} 5$, $25/4$ ☐
- record remainders as fractions and decimals, eg $25 \div 4 = 6.14$ or $6.25$ ☐
- use mental and written strategies to divide a number with three or more digits by a one-digit divisor where there is no remainder, including:
  - dividing the hundreds, then the tens, and then the ones, eg $3248 \div 4$
    - $3200 \div 4 = 800$
    - $440 \div 4 = 110$
    - $48 \div 4 = 12$
    - $80 \div 4 = 20$
  - using the formal algorithm, eg $258 \div 6$
    - $43$
    - $6 \times 2 \, 5 \, 8$
- use mental and written strategies to divide a number with three or more digits by a

Lesson
(introducing the concept)
What kind of calculation do you get?
(problem 6 from Red Dragonfly Mathematics Challenge)
Asking questions as students provide solutions and reasons
Why did you start there? What number could that be? What number could it not be? Is there another solution?
What strategies did you use to solve the task?
How can understanding inverse operations assist us?

(developing the concept)
Can you make one of your own? using different numbers - you may use the same number more than once.

Lesson
(extended the concept)
Further task from Red Dragonfly - companion mathematics challenge

Work with a partner or on your own to find solutions to this task.
What other solutions can you find?

Lesson
(developing the concept)
Discuss the concept of ‘remainder’, what is it? What does it look like?
(show array structures and that a remainder is the next row but that it is incomplete)

Introduction activity
Remainders count
CMIT website:
one-digit divisor where there is a remainder, including:
- dividing the tens and then the ones, eg 243 ÷ 4
  240 ÷ 4 = 60
  3 ÷ 4 = 03
  so 243 ÷ 4 = 60 remainder 3
  ➢ explain why the remainder in a division calculation is always less than the number divided by (the divisor) (Communicating, Reasoning)

• show the connection between division and multiplication, including where there is a remainder, eg 25 ÷ 4 = 6 remainder 1, so 25 = 4 × 6 + 1
• apply appropriate mental and written strategies, and digital technologies, to solve division word problems
  ➢ recognise when division is required to solve word problems (Problem Solving)
  ➢ use inverse operations to justify solutions to problems (Problem Solving, Reasoning)
• use and interpret remainders in solutions to division problems, eg recognise when it is appropriate to round up an answer, such as 'How many 5-seater cars are required to take 47 people to the beach?'
• record the strategy used to solve division word problems
  ➢ use selected words to describe each step of the solution process (Communicating, Problem Solving)

Work as a whole class to play against the computer.
Discuss strategies for best solution. Discuss how inverse operations will assist you.
Work as a team to find all possible solutions to each question before choosing the best option.

(strengthening the concept)
Play again in pairs, each time the students make a solution.
Ask students to draw the number sentence as an array

You could further explore if that number would make any other arrays

Lesson
(extending the concept)
Students use dice to play the remainders count activity off the computer.

Ask students to work in pairs to write word problems that match that number sentences they recorded for their game.

Swap problems with other pairs and solve problems.

Lesson
(strengthening the concept)
Mental strategies for division

Write
924 ÷ 7 =
106 ÷ 4 =

Quick question:
Estimate what the answer will be? Approximately, not exactly. Why is that your estimate?

Other discussion questions
Will either of these problems have remainders? What is the reason for your answer?
Where do you start when you estimate? How can knowing inverse operations assist us?
Now solve the problems in your head
Work through the solutions on the board as a class
Students share strategies for solving the problems
Students then write out their mental working out in their books
Showing at least two ways to solve the problems

Evaluation and comments:
# Year 7 Scope and Sequence for Mathematics - Stage 4

## Term 1
**Week 1**
- Computation with integers: MA4-4NA, MA4-1WM, MA4-2WM, MA4-3WM
  - Addition, subtraction, multiplication, division. Order of operation; apply associative, commutative & distributive laws. Compare, order, add, subtract, multiply and divide integers.

**Week 2**
- Fractions, decimals and percentages - Part 1: MA4-5NA, MA4-1WM, MA4-2WM, MA4-3WM
  - Compare fractions, mixed numerals, place fractions on an integer number line. Add, subtract, multiply and divide fractions with same and different denominators. Express one quantity as a fraction of another. Operate with decimals & percentages.

**Week 3**
- Angle Relationships, Properties of Geometric Figures 1: MA4-17MG, MA4-18MG, MA4-1WM, 2WM, 3WM
  - Review types of angles S3. Classify triangles, describe quadrilaterals according to sides and angles. Properties of quadrilaterals. Identify line and rotational symmetry. Angle sum of a triangle and a quadrilateral. Solve simple numerical problems using properties of 2D shapes.

## Tasks
**Week 1**
- Testing week: MA4-9NA, MA4-1WM, MA4-2WM, MA4-3WM

## Term 2
**Week 4**
- Indices with numerical bases: MA4-9NA, MA4-1WM, MA4-2WM, MA4-3WM
  - Operates with positive integer and zero indices of numerical bases. Investigate index numbers and represent whole numbers as products of primes. Find square roots, cube roots. Apply divisibility test.

**Week 5**
- Introductory Algebra, Algebraic Techniques 1: MA4-8NA, MA4-1WM, MA4-2WM, MA4-3WM
  - Generalises number properties to operate with algebraic expressions. Use letters to represent numbers, recognise and use simple algebraic expressions, simplify algebraic expression using the four operations.

## Tasks
**Week 1**
- NAPLAN: MA4-12MG, MA4-1WM, MA4-2WM, MA4-3WM

## Term 3
**Week 6**
- Area of Quadrilaterals, circles, unit conversion: MA4-12MG, MA4-1WM, MA4-2WM, MA4-3WM
  - Calculates the perimeters of plane shapes and circumference of circles.

**Week 7**
- Calculating Percentages-Part 2: MA4-13MG, MA4-1WM, MA4-2WM, MA4-3WM
  - Convert between metric units of area. Establish and use formulas to find the areas of triangles, special quadrilaterals and circles. Solve area problems.

**Week 8**
- Financial Mathematics: MA4-5NA, MA4-6NA, MA4-1WM, MA4-2WM, MA4-3WM
  - Finding percentages of a quantity. Perform calculations involving GST, calculate discounts, investigate and calculate best buys.

## Tasks
**Week 1**
- Simple Probability: MA4-21SP, MA4-1WM, MA4-2WM, MA4-3WM

## Term 4
**Week 9**
- Linear Relationships Part 1: MA4-11NA, MA4-1WM, MA4-2WM, MA4-3WM
  - Construct simple sample spaces for single step experiments with equally likely outcomes. Find probabilities of events in single step experiments.

**Week 10**
- Data Collection and representation: MA4-13SP, MA4-1WM, MA4-2WM, MA4-3WM
  - Collects, represents and interprets single sets of data, using appropriate statistical displays.
# Year 8 Scope and Sequence for Mathematics - Stage 4

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
<th>Week 6</th>
<th>Week 7</th>
<th>Week 8</th>
<th>Week 9</th>
<th>Week 10</th>
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<tbody>
<tr>
<td></td>
<td>MA4-4NA, MA4-1WM, 2WM, 3WM</td>
<td>MA4-5NA, MA4-1WM, 2WM, 3WM</td>
<td>MA4-9NA, MA4-18MG</td>
<td>MA4-1WM, 2WM, 3WM</td>
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<tr>
<td></td>
<td><strong>Computation with integers</strong></td>
<td><strong>Fractions, decimals and percentages 2</strong></td>
<td><strong>Indices</strong></td>
<td><strong>Angle Relationships, Parallel Line Theorems</strong></td>
<td><strong>Review of the four operations with integers. Review of fractions, decimals, percentages</strong></td>
<td><strong>Rounding decimals, terminating, recurring decimals, irrational numbers, percentages of quantities, percentage increase, decrease, percentage problems involving money.</strong></td>
<td><strong>Positive integer &amp; zero indices, numerical bases.</strong></td>
<td><strong>Apply the properties of corresponding, alternate and co-interior angles on parallel lines to find unknown angles with reasoning. Determine and justify that particular lines are parallel. Solve numerical exercises.</strong></td>
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<thead>
<tr>
<th>Task 1</th>
<th>Week 1</th>
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<td>MA4-1WM, 2WM, 3WM</td>
<td>MA4-1WM, 2WM</td>
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<td>MA4-1WM, 2WM</td>
<td>MA4-1WM, 2WM</td>
<td>MA4-1WM, 2WM, 3WM</td>
</tr>
<tr>
<td></td>
<td><strong>Area of Quadrilaterals, Circles</strong></td>
<td><strong>Single Variable Data Analysis</strong></td>
<td><strong>Linear Relationships 2</strong></td>
<td><strong>Algebraic Techniques 2</strong></td>
<td><strong>Analyses single sets of data using measures of location, and range.</strong></td>
<td><strong>Graphing linear relationships, equations.</strong></td>
<td><strong>Substitution, expand, factorise simple algebraic expressions. Solve simple linear equations. Solve simple quadratic equations of the form x² = c</strong></td>
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<thead>
<tr>
<th>Task 2</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
<th>Week 6</th>
<th>Week 7</th>
<th>Week 8</th>
<th>Week 9</th>
<th>Week 10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MA4-10NA</td>
<td>MA4-1WM, 2WM, 3WM</td>
<td>MA4-16MG</td>
<td>MA4-1WM, 2WM, 3WM</td>
<td>MA4-14MG</td>
<td>MA4-1WM, 2WM</td>
<td>MA4-17MG</td>
<td>MA4-1WM, 2WM</td>
<td>MA4-1WM, 2WM</td>
<td>MA4-1WM, 2WM, 3WM</td>
</tr>
<tr>
<td></td>
<td><strong>Equations</strong></td>
<td><strong>Pythagoras’ Theorem</strong></td>
<td><strong>Volume</strong></td>
<td><strong>Geometry and Congruency</strong></td>
<td><strong>Solve simple linear equations using algebraic techniques. Solve simple quadratic equations of the form x² = c.</strong></td>
<td><strong>Apply Pythagoras’ theorem to find sides in right-angled triangles and solve problems.</strong></td>
<td><strong>Convert between metric units of volume, capacity. Solve volume and capacity problems.</strong></td>
<td><strong>Identify congruent figures, identify congruent triangles using the four tests</strong></td>
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</table>

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<thead>
<tr>
<th>Task 3</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
<th>Week 6</th>
<th>Week 7</th>
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<th>Week 9</th>
<th>Week 10</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>MA4-4NA, MA4-1WM, 2WM, 3WM</td>
<td>MA4-7NA</td>
<td>MA4-1WM, 2WM, 3WM</td>
<td>MA4-21SP</td>
<td>MA4-1WM, 2WM, 3WM</td>
<td>MA4-21SP</td>
<td>MA4-1WM, 2WM, 3WM</td>
<td>MA4-21SP</td>
<td>MA4-1WM, 2WM, 3WM</td>
<td>MA4-21SP</td>
</tr>
<tr>
<td></td>
<td><strong>Percentages, Financial Mathematics</strong></td>
<td><strong>Rates and Ratios</strong></td>
<td><strong>Probability 2</strong></td>
<td><strong>Revision</strong></td>
<td><strong>Solve problems involving profit and loss</strong></td>
<td><strong>Apply ratios and rates to solve problems. Interpret and draw distance/time graphs</strong></td>
<td><strong>Probability of compound events, Venn Diagrams</strong></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Task 4</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
<th>Week 6</th>
<th>Week 7</th>
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</table>
Year 7
Calculating percentages, Financial Mathematics
MA4-5NA, MA4-6NA MA4-1WM, 2WM, 3WM
Time allocated: 4 Weeks

Outcomes, a student:
- communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols MA4-1WM
- applies appropriate mathematical techniques to solve problems MA4-2WM
- recognises and explains mathematical relationships using reasoning MA4-3WM
- solves financial problems involving purchasing goods MA4-6NA

Key Ideas: Finding percentages of quantities, Perform calculations involving GST. Calculate discounts and ‘best buys’.

Resources and Texts:

Vocabulary: regular price, sale price, percentage increase, percentage decrease, discount, unit price, best buy, price comparison, selling price, GST, GST exempt, goods, services

Websites, Apps: Woolworths app, Coles app, Shopbot.com.au

Teaching content:
Review percentages, find percentages of quantities and express one quantity as a percentage of another, with and without the use of digital technologies, students:
(ACMNA158)

1. calculate percentages of quantities using mental, written and calculator methods
   - choose an appropriate equivalent form for mental computation of percentages of quantities, e.g. 20% of $40 is equivalent to $40 ÷ 5
   - 25% of $40

2. express one quantity as a percentage of another, using mental, written and calculator methods, e.g. 45 minutes is 75% of an hour

Teaching and Learning activities:
1. Pre-assess student’s skills in calculating percentages using mental computation 10%, 25%, 50%, 75% of an amount are all part of the stage 3 content.
   (Assessing prior knowledge and skills)
   Pre-assess Students skills in calculating percentages using mental computation
   
   1. Find 10% of $100
   2. Find 20% of $150
   3. Find 25% of $200
   4. Find 50% of $4
   5. Find 75% of
   6. The price of a $120 jacket is discounted by 10%, what is the new discounted price?
   7. The price of a pair of shoes is $60, if the price is increased by 25%, what would be the new price of the shoes?

2. Homework Activity: finding percentages in the world around us, students find examples of where percentages are used on the internet, newspapers, magazines.
   (Introduction – background research and relevance)

3. Lesson: Modelling finding percentages of quantities using mental computation for 10%, 20%, 25%, 30%, 50%, 75%
   (Introducing the concept)

   **Find the following percentages of $200**

   Brainstorm percentage values of the same amount

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>$200</td>
</tr>
<tr>
<td>50%</td>
<td>$100</td>
</tr>
<tr>
<td>25%</td>
<td>$50</td>
</tr>
<tr>
<td>75%</td>
<td>$150</td>
</tr>
<tr>
<td>20%</td>
<td>$40</td>
</tr>
<tr>
<td>10%</td>
<td>$20</td>
</tr>
<tr>
<td>80%</td>
<td>$160</td>
</tr>
</tbody>
</table>

4. Lesson: Finding percentage of a quantity
e.g. Find 25% of $80 = 1/4 x $80 = 0.25 x 80 = $20
Investigate and calculate the Goods and Services Tax (GST), with and without the use of digital technologies, students:

3. calculate GST and GST-inclusive prices for goods purchased in Australia, given the pre-GST price
   - interpret GST information contained on receipts (Communicating)
   - investigate efficient methods of computing the GST and GST-inclusive prices (Problem Solving)
   - explain why the value of the GST itself is not equivalent to 10% of the GST-inclusive price (Communicating, Reasoning)

4. determine the pre-GST prices for goods, given the GST-inclusive price
   - explain why the pre-GST price is not equivalent to 10% off the GST-inclusive price (Communicating, Reasoning)

5. Activity: Calculating percentages of quantities game in pairs. (Developing the concept)

6. Lesson: Modelling finding percentages of quantities using calculator methods for various percentages. (Developing the concept)

7. Lesson: Expressing one quantity as a percentage of another. Demonstrate five examples on the board. (Strengthening the concept)

8. Activity: Student exercise solving problems involving finding one quantity as a percentage of another.

9. Pre-assess student’s skills in calculating 10% of a number, students’ prior knowledge of GST.

10. Internet research: What is GST? When was it introduced? What items have the GST added? What items are exempt from GST? Collect two receipts from a supermarket purchase which show how much GST was charged for items purchased. List the items you see with no GST charged and the items with GST charged. Explain how the receipt indicates that GST has been charged. Do other countries have a goods and services tax? Give an example of another country which has one and how much the tax is added to the price. (Introduction – background research and relevance)

11. Sharing of information researched, class discussion and introduction of GST.

12. Lesson: How to calculate GST? (Developing the concept)

13. Activity: Exercise to calculate the GST of goods and services. (Developing the concept)

14. Activity: Calculating the GST included in prices. (strengthening of concept)

15. Lesson: Interpreting GST information on receipts, class discussion where students unpack a receipt, indicating where GST information is located and which items are taxed.
Investigate and calculate 'best buys', with and without the use of digital technologies, students: (ACMNA174)

5. solve problems involving discounts, including calculating the percentage discount
   - evaluate special offers, such as percentage discounts, 'buy-two-get-one-free', 'buy-one-get-another-at-half-price', etc., to determine how much is saved (Communicating, Problem Solving)

6. calculate 'best buys' by comparing price per unit, or quantity per monetary unit, eg 500 grams for $4.50 compared with 300 grams for $2.75
   - investigate 'unit pricing' used by retailers and use this to determine the best buy (Problem Solving)
   - recognise that in practical situations there are considerations other than just the 'best buy', eg the amount required, waste due to spoilage (Reasoning)
   - use price comparison websites to make informed decisions related to purchases under given conditions (Problem Solving)

16. **Lesson**: Language of Best buys e.g. meanings of buy one get one free, take a further 25% off, up to 70% off

Unpacking the language in examples for evaluating special offers and determining the best price to maximise savings.

17. **Lesson**: Best buys – PowerPoint of similar products with different prices, calculate 'best buys' by comparing prices per unit, or quantity per monetary unit and compare to see which is the best value for money also considering other aspects such as quantity, quality and size etc. Students in pairs calculate unit prices and determine the best buy. Once pairs have completed the exercise each group presents to the class providing reasons for decisions.

18. **Activity**: Students calculate best buys given certain products and prices. Calculate by comparing price per unit or quantity per monetary unit

19. **Internet research**

Use the Comparison website to make informed decisions related to purchase [http://www.shopbot.com.au/](http://www.shopbot.com.au/). Your task is to research 3 items you wish to purchase. Your task is to research 3 items you wish to purchase and compare their prices from 4 different stores. The website does this for you; in your assignment create a table showing each item, the price comparison from different suppliers and a product image.

Evaluation and comments:
### Stage 3 Resource for assessing strategies: Addition and Subtraction

#### Rubric for identifying counting and addition/subtraction strategies

Observe students during activity, tally or tick in the strategy box as you see it being used.

<table>
<thead>
<tr>
<th>Class name:</th>
<th>Observer:</th>
<th>Date:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Counts on using ones</strong></th>
<th><strong>Bridging to the decade</strong></th>
<th><strong>Friends of and to ten</strong></th>
<th><strong>Using doubles</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Student counts on by ones for numbers of any size (including two-digit numbers) will use fingers or draw fence posts</td>
<td>Students bridge to ten by breaking up the second number e.g. 17 + 5; 17 and 3 is 20 then add two more makes 22</td>
<td>Students combine numbers that add to 10 e.g. 4 + 7 + 8 + 6 + 3 + 1; group 4 and 6, 7 and 3 first This can include friends of 6, 7, 8 and 9 as well.</td>
<td>Students use known facts like doubles and near doubles e.g. 5 + 6; double 5 then add one more</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Counting on</strong></th>
<th><strong>Counting back</strong></th>
<th><strong>Using number facts</strong></th>
<th><strong>Jump strategy</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Students count on from the larger number to find the total of two numbers e.g. 14 + 7, “I started with 14 and then count on seven more” 14, 15, 16, 17, 18, 19, 20, 21</td>
<td>Students count back from a number to find the number remaining e.g. 17 - ___ = 14 “I started with 17 then counted back 16, 15, 14 and I got 3”</td>
<td>Students use related addition and subtraction number facts to at least 20 e.g. 15 + 3 =18; so 18 – 15 = 3 these are called ‘Turn Around Facts’</td>
<td>Students place the first number on an empty number line and then counts forward or backwards firstly by tens and then by ones to perform a calculation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Split Strategy</strong></th>
<th><strong>Compensation strategy</strong></th>
<th><strong>Using patterns to extend number facts</strong></th>
<th><strong>Bridging the decades</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Students separate the tens from the units and add or subtract each separately before combining to obtain the final answer e.g. 46 + 33 = 40 + 6 + 30 + 3 = 40 + 30 + 6 + 3 = 70 + 9 = 79</td>
<td>Students ‘round up’ a number that is close to the decade to make the calculation simpler. e.g. 63 + 29; 63 + 30 is 93, subtract 1, to obtain 92</td>
<td>Students see the similarity between calculations of smaller and larger numbers, using an easier sum as a starting place for finding a solution. e.g. 5 – 2 = 3, so 500 – 200 is 300</td>
<td>This strategy is similar to using a split strategy, instead of splitting both numbers, students keep one number whole and bridge to the decade first. e.g. 34 + 26; 34 + 6 = 40, 40 + 20 = 60 It is a reversal of jump but is only used when the ‘ones’ add to a ten</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Forming multiples</strong></th>
<th><strong>Formal algorithm</strong></th>
<th><strong>Partitioning numbers</strong></th>
<th><strong>Inverse operations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Student change the order of addends (numbers) to form multiples of ten or other decades. e.g. 16 + 8 + 4; add 16 and 4 first</td>
<td>Students use a formal algorithm to record their calculations. e.g. 134 + 568</td>
<td>Students can expand numbers into standard and non-standard forms to make addition or subtraction easier. e.g. 500 + 670: 670= 500 + 170, so 500 + 670= 500+ 500 (or 2 x 500) = 1000+ 170= 1170</td>
<td>Students check solutions by using inverse operations. e.g. 50- 27= 23, so, 23+ 27 = 50</td>
</tr>
</tbody>
</table>
## Rubric for identifying multiplication and division strategies

Observe students during activity, tally or tick in the strategy box as you see it being used.

<table>
<thead>
<tr>
<th>Class name:</th>
<th>Observer:</th>
<th>Date:</th>
</tr>
</thead>
</table>

### Model equal groups
- **Perceptual counting and sharing**
  - Uses visual markers to represent items and groups
  - 1, 2, 3, 4, 5, 6, 7, 8, 9...
  - May need visible items

### Forms arrays of equal rows
- **Figurative- multiple count**
  - Uses visual markers to represent groups
  - 5 groups of 4 is the same as 4+4+4+4+4
  - Or
  - For 3 x 4
  - 3 + 3 is 6, 6 + 3 is 9, 9 + 3 is 12
  - 25 ÷ 5 = 5
  - 25 - 5 = 20 (one)
  - 25 - 5 = 15 (two)
  - 25 - 5 = 10 (three)
  - 25 - 5 = 5 (four)
  - 25 - 5 = 0 (five)

### Uses a double count to coordinate composite units
- **Uses doubling and repeated halving for 2, 4 and 8**
  - 7 x 8 is double 7 (14), double again (28) then double again (56)
  - 36 ÷ 4: halve 36 (gives 18) then halve again (equals 9)
  - 25 ÷ 5 is the same as 5 x ? = 25 so the answer is 5

### Uses known facts to work out unknown
- **Uses relationships between facts**
  - Multiples for 6 are double the facts for 3
  - 3 x 20 is the same as 3 x 2 tens = 6 x 10 = 60
  - 3 x 20 is the same as 3 x 2 x 10 = 6 x 10 = 60

### Model commutative property
- **Multiplying the tens then the units**
  - 7 x 19 is the same as 7 tens plus 7 nines is 70 + 63 = 133
  - 2 x 3 x 5 = 2 x 5 x 3 = 10 x 3 = 30
  - 18 x 5 = 9 x 2 x 5 = 9 x 10 = 90

### Uses an area model
- **Uses a formal algorithm**
  - (Stage 3 M&D 1)
  - Solving 27 x 8
  - 27 x 8 = 216

### Recognises grouping symbols
- **Applies order of operations**
  - (Stage 3 M&D 2)
  - 5 + (2 x 3) = 5 + 6 = 11
Online and Digital Resources for Stages 3 and 4

Digital technologies have a powerful influence on how our students learn. They are often used as a tool to engage and motivate 21st century learners. Of course, they do not replace the teacher and should never be used as the sole teaching method, but rather as a resource to support teaching and learning. For example, they may be used to introduce or consolidate a concept. The following resources have been compiled to support your teaching and learning of the Australian Mathematics curriculum.

Resource for teaching 3D Objects: Interactive cube nets

Students determine which nets form cubes in the fastest possible time.

Resource for teaching Probability: Adjustable Spinner

Change the number of sectors and increase or decrease their size to create any type of spinner. Then, conduct a probability experiment by spinning the spinner many times. How does the experimental probability compare with the theoretical probability?
Resources for teaching Fractions and Area: Design your own city, farm or school

These are great websites for teaching fractions and linking the learning the concept of area. They are suitable for Stage 3 and 4 students. Instructions are clear and easy to use.

<table>
<thead>
<tr>
<th>Stage 3</th>
<th>Stage 4</th>
<th>Stage 3</th>
<th>Stage 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fractions, Decimals and Percentages MA3-7NA compares, orders and calculates with fractions, decimals and percentages</td>
<td>Fractions, Decimals and Percentages MA4-5NA operates with fractions, decimals and percentages</td>
<td>Area MA3-10MG selects and uses the appropriate unit to calculate areas, including areas of squares, rectangles and triangles</td>
<td>Area MA4-13MG uses formulas to calculate the areas of quadrilaterals and circles, and converts between units of area</td>
</tr>
</tbody>
</table>

**Resource for teaching Fractions: Chicken Coop Fraction**

Available in the Apps Store for iPads and iPhones for free, students learn to ace fractions. The chicken themed educational game assists student to develop methodologies for solving problems involving fractions.
Resources for teaching Two Dimensional Space: Transformations

As there is some new Stage 3 content for two dimensional space, particularly around translation, reflection and rotation, we have included resources that will be helpful in teaching and consolidating students’ knowledge and understanding of transformations. This is more advanced than the content expected in Stage 1 and 2 and links to the expected outcomes for Stage 4.

<table>
<thead>
<tr>
<th>Stage 3</th>
<th>Stage 4</th>
<th>Stage 4</th>
<th>Stage 5.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space</td>
<td>Properties of Geometrical Figures</td>
<td>Linear Relationships</td>
<td>Properties of Geometrical Figures</td>
</tr>
<tr>
<td>MA3-15MG</td>
<td>MA4-17MG</td>
<td>MA4-11NA</td>
<td>MA5.1-11MG</td>
</tr>
<tr>
<td>manipulates, classifies and draws two dimensional shapes, including equilateral, isosceles and scalene triangles, and describes their properties</td>
<td>classifies, describes and uses the properties of triangles and quadrilaterals, and determines congruent triangles to find unknown side lengths and angles</td>
<td>creates and displays number patterns; graphs and analyses linear relationships; and performs transformations on the Cartesian plane</td>
<td>describes and applies the properties of similar figures and scale drawings</td>
</tr>
</tbody>
</table>

There are several other interesting and helpful resources worth a look including:

http://illuminations.nctm.org/Lesson.aspx?id=3704
http://illuminations.nctm.org/Lesson.aspx?id=1826
https://schoolsequella.det.nsw.edu.au/file/5d50e45c-ffdc-4388-b3b5-c77c2082647d/1/14148.zip/14148_02.htm
## Resources for teaching Linear Relationships

<table>
<thead>
<tr>
<th>Stage 4</th>
<th>Stage 5.1</th>
<th>Stage 5.2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Linear Relationships</strong>&lt;br&gt;MA4-11NA creates and displays number patterns; graphs and analyses linear relationships; and performs transformations on the Cartesian plane</td>
<td><strong>Linear Relationships</strong>&lt;br&gt;MA5.1-6NA determines the midpoint, gradient and length of an interval, and graphs linear relationships</td>
<td><strong>Linear Relationships</strong>&lt;br&gt;MA5.2-9NA uses the gradient-intercept form to interpret and graph linear relationships</td>
</tr>
</tbody>
</table>

### Slope


This simulation provides a learning object for students to investigate the gradient of a line. Students create lines with increasing and decreasing slopes, the formula for the gradient can be hidden or unhidden to show the calculation for gradients. Students have the option to save the lines they create and discuss the relationship between slope and the value of the gradient.

![Slope Simulation](image)

### Slope and intercept

This simulation provides a learning object for students to investigate the relationship between the gradient of a line and the equation of line.

![Slope and Intercept Simulation](image)
Point and Gradient

Make the equation

Five levels of testing for students to assess their knowledge of graphing linear functions given the equation.

http://phet.colorado.edu/sims/html/graphing-lines/latest/graphing-lines_en.html
http://phet.colorado.edu/sims/html/graphing-lines/latest/graphing-lines_en.html

The line game marks the student response and shows the correct graph.

Resources for teaching Pythagoras’ Theorem: Pythagoras in 2 minutes 2

This is a YouTube clip showing Pythagoras’ Theorem, this lends itself to a great student task where students can create their own imovie of the theorem and where they find Pythagoras’ Theorem used in real life situations https://www.youtube.com/watch?v=MmeRAsXLFI0
Subscription link
DEC Mathematics Curriculum network

Click on this image to be added to our network list for all newsletters and professional learning information

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