7.5 Content for Stage 3

Consult

Mathematics • Stage 3

Number and Algebra

Whole Numbers 1

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- orders, reads and represents numbers of any size MA3-4NA

Students:

Recognise, represent and order numbers to at least tens of millions

- apply an understanding of place value and the role of zero to read, write and order numbers of any size [L]
- state the place value of digits in numbers of any size
- order numbers of any size in ascending or descending order
- record numbers of any size using expanded notation (ie partition using place value), eg 163 480 = 100 000 + 60 000 + 3000 + 400 + 80
- partition numbers of any size in non-standard forms to aid mental calculation, eg when adding 163 480 and150 000, 163 480 could be partitioned as 150 000 + 13 480; so that 150 000 could then be doubled and added to 13 480 [CCT]
- use numbers of any size in real-life situations including in money problems [N]
  - interpret information from the internet, media, environment and other sources that use large numbers (Communicating) [L, N, ICT, CCT, PSC, WE]
- recognise different abbreviations of numbers used in everyday contexts, eg $350K represents $350 000 [L, N, WE]
- round numbers appropriately when estimating

Identify and describe factors and multiples of whole numbers and use them to solve problems (ACMNA098)

- determine the factors of a given whole number, eg 36 has factors 1, 2, 3, 4, 6, 9, 12, 18, and 36
- determine the highest common factor (HCF) of two whole numbers, eg the HCF of 16 and 24 is 8
- find multiples of a given whole number, eg multiples of 7 are 7, 14, 21, 28, …
- identify the lowest common multiple (LCM) of two whole numbers, eg the LCM of 21 and 63 is 63
- solve problems using knowledge of factors and multiples, eg ‘There are 48 people at a party. In how many ways can you set up the tables and chairs, so that each table seats the same number of people and there are no empty chairs?’

Mathematics • Stage 3

Number and Algebra

Whole Numbers 1

Background information

Students need to develop an understanding of place value relationships such as 10 thousand = 100 hundreds = 1000 tens = 10 000 ones.

Language

Students should be able to communicate using the following language: millions, whole number, lowest common multiple, highest common factor.

The abbreviation K comes from the Greek word *khilios* meaning 'thousand'. It is used in many job advertisements to represent salaries (eg a salary of $70K or $70 000). It is also used as an abbreviation for the size of computer files (eg a size of 20K, meaning twenty thousand bytes).

Mathematics • Stage 3

Number and Algebra

Whole Numbers 2

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- gives a valid reason for supporting one possible solution over another MA3-3WM
- orders, reads and represents numbers of any size MA3-4NA

Students:

Investigate everyday situations that use integers. Locate and represent these numbers on a number line (ACMNA124)

- recognise the location of negative whole numbers in relation to zero and locate them on a number line
- investigate negative numbers and the number patterns created when counting backwards on a calculator
  - recognise that negative numbers can result from subtraction (Reasoning)
  - ask 'What if' questions, eg 'What happens if we subtract a larger number from a smaller number on a calculator?' (Communicating) [L, N, CCT]
- interpret negative whole numbers in everyday contexts, eg temperature [N]

Identify and describe properties of prime, composite, square and triangular numbers (ACMNA122)

- determine whether a number is prime, composite or neither
  - explain whether a whole number is prime, composite or neither by finding the number of factors, eg '13 has two factors (1 and 13) and therefore is prime'; '21 has more than two factors (1, 3, 7, 21) and therefore is composite'; '1 is neither prime nor composite as it has only one factor, itself' (Communicating, Reasoning)
  - explain why a prime number, when modelled as an array, can have only one row (Communicating, Reasoning)
- model square and triangular numbers and record each number group in numerical and diagrammatic form [L]
  - explain how square and triangular numbers are created (Communicating, Reasoning) [CCT]
  - explore square and triangular numbers using arrays, grid paper or digital technologies (Communicating, Problem Solving) [N, ICT]
  - recognise and explain the relationship between the way each pattern of numbers is created and the name of the number group (Communicating, Reasoning) [L]

Mathematics • Stage 3

Number and Algebra

Whole Numbers 2

Background information

Square numbers *Triangular numbers*

Students could investigate patterns of triangular numbers such as when two consecutive triangular numbers are added together they have a value equal to the following square number, eg the sum of the consecutive triangular numbers 1 and 3 is equal to the square number 4.

Language

Students should be able to communicate using the following language: number line, positive number, negative number, prime number, composite number, square number, triangular number.

Words such as ‘square’ have more than one mathematical context, eg draw a square; square three; find the square root of 9. Students may need to have these differences explained.

Words such as ‘product’, ‘odd’, ‘prime’ and ‘power’ have different meanings in mathematics from their everyday usage. This may be confusing for some students.

Mathematics • Stage 3

Number and Algebra

Addition and Subtraction 1

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- gives a valid reason for supporting one possible solution over another MA3-3WM
- selects and applies appropriate strategies for addition and subtraction with counting numbers of any size MA3-5NA

Students:

Use efficient mental and written strategies and apply appropriate digital technologies to solve problems (ACMNA291)

- select and apply efficient mental, written and calculator strategies to solve addition and subtraction problems [L, N, ICT, CCT]
  - use efficient methods to record solutions to addition and subtraction problems (Communicating, Problem Solving)
- use addition and subtraction to solve problems with money, eg 'How many different ways could you give change from $10 for an item costing $4.45?' [N, CCT]
- check solutions by using the inverse operation or a different method [N, CCT]

Use estimation and rounding to check the reasonableness of answers to calculations (ACMNA099)

- round numbers when estimating
- use estimation to check solutions to addition and subtraction problems, eg 1438 + 129 is about 1440 + 130 [N]
  - explain when an exact or approximate answer is best suited to a situation (Communicating, Reasoning) [CCT]

Create simple financial plans (ACMNA106)

- use knowledge of addition and subtraction facts to create a financial plan such as a budget, eg 'Organise a class celebration on a budget of $60 for all expenses' [N, PSC, WE]
  - record numerical data in a simple spreadsheet (Communicating) [ICT]
  - give reasons for prioritising, deleting and selecting items for inclusion in a budget (Communicating, Reasoning) [N, CCT, PSC, WE]

Mathematics • Stage 3

Number and Algebra

Addition and Subtraction 1

Background information

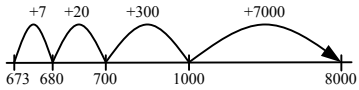
At this stage, mental strategies need to be continually reinforced and used to check results obtained using formal algorithms.

Students may find recording (writing out) informal mental strategies to be more efficient than a formal written algorithm, particularly for the case of subtraction.

For example 8000 − 673 is easier to calculate mentally than by using a formal algorithm.

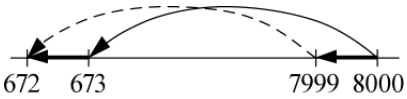
Written strategies using informal mental strategies (number line):

The jump strategy can be used on an empty number line to count up rather than back.



The answer will therefore be 7000 + 300 + 20 + 7 = 7327. Students could share possible approaches and compare them to determine the most efficient.

The difference can be shifted one unit to the left on an empty number line, so that 8000 − 673 becomes 7999 – 672, which is an easier subtraction to calculate.



Written strategies using a formal algorithm (decomposition method):

$$\begin{array}{r} {\scriptstyle 7\ 9\ 9\ 1} \\ 8\,0\,0\,0 \\ -\quad 6\,7\,3 \\ \hline 7\,3\,2\,7 \end{array}$$

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

Students may explore other currencies while creating simple travel financial plans.

Language

Students should be able to communicate using the following language: approximate, budget.

Difficulties could arise for some students with phrasing in relation to subtraction problems, eg ‘10 take away 9’ will give a different response to ‘10 was taken away from 9’.

Mathematics • Stage 3

Number and Algebra

Addition and Subtraction 2

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- gives a valid reason for supporting one possible solution over another MA3-3WM
- selects and applies appropriate strategies for addition and subtraction with counting numbers of any size MA3-5NA

Students:

Select and apply efficient mental and written strategies and appropriate digital technologies to solve problems involving all four operations with whole numbers (ACMNA123)

- add numbers with different numbers of digits, eg 42 000 + 5123 + 246
- pose and solve problems that can be solved using whole numbers of any size and more than one operation [CCT]
  - select and apply appropriate mental and written strategies with or without digital technologies to solve unfamiliar problems (Problem Solving) [N, L, ICT, CCT]
  - explain how an answer was obtained for an addition or subtraction problem and justify the selected calculation method (Communicating, Problem Solving, Reasoning) [N, CCT]
  - reflect on their chosen method of solution for a problem, considering whether it can be improved (Communicating, Reasoning) [N, CCT]
  - give reasons why a calculator was useful when solving a problem (Communicating, Reasoning) [N]
- use efficient methods to record solutions to addition and subtraction problems [L, N]
  - use a table or similar visual organiser to record methods used to solve problems (Communicating, Problem Solving) [N]
  - use a formal written algorithm as a recording method for addition and subtraction problems (Communicating, Problem Solving) [L]

Background information

Refer to background information in Addition and Subtraction 1.

Language

Refer to language in Addition and Subtraction 1.

Mathematics • Stage 3

Number and Algebra

Multiplication and Division 1

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, 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

Students:

Solve problems involving multiplication of large numbers by one- or two-digit numbers using efficient mental, written strategies and appropriate digital technologies (ACMNA100)

- multiply three- and four-digit numbers by one-digit numbers using mental and written strategies, and digital technologies [N, ICT]

  eg 432×5

  Written form of mental calculation

  $= (400 \times 5) + (30 \times 5) + (2 \times 5)$

  $= 2000 + 150 + 10$

  $= 2160$

  Algorithm

  $$\begin{array}{r} 4\ 3\ 2\ \times \\ \hline {\scriptstyle 1\ \ 1}\ \ 5 \\ \hline 2\ 1\ 6\ 0 \end{array}$$

- multiply two- or three-digit numbers by two-digit numbers using mental and written strategies including the extended form (long multiplication) [N]

  eg

  $$\begin{array}{r} 5\ 2\ 1\ \times \\ \quad 2\ 2 \\ \hline 1\ 0\ 4\ 2 \\ 1\ 0\ 4\ 2\ 0 \\ \hline 1\ 1\ 4\ 6\ 2 \end{array}$$

  - apply factorisation of numbers to aid mental computation, eg $12 \times 25 = 3 \times 4 \times 25 = 3 \times 100 = 300$ (Problem Solving) [CCT]
  - estimate answers to calculations and compare with the exact answer (Reasoning) [N]

- apply appropriate mental and written strategies, and digital technologies, to solve multiplication and division word problems [N, L, ICT, CCT]
  - use the appropriate operation in solving problems in real-life situations (Problem Solving) [N]
  - estimate answers to problems and use inverse operations to justify solutions (Problem Solving, Reasoning) [N, CCT]

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
- recognise and use different notations to indicate division, eg $25 \div 4$, $4\overline{)25}$, $\frac{25}{4}$ [L]
- record remainders as fractions or decimals, where appropriate, eg $25 \div 4 = 6\frac{1}{4}$ or 6.25 [L]

Mathematics • Stage 3

Number and Algebra

Multiplication and Division 1

- divide a number with three or more digits by a single-digit divisor using appropriate mental, written or calculator strategies and digital technologies [N, ICT]

  eg $341 \div 4$ *Written form of mental calculation*

  $340 \div 4 = 85$

  $1 \div 4 = \frac{1}{4}$

  so $341 \div 4 = 85\frac{1}{4}$

  Algorithm

  $$4\overline{)341}\quad 85\ \tfrac{1}{4}$$

- use and interpret remainders in answers to division problems, eg rounding up an answer; 'How many cars are required to take 47 people to the beach?' [CCT]

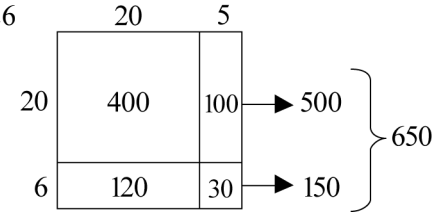
Background information

Students could extend their recall of number facts beyond the multiplication facts to 10 × 10 by memorising multiples of numbers such as 11, 12, 15, 20 and 25. They could also utilise mental strategies such as '14 × 6 is 10 sixes plus 4 sixes'.

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

Students at this stage may benefit from using an area model to understand two-digit by two-digit multiplication,

eg 25×26



Language

Students should be able to communicate using the following language: area, quotient, fraction, decimal.

In mathematics, 'quotient' refers to the answer obtained when one number is divided by another.

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

The terms rate and ratio are not introduced at this stage, but students need to be able to interpret these problems as requiring multiplication or division.

Mathematics • Stage 3

Number and Algebra

Multiplication and Division 2

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, 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

Students:

Select and apply efficient mental and written strategies and appropriate digital technologies to solve problems involving all four operations with whole numbers (ACMNA123)

- use efficient mental and written strategies, and digital technologies to solve whole-number problems involving multiplication and division, including:
  - the inverse relationship of multiplication and division, eg '150 ÷ 3 = 50 because 3 × 5 = 15 and 15 multiplied by 10 is 150'
  - using known facts, eg 10 × 9 = 90 so 13 × 9 = 90 + 9 + 9 + 9 = 90 + 27 = 117
  - multiplying the tens and then the units, eg 25 × 17 is $(25\times10)+(25\times7)=250+175=425$
  - the relationship between multiplication facts, eg 75 × 4 is double 75 and double again or 75 × 4 is the same as 150 × 2
  - factorising, eg $48\times5=8\times6\times5=8\times30=240$ [L, ICT, CCT]
  - estimate answers to problems and check to justify solutions (Problem Solving, Reasoning) [N, CCT]
  - use a table or similar visual organiser to record methods used to solve problems (Communicating, Problem Solving) [N, ICT]
- use mental strategies to multiply or divide a number by 100 or a multiple of 10 [N]
- solve problems involving multiplication and division, eg 'A recipe requires 3 cups of flour for 10 people. How many cups of flour are required for 40 people?' [N, CCT]
  - use appropriate language to compare quantities, eg 'twice as much as', 'half as much as' (Communicating) [N, CCT]

Explore the use of brackets and order of operations to write number sentences (ACMNA134)

- recognise that grouping symbols $(\ )$ or $[\ ]$ are used in number sentences to indicate operations that must be performed first [L, N]
- recognise that if more than one pair of grouping symbols is used, then the operation within the innermost set is performed first [N]
- perform calculations involving grouping symbols mentally,

eg $5+(3\times2)=5+6$; $=11$

$(2+3)\times(16-9)=5\times7$; $=35$

$3+[20\div(9-5)]=3+[20\div4]$

$=3+5$

$=8$

Mathematics • Stage 3

Number and Algebra

Multiplication and Division 2

- investigate and establish the order of operations using real-life contexts, eg 'I buy 6 goldfish each costing $10 and 2 water plants each costing $4. What is the total cost?'; this can be represented by the number sentence 6 × 10 + 2 × 4 but to obtain the total cost, multiplication must be performed first, before addition [L, N, CCT, WE]
  - write number sentences to represent real-life situations, using grouping symbols if necessary (Communicating, Problem Solving) [L, N]
- apply the order of operations to perform calculations involving mixed operations and grouping symbols mentally [N, WE],
  eg $32+2-4=34-4$ addition and subtraction only, therefore work left to right
  $=30$

  $32\div2\times4=16\times4$ multiplication and division only, therefore work left to right
  $=64$

  $32\div\left(2\times4\right)=32\div8$ perform operation in grouping symbols first
  $=4$

  $\left(32+2\right)\times4=34\times4$ perform operation in grouping symbols first
  $=136$

  $32+2\times4=32+8$ multiplication must be performed before addition
  $=40$

  - investigate whether different digital technologies apply the order of operations (Reasoning) [N, ICT, CCT]
- recognise when grouping symbols are not necessary, eg $32+\left(2\times4\right)$ has the same answer as $32+2\times4$

Background information

Students could extend their recall of number facts beyond the multiplication facts to 10 × 10 by also memorising multiples of numbers such as 11, 12, 15, 20 and 25, or by utilising mental strategies such as '14 × 6 is 10 sixes plus 4 sixes'.

The simplest multiplication word problems relate to rates, eg 'If four students earn $3 each, how much do they have all together?' Another type of problem is related to ratio and uses language such as 'twice as many as' and 'six times as many as'.

Refer also to background information in Multiplication and Division 1.

Mathematics • Stage 3

Number and Algebra
Multiplication and Division 2

Language

Students should be able to communicate using the following language: order of operations, grouping symbols, brackets.

'Grouping symbols' is a collective term used to describe brackets [ ], parentheses ( ) and braces { }. However, it is common to use the term 'brackets' as outlined below:

( ) brackets / ordinary brackets / round brackets

[ ] square brackets

{ } curly brackets

Mathematics • Stage 3

Number and Algebra

Fractions and Decimals 1

Outcomes

A student:

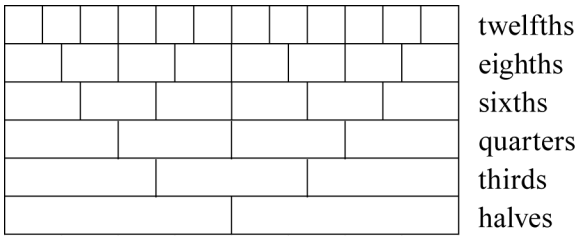
- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- gives a valid reason for supporting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

Students:

Compare and order common unit fractions and locate and represent them on a number line (ACMNA102)

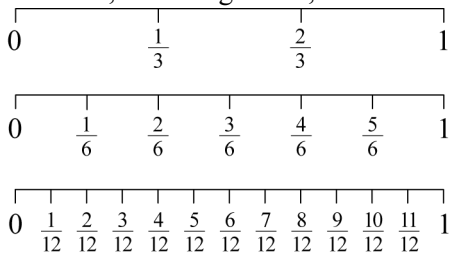
- model, compare and represent fractions, including thirds, sixths and twelfths, of a whole object or collection of objects
  - compare the relative size and/or equivalence of fractions drawn on the same diagram (Reasoning) [N, CCT],

eg



- place fractions, including thirds, sixths and twelfths, on a number line between 0 and 1,

eg



- compare and order unit fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12 and 100 [N, CCT]
  - compare the relative value of unit fractions by placing them on a number line between 0 and 1 (Communicating, Reasoning) [N]
  - investigate and explain the relationship between the value of a unit fraction and its denominator (Communicating, Reasoning) [N, CCT]

Investigate strategies to solve problems involving addition and subtraction of fractions with the same denominator (ACMNA103)

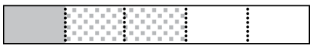
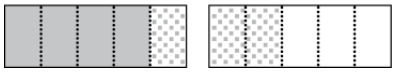
- express mixed numerals as improper fractions and vice versa, through the use of diagrams or number lines, leading to a mental strategy [L]
- recognise that $1+\frac{1}{2}=1\frac{1}{2}$ [N]

Mathematics • Stage 3

Number and Algebra

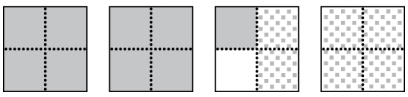
Fractions and Decimals 1

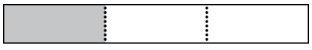
- model and represent strategies and/or diagrams to add simple proper fractions with the same denominator, where the result may be a mixed numeral, [N]

  eg $\frac{1}{5} + \frac{2}{5}$  or $\frac{4}{5} + \frac{3}{5}$ 

- model and represent a whole number added to a proper fraction, eg $2 + \frac{3}{4} = 2\frac{3}{4}$ [N]
- subtract a simple proper fraction from another proper fraction with the same denominator,

  eg $\frac{7}{8} - \frac{2}{8}$ [N]
- model and represent strategies and/or diagrams to add mixed numerals with the same denominator, eg

  $2\frac{1}{4} + 1\frac{2}{4}$ 
- use diagram, mental and written strategies to subtract a unit fraction from any whole number including 1 [N],

  eg $1 - \frac{1}{3} = \frac{2}{3}$ 
- solve word problems that involve addition and subtraction of fractions with the same denominator,

  eg 'I eat $\frac{1}{5}$ of a block of chocolate and you eat $\frac{3}{5}$ of the same block. How much of the block of chocolate has been eaten?' [N, CCT]
  - use estimation to verify that an answer is reasonable (Problem Solving, Reasoning) [N, CCT]

Recognise that the place value system can be extended beyond hundredths (ACMNA104)

- express thousandths as decimals
- interpret decimal notation for thousandths, eg $0.123 = \frac{123}{1000}$

Compare, order and represent decimals (ACMNA105)

- compare and order decimal numbers with up to three decimal places, eg 0.5, 0.125, 0.25 [L]
  - recognise that 0.17 has the same value as 0.170 (Communicating) [CCT]
- place decimal numbers of up to three decimal places on a number line between 0 and 1

Mathematics • Stage 3

Number and Algebra

Fractions and Decimals 1

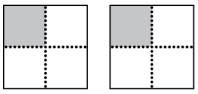
Background information

At this stage, 'simple fractions' refers to those with denominators 2, 3, 4, 5, 6, 8, 10, 12 and 100. A unit fraction is any proper fraction in which the numerator is 1, eg $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \ldots$

Fractions may be interpreted in different ways depending on the context: two quarters $\left(\frac{2}{4}\right)$ may be thought of as two equal parts of one whole that has been divided into four equal parts.

Alternatively, two quarters $\left(\frac{2}{4}\right)$ may be thought of as two equal parts of two wholes that have each been divided into quarters.

$\frac{1}{4} + \frac{1}{4} = \frac{2}{4}$



Students need to interpret a variety of word problems and translate them into mathematical diagrams and/or fraction notation. Fractions have different meanings depending on the context, eg show on a diagram $\frac{3}{4}$ of a pizza; four children share three pizzas, draw a diagram to show how much each receives.

Language

Students should be able to communicate using the following language: unit fraction, thousandths, improper fraction, reduce, lowest, is the same as, equivalent, not equivalent, common factor, estimate, quantity, round to.

The decimal 1.12 is read 'one point one two' and not 'one point twelve'.

When expressing fractions in English, the numerator is said first, followed by the denominator. However, in many Asian languages (eg Chinese, Japanese) the opposite is the case: the denominator is said before the numerator. Students from such language backgrounds should be encouraged to think in English when they are speaking about or expressing fractions.

Mathematics • Stage 3

Number and Algebra

Fractions and Decimals 2

Outcomes

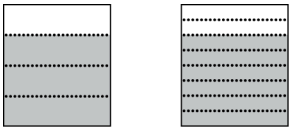
A student:

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

Students:

Compare fractions with related denominators and locate and represent them on a number line (ACMNA125)

- compare and order simple fractions with related denominators using strategies such as diagrams, the number line or equivalent fractions, eg $\frac{1}{2}, \frac{3}{4}, 1, 1\frac{1}{4}, 1\frac{1}{2}$ [N]
- find equivalent fractions by re-dividing the whole, using diagrams and number lines eg



$\frac{3}{4}$ $\frac{6}{8}$

- develop mental strategies for generating equivalent fractions, eg multiply or divide the numerator and the denominator by the same number, eg $\frac{1}{4} = \frac{2\times1}{2\times4} = \frac{3\times1}{3\times4} = \frac{4\times1}{4\times4}$, ie $\frac{1}{4} = \frac{2}{8} = \frac{3}{12} = \frac{4}{16}$
  - explain or demonstrate why two fractions are or are not equivalent (Communicating, Reasoning) [CCT]
- reduce a fraction to its lowest equivalent form by dividing the numerator and the denominator by a common factor eg $\frac{4}{16} = \frac{4\div4}{16\div4} = \frac{1}{4}$
  - apply knowledge of equivalent fractions to conversion between units of time, eg 15 minutes is the same as $\frac{15}{60}$ of an hour which is the same $\frac{1}{4}$ of an hour (Problem Solving) [N]

Solve problems involving addition and subtraction of fractions with the same or related denominators (ACMNA126)

- add and subtract simple fractions, including mixed numerals, where one denominator is the same as, or a multiple of, the other, eg $\frac{2}{3}+\frac{1}{6}$, $2\frac{3}{8}-1\frac{1}{2}$, $2\frac{3}{8}-\frac{3}{4}$ [N]
  - use improper fractions in calculations involving mixed numerals (Communicating) [N]
  - convert an improper fraction in an answer to a mixed numeral (Communicating) [N]
  - use knowledge of equivalence to simplify answers when adding and subtracting fractions (Communicating, Reasoning) [N]

Mathematics • Stage 3

Number and Algebra

Fractions and Decimals 2

- solve word problems involving the addition and subtraction of fractions where one denominator is the same as, or a multiple of the other, eg 'I ate $\frac{1}{8}$ of a cake and my friend ate $\frac{1}{4}$ of the cake. What fraction of the cake remains?' [L, N, CCT]
- multiply simple fractions by whole numbers using repeated addition, leading to a rule, eg $\frac{2}{5}\times 3=\frac{2}{5}+\frac{2}{5}+\frac{2}{5}=\frac{6}{5}=1\frac{1}{5}$ leading to $\frac{2}{5}\times 3=\frac{2\times 3}{5}=\frac{6}{5}=1\frac{1}{5}$ [CCT]

Find a simple fraction of a quantity where the result is a whole number, with and without digital technologies (ACMNA127)

- calculate unit fractions of a collection with and without digital technologies, eg calculate $\frac{1}{5}$ of 30 [ICT]
  - describe the connection between finding a unit fraction of a collection and the operation of division (Communicating, Problem Solving) [CCT]
- calculate a simple fraction of a collection/quantity with and without digital technologies, eg calculate $\frac{2}{5}$ of 30 [N, ICT]
  - explain how unit fractions can be used in the calculation of simple fractions of collections/quantities, eg 'To calculate $\frac{3}{8}$ of a quantity, I found $\frac{1}{8}$ of the collection first and then multiplied by 3.' (Communicating, Reasoning) [N, CCT]
- solve word problems involving a fraction of a collection/quantity [N]

Add and subtract decimals, with and without digital technologies, and use estimation and rounding to check the reasonableness of answers (ACMNA128)

- add and subtract decimals with the same number of decimal places, with and without digital technologies [ICT]
- add and subtract decimals with a different number of decimal places, with and without digital technologies [ICT]
  - relate decimals to fractions to aid mental strategies (Communicating) [N]
  - justify solutions using estimation and rounding (Communicating, Reasoning) [N, CCT]
- solve word problems involving the addition and subtraction of decimals, including those involving money [PSC, WE]
  - interpret a calculator display in the context of the problem, eg 2.6 means $2.60 (Communicating) [N]

Multiply decimals by whole numbers and perform divisions by non-zero whole numbers where the result are terminating decimals, with and without digital technologies (ACMNA129)

- use mental strategies to multiply simple decimals by single-digit numbers eg 3.5 × 2 [N]
- multiply decimals (up to three decimal places) by whole numbers of up to two-digits, with and without digital technologies, eg 'I measured three desks. Each desk was 1.25 m in length, so the total length is 3 × 1.25 = 3.75 m.' [N, ICT]

Mathematics • Stage 3

Number and Algebra

Fractions and Decimals 2

- divide decimals by a single-digit number where the result is a terminating decimal eg $5.25 \div 5 = 1.05$
- solve problems involving the multiplication and division of decimals, including those involving money, eg determine the 'best buy' for different size cartons of cans of soft drink [PSC, WE]

Multiply and divide decimals by powers of 10 (ACMNA130)

- recognise the number pattern formed when decimals are multiplied or divided by 10 or 100
- multiply and divide decimal numbers by 10, 100 and 1000
  - use a calculator to explore the effect of multiplying or dividing decimal numbers by multiples of ten (Reasoning)

Make connections between equivalent fractions, decimals and percentages (ACMNA131)

- recognise that the symbol % means 'percent' [L]
- represent common percentages as fractions and decimals, eg '25% means 25 out of 100 or $\frac{1}{4}$ or 0.25'
  - recognise fractions, decimals and percentages as different representations of the same value (Communicating) [N]
  - recall commonly used equivalent percentages, decimals and fractions, eg 75%, 0.75, $\frac{3}{4}$ (Communicating) [N]
- represent simple fractions as decimals and as percentages
  - interpret and explain the use of fractions, decimals and percentages in everyday contexts, eg $\frac{3}{4}$ hour = 45 minutes , percentage of native trees in the local area (Communicating, Reasoning) [N, SE]
- represent decimals as fractions and percentages, eg $1.37 = 137\% = \frac{137}{100} = 1\frac{37}{100}$

Investigate and calculate percentage discounts of 10%, 25% and 50% on sale items, with and without digital technologies (ACMNA132)

- equate 10% to $\frac{1}{10}$, 25% to $\frac{1}{4}$ and 50% to $\frac{1}{2}$ [N]
- calculate simple percentages (10%, 25%, 50%) of quantities, with and without digital technologies [N, ICT, WE]
  - choose the most appropriate equivalent form of a percentage to aid calculation, eg $25\% \text{ of } \$200 = \frac{1}{4} \text{ of } \$200 = \$200 \div 4 = \$50$ (Problem Solving) [N]
- use mental strategies to estimate discounts of 10%, 25% or 50%, eg '50% off the price of $122.70; 50% is the same as $\frac{1}{2}$, so the discount is approximately $60' [N, PSC, WE]
- calculate the sale price of an item after a discount of 10%, 25% or 50%, with and without digital technologies, recording the strategy and result

Mathematics • Stage 3

Number and Algebra

Fractions and Decimals 2

Background information

At this stage, 'simple fraction' refers to those with denominators 2, 3, 4, 5, 6, 8, 10, 12 and 100.

When adding or subtracting with mixed numerals, students should be encouraged to convert mixed numerals to improper fractions first. Working with the whole number parts separately from the fractional parts can lead to difficulties, particularly where the subtraction of the fractional parts results in a negative value, for example in the question $2\frac{1}{3} - 1\frac{5}{6}$ where $\frac{1}{3} - \frac{5}{6}$ results in a negative value. Using improper fractions results in:

$$\begin{aligned} 2\tfrac{1}{3} - 1\tfrac{5}{6} &= \tfrac{7}{3} - \tfrac{11}{6} \\ &= \tfrac{14-11}{6} \\ &= \tfrac{3}{6} \\ &= \tfrac{1}{2} \end{aligned}$$

Language

Students should be able to communicate using the following language: terminating decimal, percent, percentages, best buy, discount, sale price.

The decimal 1.12 is read 'one point one two' and not 'one point twelve'.

The word cent comes from the Latin word *centum* meaning 'one hundred'. 'Percent' means 'out of one hundred' or 'hundredths'.

A 'terminating' decimal has a finite number of decimal places, eg 3.25 (2 decimal places) or 18.421 (3 decimal places).

Mathematics • Stage 3

Number and Algebra

Patterns and Algebra 1

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- gives a valid reason for supporting one possible solution over another MA3-3WM
- analyses and creates geometric and number patterns, and constructs and completes number sentences involving the four operations MA3-8NA

Students:

Describe, continue and create patterns with fractions, decimals and whole numbers resulting from addition and subtraction (ACMNA107)

- identify and describe a simple number pattern involving one operation (including patterns that decrease), eg 4, 8, 16, 32, … 'each term in this number pattern is double the previous term'; 48, 41, 34, 27, … 'there is a difference of seven between each term in this number pattern' [N, CCT]
- create, with materials or digital technologies, a variety of patterns using whole numbers, fractions or decimals, eg $\frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{4}{4}, \frac{5}{4}, \frac{6}{4}$, … or 2.2, 2.0, 1.8, 1.6, … [ICT, CCT]
- use a number line or 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 values, eg 'Find $\square$ so that $5 \times \square = 30 - 10$'; 'Find $\square$ so that $5 \times \square = 4 \times 10$' [N]
  - describe strategies for completing simple number sentences and justify solutions (Communicating, Reasoning) [N, CCT]
- identify and use inverse operations to assist with the solution of number sentences [N], eg 'Find $\square$ so that $125 \div 5 = \square$' becomes: 'Find $\square$ so that $\square \times 5 = 125$'
  - describe how inverse operations can be used to solve a number sentence (Communicating, Reasoning) [CCT]
- complete number sentences involving multiplication and division, including using fractions or decimals, eg 'Find $\square$ so that $7 \times \square = 7.7$'
  - check solutions to number sentences by substituting the solution into the original question (Reasoning) [N, CCT]
- write number sentences to match word problems that require finding an unknown, eg 'I am thinking of a number so that when I double it and add 5 the answer is 13. What is the number?' [L, N]

Mathematics • Stage 3

Number and Algebra

Patterns and Algebra 1

Background information

This topic involves algebra without symbols. Symbols should not be introduced until the students have had considerable experience describing patterns in their own words. Students should be given opportunities to discover and create patterns and to describe, in their own words, relationships contained in those patterns. Students will typically use trial-and-error methods to find solutions to number sentences. They need to be encouraged to work backwards and to describe the processes using inverse operations. The inclusion of sentences that do not have whole number solutions will aid this process.

To represent equality of mathematical expressions, the terms ‘is the same as’ or ‘is equal to’ should be used. Use of the word ‘equals’ may suggest that the right side of an equation contains ‘the answer’, rather than a value equivalent to that on the left.

Language

Students should be able to communicate using the following language: previous term, unknown, inverse operation.

At this stage, students should be encouraged to use their own words to describe number patterns. Patterns can usually be described in more than one way and it is important for students to hear how other students describe the same pattern. Students’ descriptions of number patterns can then become more sophisticated as they experience a variety of ways of describing the same pattern.

The teacher could begin to model the use of more appropriate mathematical language to encourage this development.

Mathematics • Stage 3

Number and Algebra

Patterns and Algebra 2

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- gives a valid reason for supporting one possible solution over another MA3-3WM
- analyses and creates geometric and number patterns, and constructs and completes number sentences involving the four operations MA3-8NA

Students:

Continue and create sequences involving whole numbers, fractions and decimals. Describe the rule used to create the sequence (ACMNA133)

- continue and create number sequences, with or without digital technologies, using whole numbers, fractions and decimals, eg $\frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \ldots$ or 1.25, 2.5, 5, … [ICT, CCT]
  - describe how number sequences have been created and how they can be continued (Communicating, Problem Solving) [CCT]
- create simple geometric patterns using concrete materials [L],
  eg △ , △△ , △△△ , △△△△ , …
- complete a table of values for a geometric pattern, and describe the pattern in words,
  eg □ , □□ , □□□ , □□□□ , … ⇨

number of squares	1	2	3	4	…	100
number of matches	4	8	12	16	…	

  - describe the number pattern in a variety of ways and record descriptions using words, eg ‘It looks like the multiplication facts for four.’[L]
  - determine the rule to describe the pattern relating the bottom number to the top number in a table, eg ‘You multiply the number of squares by four to get the number of matches.’ [N, CCT]
  - use the rule to calculate the corresponding value for a larger number, eg ‘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 [L],
  eg

Position in pattern	1	2	3	4	5	6
Value of term	4	5	6	7		

  - describe the pattern in a variety of ways and record descriptions in words, eg ‘It goes up by ones, starting from four’ [L, N]
  - determine a rule to describe the pattern from the table, eg ‘To get the value of the term, you add three to the position in the pattern’ [N, CCT]
  - use the rule to calculate the value of the term for a large position number, eg ‘What is the 55th term of the pattern?’ [N]
  - 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 term (Communicating, Reasoning) [L, CCT]
  - interpret explanations written by peers and teachers that accurately describe geometric and number patterns (Communicating) [L, N, CCT]

Mathematics • Stage 3

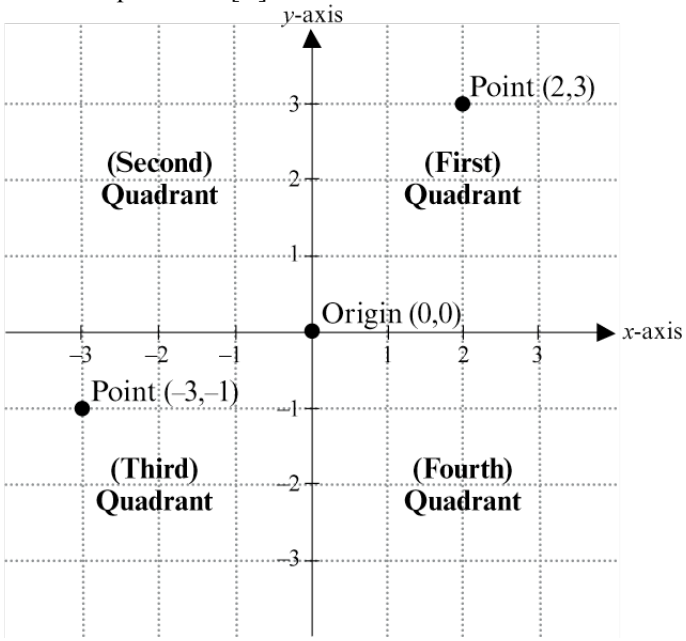
Number and Algebra

Patterns and Algebra 2

- make generalisations about numbers and number relationships, eg 'If you add a number and then subtract the same number, the result is the number you started with.' [N, CCT]

Introduce the Cartesian coordinate system using all four quadrants (ACMMG143)

- recognise that a 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), and four quadrants [L]



  - recognise that the horizontal axis and vertical axis meet at right angles (Reasoning)
- identify the point of intersection of the two axes as the origin, having coordinates (0,0) [L]
- describe and locate given coordinates of points in all four quadrants, eg the point (2,3) is in the first quadrant [L]
- read and plot a sequence of coordinates to create a picture [L]

Mathematics • Stage 3

Number and Algebra

Patterns and Algebra 2

Background information

Refer to background information in Patterns and Algebra 1

At this stage, students need to connect the value of a particular term in the pattern with its position in the pattern. This is best achieved through a table of values. Students need to see a connection between the two numbers in each column and should describe the pattern in terms of the operation that is performed on the position in the pattern to obtain the value of the term.

The notion of locating position and plotting coordinates is established in the Stage 2 Measurement and Geometry 'Position' substrand. It is further developed in this topic to include negative numbers and the use of the four-quadrant number plane.

The Cartesian plane (commonly referred to as 'the number plane') is named after Descartes who was one of the first to develop analytical geometry on the number plane. On a number plane the coordinates of a point refer to an ordered pair (x, y) describing the horizontal position x first, followed by the vertical position y.

The Cartesian plane is applied in real-world contexts, eg when determining the incline (slope) of a road between two points.

The Cartesian plane is used in algebra in Stages 4 to 6 to describe patterns and relationships between numbers, ie relationships between the x-values and y-values.

Language

Students should be able to communicate using the following language: sequence, table of values, 'position in the pattern', 'value of the term', rule, number plane, quadrant, origin, axis, axes, horizontal axis (x-axis), vertical axis (y-axis), point of intersection, point, coordinates.

Mathematics • Stage 3

Measurement and Geometry

Length 1

Outcomes

A student:

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

Students:

Choose appropriate units of measurement for length, area, volume, capacity and mass (ACMMG108)

- recognise the need for a unit longer than the metre for measuring distance
- recognise that one thousand metres is equal to one kilometre and describe one metre as one thousandth of a kilometre [L]
- measure a kilometre and half-kilometre
- use the abbreviation for kilometre (km) [L]
- select and use the appropriate unit and measuring device to measure lengths and distances
  - describe how a length or distance was estimated and measured (Communicating, Problem Solving)
  - question and explain why two students may obtain different measures for the same length, distance or perimeter (Communicating, Reasoning) [N, CCT]
- record lengths and distances using combinations of millimetres, centimetres, metres and kilometres, eg 1 km 200 m
  - explain the relationship between the size of a unit and the number of units needed, eg more metres than kilometres will be needed to measure the same distance (Communicating, Reasoning) [CCT]

Calculate the perimeter and area of rectangles using familiar metric units (ACMMG109)

- measure and calculate the perimeter of a large area, eg playground, handball courts
- calculate and compare perimeters of polygons including squares, rectangles and triangles
  - explain that the perimeters of squares, rectangles and triangles can be found by finding the sum of the side lengths (Communicating)
  - explain the relationship between the lengths of the sides and the perimeter for regular polygons, including squares and equilateral triangles (Communicating, Reasoning) [CCT]

Background information

When students are able to measure efficiently and effectively using formal units, they should be encouraged to apply their knowledge and skills in a variety of contexts. Following this they should be encouraged to generalise their method for calculating the perimeter of squares, rectangles and triangles.

Mathematics • Stage 3

Measurement and Geometry

Length 1

Language

Students should be able to communicate using the following language: kilometre, measuring device.

'Perimeter' comes from the Greek *peri-*, meaning 'around', and *metron* meaning 'measure'.

Mathematics • Stage 3

Measurement and Geometry

Length 2

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- gives a valid reason for supporting one possible solution over another MA3-3WM
- selects and uses the appropriate unit and device to measure lengths, distances and perimeters, and converts between units of length MA3-9MG

Students:

Connect decimal representations to the metric system (ACMMG135)

- record lengths and distances using decimal notation to three decimal places, eg 2.753 km

Solve problems involving the comparison of lengths and areas using appropriate units (ACMMG137)

- investigate and compare perimeters of rectangles with the same area [CCT]
  - determine the number of different rectangles that can be formed using whole-number side lengths for a given area (Problem Solving, Reasoning) [N, CCT]
- solve problems involving different units of length, eg 'Find the total length of three items measuring 5 mm, 20 cm and 1.2 m' [N, CCT]
- recognise symbols used to record speed in kilometres per hour, eg 80 km/h [L]
- solve simple problems involving speed, eg 'How long would it take to make a journey of 600 km if the average speed for the trip is 75 km/h?' [N, CCT]

Convert between common metric units of length, mass and capacity (ACMMG136)

- convert between metres and kilometres
- convert between millimetres, centimetres and metres to compare lengths and distances

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Background information

Refer to background information in Length 1.

Language

Students should be able to communicate using the following language: kilometres per hour, average speed, three decimal places, convert.

Mathematics • Stage 3

Measurement and Geometry

Area 1

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and uses the appropriate unit to calculate areas, including the areas of squares, rectangles and triangles MA3-10MG

Students:

Choose appropriate units of measurement for length, area, volume, capacity and mass (ACMMG108)

- recognise the need for a unit larger than the square metre
- identify situations where square kilometres are used for measuring area, eg a suburb [N, CCT]
- recognise and explain the need for a more convenient unit than the square kilometre
- recognise that one hectare is equal to 10 000 square metres
  - equate 1 hectare to the area of a square with side lengths of 100 m (Communicating)
  - relate the hectare to common large areas, eg a tennis court is about one-quarter of a hectare (Reasoning)
- use the abbreviations for square kilometre (km^2) and hectare (ha) [L]

Calculate the perimeter and area of rectangles using familiar metric units (ACMMG109)

- find the relationship between the length, breadth and area of rectangles [CCT]
  - explain that the area of rectangles can be found by multiplying the length by the breadth, and squares by squaring the side length (Communicating, Reasoning)
- select and use appropriate units to calculate areas of rectangles in square centimetres and square metres
- apply measurement skills to solve problems involving area in everyday situations, eg determine the area of a basketball court [N]
- use the square kilometre and hectare as formal units for measuring area
- measure the dimensions of a large rectangular area in metres and calculate its area in hectares, eg the local park [SE]

Mathematics • Stage 3

Measurement and Geometry

Area 1

Background information

It is important that students have a clear understanding of the distinction between perimeter and area.

It is important at this stage that students establish a real reference for the square kilometre and hectare, eg locating a square kilometre or hectare area on a local map.

When the students are able to measure efficiently and effectively using formal units, they should be encouraged to apply their knowledge and skills in a variety of contexts.

Students could be encouraged to find more efficient ways of counting such as finding how many squares in one row and multiplying this by the number of rows. Students should then begin to generalise their methods to calculate the area of rectangles and triangles.

At this Stage, the formulas are described in words and not symbols.

Language

Students should be able to communicate using the following language: square kilometre, hectare, dimensions, breadth.

'Breadth' is another term for width and usually refers to the shorter side of a rectangle.

The abbreviation m^2 is read 'square metre(s)' and not 'metre squared' or 'metre square'.

The abbreviation cm^2 is read 'square centimetre(s)' and not 'centimetre squared' or 'centimetre square'.

Mathematics • Stage 3

Measurement and Geometry

Area 2

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- selects and uses the appropriate unit to calculate areas, including the areas of squares, rectangles and triangles MA3-10MG

Students:

Solve problems involving the comparison of lengths and areas using appropriate units (ACMMG137)

- investigate the area of a triangle by comparing the area of a given triangle to the area of a rectangle of same length and perpendicular height, eg cut and paste a copy of the given triangle around the given triangle to form a rectangle
  - explain the relationship between the area of a triangle and the area of a rectangle of same length and perpendicular height (Communicating, Reasoning) [CCT]
- establish the relationship between the base length, perpendicular height and area of a triangle [CCT]
- investigate and compare the areas of rectangles that have the same perimeter [CCT]
  - investigate connections with multiplication when finding areas of rectangles that have the same perimeter (Problem Solving) [N]
  - extend mathematical tasks by asking questions, eg 'If I change the dimensions of a rectangle but keep the perimeter the same, will the area change?' (Communicating, Problem Solving) [CCT]
- read and interpret one-to-many scales on maps and simple scale drawings to calculate an area, eg calculate the area of a shopping centre on a map where 1 cm represents 100 m [L, N]
  - use a square centimetre grid overlay on a map of the school to calculate its area (Problem Solving) [N]
- find the surface area of rectangular prisms by using a square centimetre grid overlay or by counting unit squares [N]

Background information

Refer to background information in Area 1.

Language

Students should be able to communicate using the following language: perpendicular height, base, scale drawing, surface area.

Mathematics • Stage 3

Measurement and Geometry

Volume and Capacity 1

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- gives a valid reason for supporting one possible solution over another MA3-3WM
- selects and uses the appropriate unit to estimate, measure and calculate volumes and capacities, and converts between units of capacity MA3-11MG

Students:

Choose appropriate units of measurement for length, area, volume, capacity and mass (ACMMG108)

- estimate then measure the volume of rectangular containers by packing with cubic centimetre blocks
  - explain the advantages and disadvantages of using cubic centimetre blocks as a unit to measure volume (Communicating, Reasoning) [CCT]
- recognise the need for a unit larger than the cubic centimetre
- estimate the size of a cubic metre, half a cubic metre and two cubic metres
- use the cubic metre as a formal unit to measure larger volumes
  - explain why volume is measured in cubic metres in certain situations, eg wood bark, soil, concrete (Communicating, Reasoning) [N, CCT]
- record volumes using the abbreviation for cubic metre (m^3) [L]
- select and use appropriate units to estimate the volume of a variety of objects, eg cubic centimetres for a lolly jar; cubic metres for the classroom

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Background information

The attribute of volume is the amount of space occupied by an object or substance and can be measured in cubic units, eg cubic centimetres (cm^3) and cubic metres (m^3).

Capacity refers to the amount a container can hold, and can be measured in millilitres (mL) and/or litres (L). Capacity is only used in relation to containers and generally refers to liquid measurement. The capacity of a closed container will be slightly less than its volume – capacity is based on the inside dimensions, while volume is determined by the outside dimensions of the container. It is not necessary to refer to these definitions with students (capacity is not taught as a separate concept to volume until Stage 4).

When students are able to measure efficiently and effectively using formal units, they could use centimetre cubes to construct rectangular prisms, counting the number of cubes to determine volume, then begin to generalise their method for calculating the volume.

The cubic metre can be related to the metre as a unit to measure length and the square metre as a unit to measure area. It is important that students are given opportunities to reflect on their understanding of length and area so they can use this to calculate volume.

When recording units of measurement, a space should be left between the number value and the abbreviated unit of measurement, eg 3 mL and not 3mL.

Mathematics • Stage 3

Measurement and Geometry
Volume and Capacity 1

Language

Students should be able to communicate using the following language: cubic metre.

The abbreviation m^3 is read 'cubic metre(s)' and not 'metres cubed'.

Mathematics • Stage 3

Measurement and Geometry

Volume and Capacity 2

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- gives a valid reason for supporting one possible solution over another MA3-3WM
- selects and uses the appropriate unit to estimate, measure and calculate volumes and capacities, and converts between units of capacity MA3-11MG

Students:

Connect volume and capacity and their units of measurement (ACMMG138)

- select the appropriate unit to measure volume and capacity, eg cubic centimetres for volume but millilitres for capacity [N]
- demonstrate that a cube of side 10 cm will displace 1 litre of water
- demonstrate, by using a medicine cup, that a cube of side 1 cm will displace 1 mL of water
- equate 1 cubic centimetre to 1 millilitre and 1000 cubic centimetres to 1 litre
- find the volume of irregular solids in cubic centimetres using a displacement strategy

Connect decimal representations to the metric system (ACMMG135)

- record volume and capacity using decimal notation to three decimal places, eg 1.275 L

Convert between common metric units of length, mass and capacity (ACMMG136)

- convert between millilitres and litres

Calculate volumes of rectangular prisms (ACMMG160)

- construct rectangular prisms using cubic centimetre blocks and count to determine volume
  - construct different rectangular prisms that have the same volume (Problem Solving) [CCT]
  - explain that objects with the same volume may be different shapes (Communicating, Reasoning) [CCT]
  - describe rectangular prisms in terms of layers, eg ‘There are three layers of eight cubic centimetre blocks’ (Communicating)
- use repeated addition to find the volume of rectangular prisms, eg ‘My rectangle has three layers of six cubes; so the total number of cubes is six plus six plus six, or eighteen’
- determine the relationship between the number of cubes in one layer, the number of layers and the volume of rectangular prisms [CCT]
  - explain that volume of rectangular prisms can be found by finding the number of cubes in one layer and multiplying by the number of layers, (Communicating, Reasoning) [CCT]
- calculate the volume of rectangular prisms

Mathematics • Stage 3

Measurement and Geometry

Volume and Capacity 2

Background information

One millilitre of water has a volume of one cubic centimetre and a mass of one gram. While the relationship between one millilitre and one cubic centimetre is constant for all substances, the same quantity of other substances may have differing masses. Students should not be taught that one millilitre is always equal to one gram.

Refer also to background information in Volume and Capacity 1.

Language

Students should be able to communicate using the following language: convert, displace, construct, irregular, regular, three decimal places.

Refer also to language in Volume and Capacity 1.

Mathematics • Stage 3

Measurement and Geometry

Mass 1

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- selects and uses the appropriate unit and device to measure masses of objects, and converts between units of mass MA3-12MG

Students:

Choose appropriate units of measurement for length, area, volume, capacity and mass (ACMMG108)

- recognise the need for a unit larger than the kilogram
- use the tonne to record large masses, eg sand, soil, vehicles
- record mass using the abbreviation for tonne (t) [L]
- select and use the appropriate unit and device to measure mass [N]
- find the approximate mass of a small object by establishing the mass of a number of that object, eg 'The stated weight of a box of chocolates is 250 g. If there are 20 chocolates in the box, what does each chocolate weigh?' [CCT]

Background information

Gross mass is the mass of the contents and the container. Net mass is the mass of the contents only.

Local industry could provide a source for the study of measurement in tonnes, eg weighbridges, cranes and hoists.

Language

Students should be able to communicate using the following language: tonne.

'Mass' and' weight' have become interchangeable in everyday usage.

Mathematics • Stage 3

Measurement and Geometry

Mass 2

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- selects and uses the appropriate unit and device to measure masses of objects, and converts between units of mass MA3-12MG

Students:

Connect decimal representations to the metric system (ACMMG135)

- measure mass using scales and record using decimal notation with up to three decimal places, eg 0.875 kg

Convert between common metric units of length, mass and capacity (ACMMG136)

- convert between kilograms and grams and between kilograms and tonnes
- solve problems involving different units of mass, eg find the total mass of three items weighing 50 g, 750 g and 2.5 kg [N, CCT]
- relate the mass of one litre of water to one kilogram

Background information

One litre of water has a mass of one kilogram and a volume of 1000 cubic centimetres. While the relationship between capacity and volume is constant for all substances, the same volume of substances other than water may have different masses, eg 1 litre of oil will have a lighter mass than 1 litre of water which is turn has a lighter mass than 1 litre of honey. This can be demonstrated using digital scales.

Refer also to background information in Mass 1.

Language

Students should be able to communicate using the following language: convert.

Refer to language in Mass 1.

Mathematics • Stage 3

Measurement and Geometry

Time 1

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- uses twenty-four hour time and am and pm notation in real-life situations, and constructs timelines MA3-13MG

Students:

Compare 12- and 24- hour time systems and convert between them (ACMMG110)

- tell the time accurately using 24-hour time, eg '2330 is the same as 11:30 pm.' [L]
  - explain circumstances where 24-hour time is used, eg transport, armed forces, digital technologies (Communicating) [CCT]
- convert between 24-hour time and am or pm notation [L]
- compare the local times in various time zones in Australia, including during daylight saving [N]

Determine and compare duration of events

- use start and finish times to calculate the elapsed time of events, eg the time taken to travel from home to school
- use a stopwatch to measure and compare the duration of events

---

Background information

Australia is divided into three time zones. Time in Queensland, New South Wales, Victoria and Tasmania is Eastern Standard Time (EST), time in South Australia and the Northern Territory is half an hour behind EST and time in Western Australia is two hours behind EST.

Twenty-four hour time is typically recorded without the use of the colon (:), eg 3:45 pm is written as 1545 or 1545 h and read as 'fifteen forty-five hours'.

Language

Students should be able to communicate using the following language: 24-time, elapsed time, time zones, local time, daylight-saving.

Mathematics • Stage 3

Measurement and Geometry

Time 2

Outcomes

A student:

- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- uses twenty-four hour time and am and pm notation in real-life situations, and constructs timelines MA3-13MG

Students:

Interpret and use timetables (ACMMG139)

- read, interpret and use timetables from real-life situations, including those involving 24-hour time [L, N, PSC]
- select the appropriate unit to measure time and order a series of events according to the time taken to complete them [N]
- use bus, train, ferry and airline timetables, including those accessed on the internet, to prepare simple travel itineraries [L, N, ICT, PSC]
    - interpret timetable information to solve unfamiliar problems, using a variety of strategies (Problem Solving) [L, N, CCT]

Investigate timelines

- determine a suitable scale and draw an accurate timeline using the scale, eg represent events using a one-to-many scale of 1 cm = 10 years [N]
- interpret a given timeline using the given scale [L, N]

Background information

Refer to background information in Time 1.

Language

Students should be able to communicate using the following language: itinerary, scale.

Mathematics • Stage 3

Measurement and Geometry

Three-Dimensional Space 1

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- gives a valid reason for supporting one possible solution over another MA3-3WM
- identifies three-dimensional objects on the basis of their properties, and visualises, sketches and constructs them given drawings of different views MA3-14MG

Students:

Connect three-dimensional objects with their nets and other two-dimensional representations (ACMMG111)

- recognise similarities and differences between pyramids or prisms, eg between a triangular prism and a hexagonal prism
    - explain why particular three-dimensional structures are used in the built environment or appear in the natural environment (Communicating, Reasoning) [N, CCT]
- identify any pairs of parallel faces of a three-dimensional object
- name prisms or pyramids according to the shape of their base, eg rectangular prism, hexagonal prism [L]
- identify and describe the properties of three-dimensional objects [L]:
    - number of faces
    - shape of faces
    - number and type of identical faces
    - number of vertices
    - number of edges
    - apex of a pyramid
- visualise and sketch three-dimensional objects from different views [N, CCT]
    - reflect on own drawing of a three-dimensional object and consider whether it can be improved (Reasoning) [CCT, PSC]
- visualise and sketch nets for given three-dimensional objects [N, CCT]
    - recognise whether a diagram is a net of a solid (Reasoning) [CCT]
- visualise and name a common solid given its net [CCT]

Mathematics • Stage 3

Measurement and Geometry

Three-Dimensional Space 1

Background information

At this Stage, the formal names for particular prisms and pyramids (eg rectangular prism, hexagonal pyramid) are introduced while students are engaged in their construction and representation. Only 'family' names were introduced in the previous stage, eg prism.

It is important that geometrical terms are not over-emphasised at the expense of understanding the concepts that the terms represent.

In Geometry a three-dimensional object is called a solid. The three-dimensional object may in fact be hollow but it is still defined as a geometrical solid. Models at this stage should include skeletal models.

Language

Students should be able to communicate using the following language: vertex, vertices, apex, solid.

The mathematical term for a corner of a three-dimensional object is 'vertex'. The plural is 'vertices'.

Mathematics • Stage 3

Measurement and Geometry

Three-Dimensional Space 2

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- identifies three-dimensional objects on the basis of their properties, and visualises, sketches and constructs them given drawings of different views MA3-14MG

Students:

Construct simple prisms and pyramids (ACMMG140)

- create prisms and pyramids using a variety of materials, eg plasticine, paper or cardboard nets, straws and tape, multilink cubes, computer drawing programs [ICT]
- construct three-dimensional models given drawings of different views
- interpret and make models from isometric drawings [CCT]
- construct three-dimensional models and sketch the front, side and top views
  - describe to a peer how to construct or draw a three-dimensional object (Communicating) [L]
- show simple perspective in drawings by showing depth [N, CCT]

Background information

Students at this stage are continuing to develop their skills of visual imagery, including the ability to perceive and hold an appropriate mental image of an object or arrangement, and predict the shape of an object that has been moved or altered.

Refer to background information in Three-Dimensional Space 1.

Language

Students should be able to communicate using the following language: depth, construct, isometric drawing.

Mathematics • Stage 3

Measurement and Geometry

Two-Dimensional Space 1

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- gives a valid reason for supporting one possible solution over another MA3-3WM
- manipulates, classifies and draws two-dimensional shapes, including triangles, and describes their properties MA3-15MG

Students:

Classify two-dimensional shapes and describe their features

- manipulate, identify and name right-angled, isosceles, equilateral and scalene triangles [L]
    - recognise that a triangle can be both right-angled and isosceles or right-angled and scalene (Reasoning) [CCT]
- explore by measurement angle properties of isosceles, equilateral and scalene triangles [CCT]
- compare and describe side properties of isosceles, equilateral and scalene triangles
- explore by measurement angle properties of squares, rectangles, parallelograms and rhombuses [CCT]
- select and classify a shape from a description of its features [L]
    - recognise that two-dimensional shapes can be classified in more than one way, eg a rhombus can be more simply classified as a parallelogram (Communicating, Reasoning) [CCT]
- identify and draw regular and irregular two-dimensional shapes from descriptions of their side and angle properties [L]
    - use tools such as templates, rulers, set squares and protractors to draw regular and irregular two-dimensional shapes (Communicating, Problem Solving) [CCT]
    - explain the difference between regular and irregular shapes (Communicating)
    - construct a shape using computer drawing tools, from a description of its side and angle properties (Communicating, Problem Solving) [ICT]

Describe translations, reflections and rotations of two-dimensional shapes. Identify line and rotational symmetries (ACMMG114)

- follow and use the terms ‘translate’, ‘reflect’ and ‘rotate’ to describe the movement of two-dimensional shapes
    - rotate a graphic or object through a specified angle about a particular point, including using the rotate function in a computer drawing program (Communicating) [ICT]
- describe the effect when a two-dimensional shape is translated, reflected or rotated, eg when a vertical arrow is rotated 90° the resulting shape points horizontally
    - recognise that the properties of shapes do not change when shapes are rotated (Reasoning) [CCT]

Mathematics • Stage 3

Measurement and Geometry

Two-Dimensional Space 1

- identify and quantify the total number of lines of symmetry (if any exist) of two-dimensional shapes, including the special groups of quadrilaterals and triangles
- identify shapes that have rotational symmetry and determine the order of rotational symmetry
    - construct designs with rotational symmetry, including using computer drawing tools (Communicating, Problem Solving) [ICT]

Apply the enlargement transformation to familiar two-dimensional shapes and explore the properties of the resulting image compared with the original (ACMMG115)

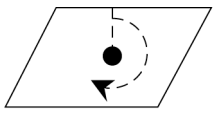
- make enlargements of two-dimensional shapes, pictures and maps with and without digital technologies [N, ICT]
    - overlay an image with a small grid (eg 5 mm by 5 mm) and create an enlargement by drawing the contents of each cell onto a larger grid (eg 2 cm by 2 cm) (Communicating, Problem Solving) [N, CCT]
    - investigate and use functions of digital technologies that allow graphics to be enlarged without losing the relative proportions of the image (Problem Solving) [ICT]
- compare and discuss representations of the same object or scene in different sizes, eg student drawings enlarged on a photocopier [N]
    - measure an interval on the original and its enlargement to determine how many times larger the enlargement is (Problem Solving, Reasoning) [CCT]

Background information

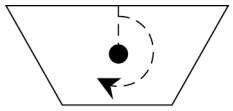
A shape has rotational symmetry if a tracing of the shape, rotated part of a full turn around its centre, matches the original exactly.

The order of rotational symmetry refers to the number of times the tracing of a shape appears in a corresponding position when rotated around the central point for one full turn,
eg

A regular octagon has rotational symmetry of order 8.



A parallelogram has rotational symmetry of order 2



A trapezium does not have rotational symmetry.

Mathematics • Stage 3

Measurement and Geometry

Two-Dimensional Space 1

Language

Students should be able to communicate using the following language: full turn, translation, reflection, rotation, isosceles triangle, equilateral triangle, scalene triangle, right-angled triangle, classify, set square, protractor, rotational symmetry, order of rotational symmetry, enlargement, transformation, grid, cell.

Scalene means ‘uneven’ (Greek word *skalenos*: uneven); our English word ‘scale’ comes from the same word. Isosceles comes from the two Greek words *isos* (equals) and *skelos* (leg). Equilateral comes from the two Latin words *aequus* (equal) and *latus* (side). Equiangular comes from *aequus* and another Latin word, *angulus* (corner).

A feature is a generally observable attribute of an object or shape. A property of an object or shape is an attribute, the identification of which requires mathematical knowledge.

Mathematics • Stage 3

Measurement and Geometry

Two-Dimensional Space 2

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- manipulates, classifies and draws two-dimensional shapes, including triangles, and describes their properties MA3-15MG

Students:

Investigate the diagonals of two-dimensional shapes and identify parts of circles

- identify and draw diagonals on two-dimensional shapes
- compare and describe diagonals of different two-dimensional shapes
  - investigate which of the special groups of quadrilaterals have diagonals that are equal in length (Problem Solving)
  - investigate whether the diagonals of a particular shape are also axes of symmetry of the shape (Problem Solving)
- create a circle by finding points that are equidistant from a fixed point (the centre)
- identify and name parts of a circle, including the centre, radius, diameter, circumference, sector, semi-circle and quadrant [L]

Investigate combinations of translations, reflections and rotations, with and without the use of digital technologies (ACMMG142)

- identify if a two-dimensional shape has been translated, reflected or rotated and how many times, eg the square has been rotated 90° once and then reflected once
- construct patterns of two-dimensional shapes that involve translations, reflections and rotations using computer software [ICT]
- predict the next translation, reflection or rotation in a pattern, eg 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) [CCT]

Language

Students should be able to communicate using the following language: diagonal, axis of symmetry, equidistant, fixed point, centre, radius, diameter, circumference, sector, semi-circle, quadrant.

Mathematics • Stage 3

Measurement and Geometry

Angles 1

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- classifies, measures and constructs angles MA3-16MG

Students:

Estimate, measure and compare angles using degrees. Construct angles using a protractor (ACMMG112)

- identify the arms and vertex of an angle where both arms are invisible, such as rotations and rebounds
- recognise the need for a formal unit for the measurement of angles and use the symbol for degrees (°) when recording angle measurements [L]
- use a protractor to measure and to construct angles of any size between 0° and 360°
  - explain how a protractor is used to measure an angle (Communicating) [L]
  - explore and explain how to use a semicircular protractor to measure a reflex angle (Communicating, Reasoning) [CCT]
  - extend the arms of an angle where necessary to facilitate measurement of the angle using a protractor (Problem Solving) [CCT]
- estimate, measure and compare angles in degrees, eg compare angles in different two-dimensional shapes [CCT]

Background information

A circular protractor calibrated from 0° to 360° may be easier for students to use to measure reflex angles than a semicircular protractor calibrated from 0° to 180°.

Language

Students should be able to communicate using the following language: degrees, protractor, invisible, rotation, rebound.

Mathematics • Stage 3

Measurement and Geometry

Angles 2

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- classifies, measures and constructs angles MA3-16MG

Students:

Investigate, with and without digital technologies, angles on a straight line, angles at a point and vertically opposite angles. Use results to find unknown angles (ACMMG141)

- identify and name adjacent angles, vertically opposite angles, straight angles and angles of complete revolution [L]
  - recognise right angles, straight angles and angles of complete revolution embedded in diagrams (Reasoning)
  - recognise vertically opposite angles in different orientations and embedded in diagrams (Reasoning)
- establish and use the equality of vertically opposite angles
- use knowledge of interior angles of the special groups of triangles and quadrilaterals to find the value of unknown angles [N, CCT]

Background information

At this Stage, students are to be encouraged to give reasons when finding unknown angles.

Language

Students should be able to communicate using the following language: straight line, point, vertically opposite angles, adjacent angles, interior angle, orientation, triangle, quadrilateral.

Mathematics • Stage 3

Measurement and Geometry

Position

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- locates and describes position on maps using a grid reference system MA3-17MG

Students:

Use a grid reference system to describe locations. Describe routes using landmarks and directional language (ACMMG113)

- find a place on a map, given its coordinates [L, N]
  - describe the direction of one place relative to another, eg 'Perth is west of Sydney' (Communicating) [L, N]
- use a given map to plan or show a route, eg draw a possible route to the local park or use an Aboriginal land map to plan a route [L, N, AHC]
  - use a street directory or online map to find the route to a given place (Problem Solving) [L, N, ICT]
  - describe a route taken on a map using landmarks and directional language (Communicating) [L, N]
- locate a place on a map which is a given direction from a town or landmark, eg locate a town that is north-east of Broken Hill [L, N]
- draw and label a grid on a map
- recognise that the same location can be represented by maps or plans using different scales [CCT]

Background information

Students should be taught to give map locations by giving the horizontal coordinate before the vertical coordinate.

Language

Students should be able to communicate using the following language: label, horizontal, vertical.

The word 'scale' has different meanings in different contexts. Scale could mean the enlargement or reduction factor for a drawing, the scale marked on a measuring device, a fish scale or a musical scale.

Mathematics • Stage 3

Statistics and Probability

Data 1

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- gives a valid reason for supporting one possible solution over another MA3-3WM
- uses appropriate data collection methods, constructs and interprets data displays, and analyses sets of data MA3-18SP

Students:

Pose questions and collect categorical or numerical data by observation or survey (ACMSP118)

- pose and refine questions to construct a survey to obtain categorical and numerical data about a issue of interest
- collect categorical and numerical data through observation or by conducting surveys, eg observe the number of a particular type of insect in one square metre of the playground over time

Construct displays, including column graphs, dot plots and tables, appropriate for data type, with and without the use of digital technologies (ACMSP119)

- tabulate collected data, including numerical data, with and without the use of digital technologies such as spreadsheets [ICT]
- name and label the horizontal and vertical axes when constructing graphs [L]
- use many-to-one correspondence on the vertical axis to draw column and line graphs of numerical data, with and without the use of digital technologies
- construct dot plots for numerical data, eg the heights of students [N, ICT]
- consider the data type to determine and draw the most appropriate display for the data, including column graphs, dot plots and line graphs
    - discuss and justify the choice of data display used (Communicating, Reasoning) [N, CCT]
    - recognise that line graphs are used to represent data that demonstrates continuous change, eg hourly temperature (Communicating) [SE]
    - recognise which types of graph are most appropriate to represent categorical data (Communicating)

Describe and interpret different data sets in context (ACMSP120)

- interpret a given line graph using many-to-one correspondence on the axes [L]
- describe and interpret information presented in tables, dot plots, column graphs and line graphs
    - interpret information presented in a graph, eg ‘The graph shows that the heights of all children in the class are between 125 cm and 154 cm’ (Communicating) [L, N]
    - determine the total number of people represented in a column graph (Problem Solving, Reasoning) [N]
    - discuss and draw conclusions from different data displays, eg ‘Football is the most popular sport for students in Year 5 at our school’ (Communicating, Reasoning) [L, N]

Mathematics • Stage 3

Statistics and Probability

Data 1

Background information

Column graphs are useful in recording categorical data, including results obtained from simple probability experiments.

Many-to-one correspondence in a column/line graph means that one unit on the vertical axis is used to represent more than one of what is being counted/measured, eg 1 cm on the vertical axis used to represent 20 cm of height.

Line graphs should only be used where meaning can be attached to the points on the line between plotted points.

Dot plots are an alternative to a column graph when there are very few data values. Each value is recorded as a dot so that the frequencies for each of the values can be counted easily.

Students need to be provided with opportunities to discuss what information can be drawn from data presented. Advantages and disadvantages of different representations of the same data should be explicitly taught.

Categorical data can be separated into distinct groups, eg colour, gender, blood type. Numerical data is expressed as numbers and obtained by either counting or measurement of a physical attribute, eg the number of students in a class (count) or the heights of students in a class (measurement).

Language

Students should be able to communicate using the following language: representation, tabulate, categorical data, numerical data, line graph, dot plot.

Mathematics • Stage 3

Statistics and Probability

Data 2

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- gives a valid reason for supporting one possible solution over another MA3-3WM
- uses appropriate data collection methods, constructs and interprets data displays, and analyses sets of data MA3-18SP

Students:

Interpret and compare a range of data displays, including side-by-side column graphs for two categorical variables (ACMSP147)

- interpret information presented in two-way tables [L, N]
- create a two-way table to organise data involving two categorical variables,
  eg

Drinks	Boys	Girls
Milk	5	6
Water	3	2
Juice	2	1

- interpret side-by-side column graphs for two categorical variables, eg favourite television show of students in Year 1 compared to students in Year 6 [L, N]
  - compare side-by-side column graphs with two-way tables (Reasoning) [CCT]
- interpret and compare different displays of the same data set to determine the most appropriate display for the data set
  - compare the effectiveness of different student-created data displays (Communicating) [N]
  - discuss the advantages and disadvantages of different representations of the same data (Communicating) [N, CCT, EU]
  - explain which display is the most appropriate for interpretation of a particular data set (Communicating, Reasoning) [L, N, CCT]

Interpret secondary data presented in digital media and elsewhere (ACMSP148)

- interpret data representations found in digital media and in factual texts [L, N, ICT]
  - interpret tables and graphs from the media/internet, eg data about different sports teams (Reasoning) [N, ICT, CCT]
  - identify and describe conclusions that can be drawn from a particular representation of data (Communicating, Reasoning) [L, N]
- critically evaluate data representations found in digital media and their related claims [L, N, ICT, CCT, PSC, EU]
  - discuss the messages the people who created a particular data representation might have wanted to convey (Communicating) [L, CCT, PSC, EU]
  - identify sources of possible bias in representations of data in the media by discussing various influences on data collection and representation, eg who created/paid for the data collection or whether the representation is part of an advertisement (Communicating, Reasoning) [L, CCT, PSC, EU]
  - identify misleading representations of data in the media, eg broken axes or graphics that are not drawn to scale (Reasoning) [L, N, ICT, CCT, PSC, EU]

Mathematics • Stage 3

Statistics and Probability

Data 2

Background information

Categorical variables can be separated into distinct groups, eg colours, gender, blood type.

Data selected for interpretation can include: census data, environmental audits of resources such as water and energy, and sports statistics.

Language

Students should be able to communicate using the following language: side-by-side column graph, bias.

Refer also to language in Data 1.

Mathematics • Stage 3

Statistics and Probability

Chance 1

Outcomes

A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- orders the likelihood of simple events using fractions MA3-19SP

Students:

List outcomes of chance experiments involving equally likely outcomes and represent probabilities of those outcomes using fractions (ACMSP116)

- use the term 'probability' to describe the numerical value that represents the likelihood of an outcome of a chance experiment [L]
- recognise that outcomes are described as 'equally likely' when the chance of any one outcome has the same chance of occurring as any other outcome [L]
- list all outcomes for chance experiments where each outcome is equally likely to occur and assign probabilities to these outcomes using fractions, eg for a throw of a standard six-sided die or one spin of a eight-sector spinner [N]
    - determine the likelihood of winning simple games by considering the number of possible outcomes and the consequent chance of winning, eg rock-paper-scissors (Problem Solving, Reasoning) [N, ICT, CCT]

Recognise that probabilities range from 0 to 1 (ACMSP117)

- verify that the sum of the probabilities of all the outcomes of any chance experiment is equal to 1 [N]
- order commonly used 'chance words' on an interval between zero (impossible) and one (certain), eg 'equal chance' would be placed at 0.5 [L]
    - describe events that are impossible or certain (Communicating) [L, CCT]
    - describe the likelihood of a variety of events as being more or less than a half (50% or 0.5) and order the events on an interval (Communicating) [N]

Background information

Students will need some prior experience of ordering decimal fractions (tenths) on a number line from zero to one.

The probability of chance events occurring can be ordered on a scale from zero to one. A probability of zero describes the probability of an event that is impossible. A probability of one describes the probability of an event that is certain. Therefore, events with an equal probability of occurring can be described as having a probability of 0.5. Other expressions of chance fall between zero and one, eg 'unlikely' will take a numerical value somewhere between 0 and 0.5.

Mathematics • Stage 3

Statistics and Probability

Chance 1

Language

Students should be able to communicate using the following language: represent, probability.

The term ‘frequency’ is used to describe the number of times a particular outcome occurs in a chance experiment. In Stage 4, students will also use this term to describe the number of times a particular score occurs in a data set.

The probability of an outcome is the value (between 0 and 1) used to describe the chance that the outcome will occur.

Mathematics • Stage 3

Statistics and Probability

Chance 2

Outcomes

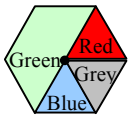
A student:

- describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations MA3-2WM
- gives a valid reason for supporting one possible solution over another MA3-3WM
- orders the likelihood of simple events using fractions MA3-19SP

Students:

Compare observed frequencies across experiments with expected frequencies (ACMSP146)

- use the term 'frequency' to describe the number of times a particular outcome occurs in a chance experiment [L]
- distinguish between the 'frequency' of an outcome and the 'probability' of an outcome in a chance experiment (Communicating) [L]
- compare the predicted frequencies of outcomes of chance experiments with the observed frequencies of the outcomes of the experiment, including where the outcomes are not equally likely
  - recognise that some random generators have outcomes that are not equally likely and discuss the effect on predicted outcomes,
    eg on this spinner, green is more likely to occur than red or grey or blue (Reasoning)



  - discuss the 'fairness' of simple games involving chance (Communicating, Reasoning) [N, CCT, PSC]
- explain why observed frequencies in probability experiments may differ from predicted frequencies (Communicating, Reasoning) [L, N, CCT]

- use samples to make predictions about a larger 'population' from which the sample comes,
  eg take a random sample of coloured sweets from a bag, calculate the probability of obtaining each colour of sweet and use these probabilities and the total number of sweets in the bag to predict the number of each colour of sweet in the bag [CCT, N]
  - discuss whether a prediction about a larger population, from which a sample comes, would be the same if a different sample was used (Communicating, Reasoning) [L, N, CCT]

Describe probabilities using fractions, decimals and percentages (ACMSP144)

- list all outcomes for chance experiments where the outcomes are not equally likely to occur and assign probabilities to these outcomes using fractions [N]
- use knowledge of equivalent fractions, decimals and percentages to assign probabilities to the likelihood of outcomes, eg there is five in ten, $\frac{1}{2}$, 0.5, 50% or one in two chance of this happening [N]
  - use probabilities in real-life contexts, eg 'My football team has a 50% chance of winning the game' (Communicating, Reasoning) [N]

Mathematics • Stage 3

Statistics and Probability

Chance 2

- design a spinner or label a die so that a particular outcome is more likely than another and discuss the probabilities of the outcomes using fractions (Communicating, Problem Solving) [CCT]

Conduct chance experiments with both small and large numbers of trials using appropriate digital technologies (ACMSP145)

- assign expected probabilities to outcomes in chance experiments involving digital random generators and compare these with the observed probabilities after both small and large numbers of trials [N, ICT]
- determine and discuss the differences between the observed probabilities and the expected probabilities after both small and large numbers of trials (Communicating, Reasoning) [L]
- explain what happens to the observed probabilities as the number of trials increases (Communicating, Reasoning) [L]

Background information

Random generators include coins, dice and spinners.

Refer also to background information in Chance 1.

Language

Students should be able to communicate using the following language: likelihood, frequency, fairness, experiment, trial, sample, random sample, population.