# Learning sequence thinking mathematically 3 Stage 3

**Learning sequence description**

This sequence of lessons provides opportunities to deepen critical aspects of number knowledge through tight, targeted teaching and opportunities to apply skills (contexts for enriching learning such as games and investigations). Students will explore the flexibility of numbers and operations whilst also exploring patterns and aspects of measurement and geometry. These tasks are designed to support learning in these areas through working mathematically.

## Syllabus outcomes and content

**The following activities provide opportunities for students to demonstrate progress towards the following outcomes. A student:**

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

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

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

**MA3-4NA** orders, reads and represents integers of any size and describes properties of whole numbers

**MA3-5NA** selects and applies appropriate strategies for addition and subtraction with counting numbers of any size

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

**MA3-7NA** compares, orders and calculates with fractions, decimals and percentages

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

**MA3-10MG** selects and uses the appropriate unit to calculate areas, including areas of squares, rectangles and triangles

**MA3-15MG** manipulates, classifies and draws two-dimensional shapes, including equilateral, isosceles and scalene triangles, and describes their properties

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## What’s (some of) the mathematics? (The purpose/learning intention)

* Numbers can be represented in many different ways. You can use things like diagrams, words, symbols and materials and technologies to represent them.
* Mathematicians use a range of representations and materials to communicate ideas and solve problems
* Different people think about quantities, problems and patterns in different ways
* Numbers can be broken up into smaller parts (part-part-whole)
  + We can use this as a strategy for mental computation
  + You can partition composite units too, for example, 3 sixes can be partitioned in 3 fours and 3 twos.
* Shapes can also be broken up (decomposed) into smaller shapes. Sometimes this changes their categorisation and sometimes it doesn’t.
  + Like how numbers can be composed of other numbers (e.g. 100 is 6 tens and 4 tens; 1-quarter is 1-eighth and 1-eighth), shapes can also be composed of other shapes. E.g, a trapezium can be formed using a square and a triangle.
* Numbers, shapes and patterns can be related to other numbers, shapes and patterns in many different ways
* Usually, you can solve problems in many different ways
  + Some strategies are more efficient than others
  + An important aspect of efficiency is the number of steps you go through to solve a problem
  + The strategies you are able to use depend on how confident you feel working within a particular context and what knowledge you bring with you about numbers and operations.
* When solving problems we can use a range of strategies and relationships such as:
  + ‘make ten’, ‘bridging to ten’ and using ‘landmark numbers’ (typically multiples of tens and fives)
  + Applying an understanding of place value by partitioning, regrouping and renaming
  + Using known number facts such as familiar multiplication facts, combinations to 10 and 20, doubles, and near doubles
  + keeping a ‘constant difference’
  + using derived facts (using known facts to work out unknown facts)
  + using the commutative, associative and distributive properties
  + using doubling and halving
  + factorising one number, eg 5 × 8 is the same as 5 × 2 × 4, which becomes 10 × 4
  + Use inverse operations
* You can quantify a collection in different ways. You can use skills in subitising and visual recognition of structures like ten-frames and dice (for example), or you can use counting. You might also use these skills together.
* A pattern has an element (a repeating core) that repeats over and over and over again.
* There are different kinds of patterns, such as repeating patterns (like AB, AAB, ABC, etc.), growing and shrinking patterns (like the counting sequences…10, 9, 8, 7 where you take away 1 each time), patterns like ten-frames and dice patterns have a particular structure that always represents a particular quantity, patterns in combinations, like numbers that combine to make 10. With whole numbers, 7 and 3 is a pattern because when I have 7 of something and I join it with 3 of something, I will have 10 of something. It’s a mathematical regularity.
  + Patterns can be described and represented in different ways
* Collections and quantities can look different and have the same value
  + This includes fractional parts
* The = symbol describes an equivalent relationship (it does not mean ‘perform an operation’, or ‘write the answer here’)
* Shapes (like trapeziums) are still the same shape when they’re orientated differently in space or are presented in different sizes
  + The word ‘trapezium’ can be used to describe different shapes such as rectangles, oblongs, and squares as they fit within the definition of a trapezium.
* We can determine the size of fractional parts by using direct comparison, moving, re-shaping and imagining changes to other shapes
  + We can do the same for comparing and measuring area

There are numerous skills you might observe from students as they participate in these learning experiences. Teachers are encouraged to use the understandings and skills identified above to form the basis of their assessment focus as well as provide focal points for intentional teaching, reflection and feedback.

It is important to note that for each task, it is highly likely that there are a number of mathematical goals (learning intentions) you may like to draw student’s attention to. Teachers should make decisions based on their knowledge of their students.

## Day 1

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| Item | Learning experience | Differentiation strategies and/or adjustments | Resources |
| 1.1 | Staircase pattern 3  (Adapted from [AAMT Top Drawer Teachers Making a staircase](https://topdrawer.aamt.edu.au/Patterns/Big-ideas/Growing-patterns/Making-a-staircase) and AAMT Top Drawer Growing patterns)  Students view Staircase patterns 3 – part 1 and complete the investigation after the video in their student workbook. |  | Device to watch video  [Staircase pattern 3 video](https://sites.google.com/education.nsw.gov.au/get-mathematical-stage-3/targeted-teaching/staircase-pattern-3)  Student workbook  Coloured pencils/ markers |
| 1.2 | **Opportunity for monitoring student learning**  Teachers should use what they know about their students and information at the beginning of this document to make decisions about what they need to focus on as they use these tasks. Some aspects you may like to focus on today include:   * Can students describe spatial and numerical aspects of the structure? (Do they notice things such as the shape, the number of cubes, changes to quantities in each row and/or each column, different ways of counting/combining collections to determine ‘how many?’, symmetry, and links to multiplicative thinking, etc.?) * Can students identify and describe patterns using diagrams, words and symbols? Can they continue patterns and describe them in different ways? * To be determined |  |  |

## Day 2

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| Item | Learning experience | Differentiation strategies and/or adjustments | Resources |
| 2.1 | Pascal’s triangle  (from [youcubed](https://www.youcubed.org/wp-content/uploads/2017/07/WIM-Day-4-gr-5-9-vF.pdf))  Students investigate Pascal’s triangle and record their responses to the tasks in their student workbook. |  | Student workbook  Coloured pencils/ markers |
| 2.2 | **Opportunity for monitoring student learning**  Some aspects you may like to focus on today include:   * Can students identify and describe patterns using diagrams, words and symbols? Can they find patterns and describe them in different ways? * To be determined |  |  |

## Day 3

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| Item | Learning experience | Differentiation strategies and/or adjustments | Resources |
| 3.1 | How many characters challenge  Students view videos and complete tasks after each video in their student workbook.  How many unique characters – part 1  How many unique characters – part 2 |  | Device to view video  [How many characters challenge videos](https://sites.google.com/education.nsw.gov.au/get-mathematical-stage-3/targeted-teaching/how-many-unique-characters)  Student workbook  Coloured pencils/ markers |
| 3.4 | **Opportunity for monitoring student learning**  Some aspects you may like to focus on today include:   * How do students record their ideas? * Can students use a tree diagram to model possible combinations? Can they reason multiplicatively with ‘for each’ ideas? * To be determined |  |  |

## Day 4

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| Item | Learning experience | Differentiation strategies and/or adjustments | Resources |
| 4.1 | How to make a tangram  Students view video – How to make a tangram  This learning experience will need the support of an adult. |  | Device to view video  [How to make a tangram video](https://sites.google.com/education.nsw.gov.au/get-mathematical-stage-3/targeted-teaching/how-to-make-a-tangram)  Pair of scissors  Square sheet of paper |
| 4.2 | What is a PLOCOROO?  (From reSolve)  As a follow up to the how many unique characters, you may like to use [Multiplication Cartesian product](https://www.resolve.edu.au/multiplication-cartesian-product) with your students. |  | [Multiplication Cartesian product](https://www.resolve.edu.au/multiplication-cartesian-product) webpage |
| 4.3 | **Opportunity for monitoring student learning**  Some aspects you may like to focus on today include:   * Can students use a tree diagram to model possible combinations? Can they reason multiplicatively with ‘for each’ ideas? * To be determined |  |  |

## Day 5

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| Item | Learning experience | Differentiation strategies and/or adjustments | Resources |
| 5.1 | Tangrams 3.1: exploring trapeziums  Students view videos and complete tasks after each video in their student workbook.  Tangrams 1 –part 1  Tangrams 1 –part 2  Tangrams 1 –part 3 |  | Device to view video  [Tangrams 3.1: exploring trapeziums videos](https://sites.google.com/education.nsw.gov.au/get-mathematical-stage-3/targeted-teaching/tangrams-3-1-exploring-trapeziums)  Tangram  Student workbook  Pencil/ marker |
| 5.2 | **Opportunity for monitoring student learning**  Some aspects you may like to focus on today include:   * Can students classify two-dimensional shapes according to their side and angle properties? Do they identify key features of shapes? * How do students record their ideas? * How do students talk about the movement of shapes? * To be determined |  |  |

## Day 6

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| Item | Learning experience | Differentiation strategies and/or adjustments | Resources |
| 6.1 | Tangrams 3.2: investigating fractions  Students view videos and respond to the tasks after each video in their student workbook.  Tangrams 2– part 1  Tangrams 3– part 1  Tangrams 3– part 2  Tangrams 3– part 3 |  | Device to view video  [Tangrams 3.2: investigating fractions videos](https://sites.google.com/education.nsw.gov.au/get-mathematical-stage-3/targeted-teaching/tangrams-3-2-investigating-fractions)  Tangram  Coloured pencils/markers  Student workbook |
| 6.2 | **Opportunity for monitoring student learning**  Some aspects you may like to focus on today include:   * Can students classify two-dimensional shapes according to their side and angle properties? Do they identify key features of shapes? * How do students investigate, compare and describe fractions? * To be determined |  |  |

## Day 7

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| Item | Learning experience | Differentiation strategies and/or adjustments | Resources |
| 7.1 | Order! Order! 2(from Mike Askew)  Students view video – Order! Order! 2 and respond to task in their workbook.  Students play Order! Order!  How to play  Roll the dice and create and record a 4-digit number.  Repeat until you have 4 numbers.  Order them from smallest to largest, and largest to smallest in the fewest moves possible, moving adjacent cards only |  | Device to view video  [Order! Order! 2 video](https://sites.google.com/education.nsw.gov.au/get-mathematical-stage-3/contexts-for-practise/order-order-2)  Student workbook  1-9 sided dice  Post it notes or pieces of paper  Pencil/ marker |
| 7.2 | Tangrams 3.3: reimagining wholes  Students view video – Tangrams 4 part 1 and respond to the task after the video in their student workbook. |  | Device to view video  [Tangram 4 part 1 video](https://sites.google.com/education.nsw.gov.au/get-mathematical-stage-3/targeted-teaching/tangrams-3-3-reimagining-wholes)  Tangram  Colour pencils/markers  Student workbook |
| 7.3 | **Opportunity for monitoring student learning**  Some aspects you may like to focus on today include:   * How do students record, name and order numbers? Do they explain that the place a digit has determines its value? Do they use place value knowledge and reasoning to order numbers? * How do students investigate, compare and describe fractions? * To be determined |  |  |

## Day 8

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| Item | Learning experience | Differentiation strategies and/or adjustments | Resources |
| 8.1 | Mastermind  Students view video – Mastermind  Students play Mastermind within a number range that suits them.  How to play  Each player writes down a 3-digit number (with no repeating digits)  Each player draws up their game board (a table with 3 columns: 'guess', 'digits', 'places'  Players take turns to guess a 3-digit number  Their opponent tells them how many digits are correct and how many are in the correct place  Players record their guess, the number of digits that are correct and the number of digits that are in the right place. Players then use this information to refine their guesses.  The first player to correctly guess their opponents' number is the winner!  Players can choose to play using 4-digit numbers, 5-digit numbers, 2-digit numbers etc. |  | Device to view video  [Mastermind video](https://sites.google.com/education.nsw.gov.au/get-mathematical-stage-3/contexts-for-practise/mastermind)  Student workbook  Coloured pencils/markers |
| 8.2 | Factors fun  Students view video – Factors fun  Students create their own spinner and play Factors fun.  How to play  Get your game board, spinner, recording sheet, counters, and pencils ready  Take it in turn to spin the spinner and divide the number by the chosen divisor (for example, 5)  Players work out the solution and explain their thinking to their partner.  The partner records their thinking and if they agree, the student is able to place one of their counters on the number on the game board, claiming that place.  If the number is taken, students miss a turn.  If there are no new counters that can be added to the game board, players have to move an existing counter to a new place.  Students win by getting four counters in a row (in any orientation, including a square).  If preferred, students can use 5 or 6 counters, looking for 4 in a row. |  | Device to view video  [Factors fun video](https://sites.google.com/education.nsw.gov.au/get-mathematical-stage-3/contexts-for-practise/factors-fun)  Game board and spinner in the Student workbook  Coloured pencils/markers  Paperclip  8 counters (4 of one colour and 4 of a different colour) |
| 8.3 | **Opportunity for monitoring student learning**  Some aspects you may like to focus on today include:   * How do students record, name and reason with numbers? Do they explain that the place a digit has determines its value? * Do students use what they know about multiplication with division? Do they use appropriate language to describe division situations? What number facts do students know? How they find answers to number facts they don’t know yet? * To be determined |  |  |

## Day 9

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| Item | Learning experience | Differentiation strategies and/or adjustments | Resources |
| 9.1 | Which would you do in your head?  (Inspired by McIntosh Reys, Reys and Hope)  Students view videos and complete tasks after each video in their student workbook.  Which would you do in your head 2? Part 1  Which would you do in your head 2? Part 2 |  | Device to watch video  [Which would you do in your head? videos](https://sites.google.com/education.nsw.gov.au/get-mathematical-stage-3/targeted-teaching/which-one-would-you-do-in-your-head)  Student workbook  Pencil/ marker |
| 9.2 | Leftovers  (Adapted from Marilyn Burns)  Students view video – Leftovers.  Students play Leftovers  How to play  Write the numbers 1-10 (or 1-20) along the top of your paper  Record your starting number (we used 100 but you can change the starting number to any number you like)  Player 1 chooses a divisor that will result in leftovers (remainders)  Player 1 works out the solution to their problem (in this case, Barbara worked out 100/7)  Player 1 collects the leftovers (remainders) as points  The chosen number (in this case, 7) is crossed off the list of options  A new starting number is determined by subtracting the leftovers from the previous starting number (e.g. 100 - 2 = 98)  Play continues until there are no more moves that can be made  The winner is the person with the most leftovers. |  | Device to view video  [Leftovers video](https://sites.google.com/education.nsw.gov.au/get-mathematical-stage-3/contexts-for-practise/leftovers)  Student workbook  Coloured pencils/ markers |
| 9.3 | **Opportunity for monitoring student learning**  Some aspects you may like to focus on today include:   * Do students choose from a range of known strategies to solve additive problems? Do they use place value knowledge, known facts and part-part-whole number knowledge? Do they apply the commutative and associative properties? * To be determined |  |  |

## Day 10

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| Item | Learning experience | Differentiation strategies and/or adjustments | Resources |
| 10.1 | ABC educational resources  ABC TV Education, in collaboration with the NSW Department of Education, have planned a daily schedule of free to air educational programs.  Select a resource to use from Upper primary (Years 3-6) |  | [Upper primary (Years 3-6)](https://education.nsw.gov.au/teaching-and-learning/learning-from-home/teaching-at-home/teaching-and-learning-resources/non-department-resources/abc-educational-resources/upper-primary) webpage |
| 10.2 | Hit it!  (from Mike Askew)  Students view video – Hit it!  How to play  Draw up your game board (in this game, we were working with 3-digit numbers but you can use larger or smaller numbers if you like)  Select a multiple of hundred between 100 and 900 to be your target number  The person with the most letters in their surname goes first  Take it in turns to roll the dice and use the digit somewhere in your number  Once the digits are full, players read their number and determine how far they are away from the target number. The player who is closest to the target number wins a point.  The winner with the most points after 3 rounds is declared the winner. |  | Device to watch video  [Hit it! video](https://sites.google.com/education.nsw.gov.au/get-mathematical-stage-3/contexts-for-practise/hit-it)  Student workbook  Pencil/ marker  9-sided dice |
| 10.3 | **Opportunity for monitoring student learning**  Some aspects you may like to focus on today include:   * How do students record, name and reason with numbers? Do they explain that the place a digit has determines its value? * To be determined |  |  |

**Reflection and evaluation**

These simple questions may help you reflect on your students’ learning and plan for next steps.

What worked well and why?

What didn’t work and why?

What might I do differently next time?

What are the next steps for student learning based on the evidence gathered?