7.5 Content for Stage 3

✍ Consult

Mathematics • Stage 3

Number and Algebra

Whole Numbers 1

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology

3.4 selects and applies appropriate strategies to calculate using the four operations

Students:

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

- find factors for whole numbers,
  eg 24 has factors of $1, 2, 3, 4, 6, 8, 12$ and 24 [N]
- determine the highest common factor (HCF) of two numbers [N],
  eg the HCF of 16 and 24 is 8
- find multiples of whole numbers,
  eg multiples of 7 are $7, 14, 21, 28, 35, \ldots$ [N]
- investigate lowest common multiple (LCM) of two numbers [N],
  eg the LCM of 21 and 63 is 3
- solve problems using knowledge of factors and multiples,
  eg 'There are 48 people at the party, how many different ways can you seat them at tables?' (Problem Solving) [N] [CCT]

Create simple financial plans

- use knowledge of large numbers to create a simple budget, eg for a class fundraising event [N] [WE]
  - record numerical data in a simple spreadsheet (Fluency) [ICT] [L]
- recognise different abbreviations of numbers used in everyday contexts,
  eg \$350K represents \$350 000 [L] [N]
- use large numbers in real-life situations, eg population, money applications [N]
  - interpret information from the internet, media, environment and other sources that use large numbers (Understanding) [ICT] [N]

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:

The abbreviation K comes from the Greek word *khilioi* meaning thousand. It is used in many job advertisements to represent salaries (eg a salary of $70K meaning $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:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.4 selects and applies appropriate strategies to calculate using the four operations

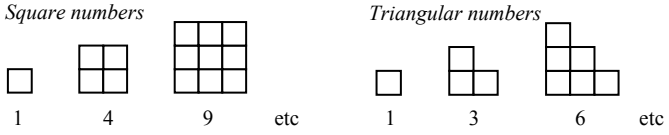
Students:

Investigate everyday situations that use positive and negative whole numbers and zero. Locate and represent these numbers on a number line

- apply an understanding of place value and the role of zero to read, write and order numbers of any size [N] [L]
- recognise the location of negative numbers in relation to zero and locate them on a number line [N]
  - connect negative numbers with subtraction (Understanding) [CCT]
- investigate negative numbers and the number patterns created when counting backwards on a calculator [N]
  - ask 'What if' questions, eg 'What happens if we subtract a larger number from a smaller number on a calculator?' (Understanding) [CCT]
- interpret negative whole numbers in everyday contexts, eg temperature [N] [L]

Identify and describe properties of prime, composite, square and triangular numbers

- determine whether a number is prime or composite 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'
- explain why a prime number when modelled as an array has only one row [CCT]
- investigate special groups of numbers including square and triangular numbers, the Fibonacci number sequence and numbers in Pascal's Triangle
- generate, describe and record number patterns using a variety of strategies [N] [L]



Investigate other Number Systems

- recognise, read and convert Roman numerals used in everyday contexts, eg books, clocks, films [N] [L]
- identify differences between the Roman and Hindu-Arabic systems of recording numbers [L] [IU]
- compare the Hindu-Arabic number system with number systems from different societies past and present [IU] [CCT]

Mathematics • Stage 3

Number and Algebra
Whole Numbers 2

- discuss the strengths and weaknesses of different number systems (Understanding) [CCT] [IU]
- recognise and describe the advantages of the Hindu-Arabic number system (Understanding) [L] [IU]

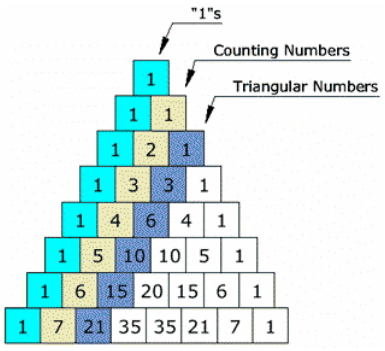
Background Information:

Number systems from different societies past and present could include Egyptian, Babylonian, Roman, Mayan, Aboriginal, and Papua-New Guinean. The differences to be compared may include those related to the symbols used for numbers and operations, the use of zero, the base system, place value, and notation for fractions.

When identifying Roman numerals in everyday contexts it needs to be noted that the number four is sometimes represented using IIII instead of IV.

The internet is a source of information on number systems in use in other cultures and/or at other times in history.

The Chinese mathematician, Chu Shi-kie, wrote about the triangle result (which we now call Pascal's triangle) in 1303; at least 400 years before Pascal.



In the Fibonacci sequence $(1,1,2,3,5,8,13,\ldots)$, the preceding two numbers add to form the next number in the series, ie $1+1$ is 2, $1+2$ is 3, $2+3$ is 5, $3+5$ is 8 and so on.

Language:

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:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology

3.3 gives a valid reason for supporting one possible solution over another

3.4 selects and applies appropriate strategies to calculate using the four operations

Students:

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

- select and apply efficient mental, written or calculator strategies to solve addition and subtraction problems (Problem Solving) [N] [CCT]
- check solutions by using the inverse operation or a different method (Problem Solving) [CCT]

Use estimation and rounding to check the reasonableness of answers to calculations

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

Create simple financial plans

- use addition and subtraction to solve problems with money, eg 'How many different ways could you give change from $20 for an item costing $4.45?' (Problem Solving) [CCT] [N] [PSC]
- use knowledge of addition and subtraction facts to create a budget, eg 'Organise a class celebration on a budget of $60 for all expenses' [WE]
  - give reasons for prioritising, deleting and selecting items for inclusion in the budget (Reasoning) [CCT] [WE]
  - provide an explanation of items in the budget and relate to value for money (Understanding) [CCT] [WE]
  - compare cost of goods and justify selection (Reasoning) [CCT] [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 that their own written strategies that are based on mental strategies may be more efficient than a formal written algorithm, particularly for the case of subtraction.
For example $8000 - 673$ is easier to do mentally than by using either the decomposition or the equal addends methods.

Mentally: $8000 = 7999 + 1$
$7999 - 673 = 7326$

The answer will therefore be $7326 + 1 = 7327$. This is just one way of doing this mentally: students could share possible approaches and compare them to determine the most efficient.

Decomposition Method:

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

Language:

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:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology

3.3 gives a valid reason for supporting one possible solution over another

3.4 selects and applies appropriate strategies to calculate using the four operations

Students:

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

- pose problems that can be solved using counting numbers of any size and more than one operation [CCT]
  - use a number of strategies to solve unfamiliar problems, including simplifying the problem (Fluency)
  - explain how an answer was obtained for an addition or subtraction problem and justify the selected calculation method (Understanding, Reasoning) [N] [CCT]
  - give reasons why a calculator was useful when solving a problem (Reasoning) [CCT]
  - reflect on chosen method of solution for a problem, considering whether it can be improved (Understanding, Reasoning) [CCT]
- use a formal written algorithm and apply place value concepts to solve addition and subtraction problems, involving counting numbers of any size (Problem Solving) [L] [N]
- add numbers with different numbers of digits, eg $42\,000 + 5123 + 246$ [N]

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:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology

3.4 selects and applies appropriate strategies to calculate using the four operations

Students:

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

- apply appropriate mental, written or calculator strategies to solve multiplication and division problems (Problem Solving) [N]
  - use the appropriate operation in solving problems in real-life situations (Fluency) [N]
- multiply three- and four-digit numbers by one-digit numbers using mental, written or calculator strategies [N]

eg 432×5

Mental

$$= (400 \times 5) + (30 \times 5) + (2 \times 5)$$
$$= 2000 + 150 + 10$$
$$= 2160$$

Written

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

- multiply three-digit numbers by two-digit numbers using the extended form (long multiplication) [N]

eg

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

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

- 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]
- divide a number with three or more digits by a single- digit divisor using mental or written strategies [N]

eg $341 \div 4$

Mental

$$340 \div 4 = 85$$
$$1 \div 4 = \tfrac{1}{4}$$
$$\text{so } 341 \div 4 = 85\tfrac{1}{4}$$

Written

$$\begin{array}{r} 85\frac{1}{4} \\ 4\overline{)3\ 4\ 1} \end{array}$$

- use and interpret remainders in answers to division problems, eg realising that the answer needs to be rounded up if the problem involves finding the number of cars needed to take 48 people to an event [N] [CCT]

Mathematics • Stage 3

Number and Algebra
Multiplication and Division 1

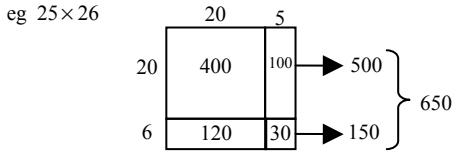
Background Information:

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, and/or utilise mental strategies such as '14×6 is 10 sixes plus 4 sixes'.

One is not a prime number because it has only one factor, itself.

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

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



Language:

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

Mathematics • Stage 3

Number and Algebra
Multiplication and Division 2

Outcomes
A student:
3.1 describes and represents mathematical situations using appropriate terminology and conventions
3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology
3.4 selects and applies appropriate strategies to calculate using the four operations

Students:

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

- use mental and written strategies to solve whole number problems
  - the inverse relationship of multiplication and division, eg '$150 \div 3 = 50$ because $3 \times 5 = 15$ then I multiply by 10'
  - using known facts, eg $10 \times 9 = 90$ so $13 \times 9 = 90 + 9 + 9 + 9 = 90 + 27 = 117$
  - multiplying the tens and then the units, eg 25×17 is $(25 \times 10) + (25 \times 7) = 250 + 175 = 425$
  - 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 $18 \times 5 = 9 \times 2 \times 5 = 9 \times 10 = 90$ (Problem Solving) [N] [CCT]
- estimate answers to problems and check to justify solutions (Reasoning, Problem Solving) [CCT] [N]
- use mental strategies to multiply or divide a number by 100 or a multiple of 10 [N]
- pose and solve problems involving simple proportions, eg 'If a recipe for 8 people requires 3 cups of sugar, how many cups would be needed for 4 people?' (Problem Solving) [N] [CCT]

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

- perform calculations recognising that operations within grouping symbols must be calculated first,
  eg $5 + (3 \times 2) = 5 + 6 = 11$; $(10 + 6) \div 2 = 16 \div 2 = 8$ [N]

Mathematics • Stage 3

Number and Algebra
Multiplication and Division 2

- apply the order of operations to calculations involving mixed operations and grouping symbols [N],
  eg $32 + 2 - 4 = 34 - 4$ working left to right
  $= 30$

  $32 \div 2 \times 4 = 16 \times 4$ working left to right
  $= 64$

  $32 \div (2 \times 4) = 32 \div 8$ grouping symbols first
  $= 4$

  $(32 + 2) \times 4 = 34 \times 4$ grouping symbols first
  $= 136$

  $32 + 2 \times 4 = 32 + 8$ multiplying first
  $= 40$

- recognise equivalence when grouping symbols are used,
  eg $32 + 2 \times 4$ is the same as $32 + (2 \times 4)$ [N]

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, and/or utilise mental strategies such as '14×6 is 10 sixes plus 4 sixes'.

One is not a prime number because it has only one factor, itself.

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

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

Language:

'Grouping symbols' is the term used to describe brackets, parentheses and braces used in order of operations

Mathematics • Stage 3

Number and Algebra

Fractions and Decimals 1

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

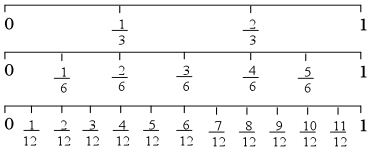
3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology

3.5 calculates with simple decimals, fractions and percentages

Students:

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

- model, compare and represent thirds, sixths and twelfths of a whole object or collection of objects [L] [N]
- place thirds, sixths or twelfths on a number line between 0 and 1 to develop equivalence,



eg [N]

- recognise that $1+\frac{1}{2}=1\frac{1}{2}$ [N]

  – explain or demonstrate why two fractions are or are not equivalent (Reasoning, Understanding) [L] [CCT] [N]

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

- add and subtract fractions with the same denominator, eg $\frac{5}{6}+\frac{3}{6}$ [N]

  – use estimation to verify that an answer is reasonable (Problem Solving) [N]

- express mixed numerals as improper fractions, and vice versa, through the use of diagrams or number lines, leading to a mental strategy [N] [CCT]

Recognise that the number system can be extended beyond hundredths

- express thousandths as decimals
- interpret decimal notation for thousandths [L]

Compare, order and represent decimals

- compare and order decimal numbers with up to three decimal places, eg 0.5, 0.125, 0.25 [L] [N]
- place decimal numbers on a number line between 0 and 1 [N]

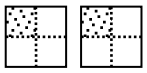
Mathematics • Stage 3

Number and Algebra
Fractions and Decimals 1

Background Information:

Fractions may be interpreted in different ways depending on the context, eg 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:

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

Mathematics • Stage 3

Number and Algebra

Fractions and Decimals 2

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.3 gives a valid reason for supporting one possible solution over another

3.5 calculates with simple decimals, fractions and percentages

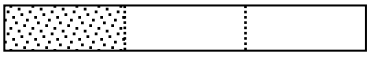
Students:

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

- compare and order fractions using strategies such as diagrams, the number line or equivalent fractions, eg $\frac{1}{2}, \frac{3}{4}, 1, 1\frac{1}{4}, \ldots$ [L] [N]

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

- add and subtract simple fractions where one denominator is a multiple of the other, eg $\frac{2}{3}+\frac{1}{6}=\frac{4}{6}+\frac{1}{6}=\frac{5}{6}$ [N]
  - interpret an improper fraction in an answer, eg $\frac{3}{4}+\frac{3}{8}=\frac{9}{8}=1\frac{1}{8}$ (Understanding) [L] [N]
- use written, diagram and mental strategies to subtract a unit fraction from 1, eg $1-\frac{1}{3}=\frac{2}{3}$ [L]

 [N]

- use written, diagram and mental strategies to subtract a unit fraction from any whole number, eg $4-\frac{1}{3}$ [N]
- multiply simple fractions by whole numbers using repeated addition, leading to a rule, eg $3\times\frac{2}{5}=\frac{2}{5}+\frac{2}{5}+\frac{2}{5}=\frac{6}{5}$ leading to $3\times\frac{2}{5}=\frac{3\times2}{5}=\frac{6}{5}$ [N] [CCT]

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

- calculate unit fractions of a collection, eg calculate $\frac{1}{5}$ of 30 [N]
  - describe the connection between finding a unit fraction of a collection and the operation of division (Understanding) [CCT]
- calculate a simple fraction of a collection, eg calculate $\frac{2}{5}$ of 30 [N]
  - use knowledge of unit fractions to aid mental strategies (Fluency) [N]

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

- add and subtract decimals with the same number of decimal places (up to 2 decimal places) [N]
- add and subtract decimals with a different number of decimal places [N]

Multiply decimals by whole numbers and perform divisions that result in terminating decimals, with and without digital technologies

- use mental strategies to multiply simple decimals by single-digit numbers, eg 3.5×2 [N]

Mathematics • Stage 3

Number and Algebra

Fractions and Decimals 2

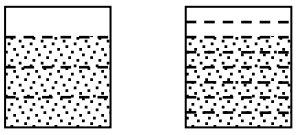
- multiply decimals (up to three decimal places) by a whole number of no more than two-digits, eg 'I measured three desks. Each desk was 1.25 m in length, so the total length is $3 \times 1.25 = 3.75$ m ' [N]
- divide decimals by a single-digit number [N]

Multiply and divide decimals by powers of 10

- 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 [N]
  - use a calculator to explore the effect of multiplying or dividing decimal numbers by multiples of ten (Fluency, Reasoning)

Make connections between equivalent fractions, decimals and percentages

- recognise that the symbol % means 'percent' [L]
- relate a common percentage to a fraction or decimal, eg ' 25% means 25 out of 100 or 0.25 ' [N]
  - recall commonly used equivalent fractions, eg 75%, 0.75, $\frac{3}{4}$ (Fluency) [N]
- equate 10% to $\frac{1}{10}$, 25% to $\frac{1}{4}$ and 50% to $\frac{1}{2}$ [N]
- represent simple fractions as a decimal and as a percentage [N]
  - interpret and explain the use of fractions, decimals and percentages in everyday contexts, eg $\frac{3}{4}$ hour $= 45$ minutes (Understanding) [N]
- find equivalent fractions using diagrams and number lines by re-dividing the unit

eg 

[N]

- develop a mental strategy for finding equivalent fractions, eg multiply or divide the numerator and the denominator by the same number, eg $\frac{1}{4} = \frac{2 \times 1}{2 \times 4} = \frac{3 \times 1}{3 \times 4} = \frac{4 \times 1}{4 \times 4}$ ie $\frac{1}{4} = \frac{2}{8} = \frac{3}{12} = \frac{4}{16}$ [N] [CCT]
- reduce a fraction to its lowest equivalent form by dividing the numerator and the denominator by a common factor [N]
  - explain or demonstrate why two fractions are or are not equivalent (Understanding, Reasoning) [N] [CCT]

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

- calculate simple percentages (10%, 20%, 25%, 50%) of quantities, eg 20% of $\$300 = \frac{1}{5}$ of $\$300 = \$60$ [N]

Mathematics • Stage 3

Number and Algebra
Fractions and Decimals 2

- use mental strategies to convert between percentages and fractions to estimate discounts, eg '50% off the price of $120, 50% is the same as $\frac{1}{2}$, so the discount is $60' [N] [PSC]

Background Information:

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

Language:

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'.

In Chance, the likelihood of an outcome may be described as, for example, 'one in four'.

Students may need assistance with the subtleties of the English language when solving problems, eg '10% of $50' is not the same as '10% off $50'.

Mathematics • Stage 3

Number and Algebra

Patterns and Algebra 1

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology

3.3 gives a valid reason for supporting one possible solution over another

3.6 analyses geometric and number patterns and completes number sentences involving the four operations

Students:

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

- identify and describe a simple number pattern involving one operation (including patterns that decrease), eg $4,8,16,32,\ldots$ 'each term in this number pattern is double the previous term'; $48,41,34,27,\ldots$ 'there is a difference of seven between each term in this number pattern' [N] [CCT]
- use a number line or diagrams to create patterns involving fractions or decimals
- create, with materials or a calculator, a variety of patterns using whole numbers, fractions or decimals,
  eg $\frac{1}{4},\frac{2}{4},\frac{3}{4},\frac{4}{4},\frac{5}{4},\frac{6}{4},\ldots$ or $2.2,2.0,1.8,1.6,\ldots$ [CCT]

Use equivalent number sentences involving multiplication and division to find unknown quantities

- complete number sentences that involve more than one operation by calculating missing values,
  eg Find $\square$ so that $5+\square=12-4$ [N]
  - describe strategies for completing simple number sentences and justify solutions (Understanding, Reasoning) [N] [CCT]
- complete number sentences involving fractions or decimals, eg find $\square$ so that $7\times\square=7.7$ [N]
- construct a number sentence to match a problem that is presented in words and requires 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] [CCT]
- check solutions to number sentences by substituting the solution into the original question (Problem Solving)
- identify and use inverse operations to assist with the solution of number sentences [N],
  eg Find $\square$ so that $125\div5=\square$ becomes: find $\square$ so that $\square\times5=125$
  - describe how inverse operations can be used to solve a number sentence (Understanding) [CCT]

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.

Language:

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:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.6 analyses geometric and number patterns and completes number sentences involving the four operations

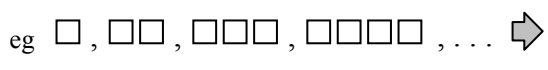
Students:

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

- create a simple geometric pattern involving multiples 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	…
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 a rule to describe the pattern from the table, eg ‘You multiply the top number by four to get the bottom number.’ [N] [CCT]
  - use the rule to calculate the corresponding value for a larger number

  – question how number patterns have been created and how they can be continued (Understanding) [CCT]

  – describe what has been learnt from creating patterns, making connections with number facts and number properties (Understanding) [CCT]

- complete a table of values for number patterns involving one operation (including patterns that decrease) and describe the pattern in words [N]

  eg

First Number	1	2	3	4	5	6
Second Number	4	8	12	16		

  - describe the pattern in a variety of ways and record descriptions using words
  - determine a rule to describe the pattern from the table

  – interpret sentences written by peers and teachers that accurately describe geometric and number patterns (Understanding) [L]

- use the rule to calculate the corresponding value for a larger number [N]
- 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.’ [L] [CCT] [N]

Background Information:

Refer to background information in Patterns and Algebra 1

Mathematics • Stage 3

Number and Algebra
Patterns and Algebra 2

Language:

Refer to language in Patterns and Algebra 1

Mathematics • Stage 3

Measurement and Geometry

Length 1

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.3 gives a valid reason for supporting one possible solution over another

3.7 selects appropriate units to calculate lengths, areas, volumes, capacities and masses

Students:

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

- recognise the need for a unit longer than the metre for measuring distance
- recognise that one thousand metres equal one kilometre and describe one metre as one thousandth of a kilometre [N]
- measure a kilometre and half-kilometre
- use the abbreviation for kilometre (km) [L]
- measure and record lengths or distances using combinations of millimetres, centimetres, metres and kilometres [N]
  - 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 (Understanding, Reasoning) [N] [CCT]
- select and use the appropriate unit and device to measure lengths or distances [CCT]
  - describe how a length or distance was estimated and measured (Understanding) [N]
  - explain why two students may obtain different measures for the same length (Understanding, Reasoning) [N] [CCT]
- interpret symbols used to record speed in kilometres per hour, eg 80 km/h [L]

Calculate the perimeter and area of rectangles using familiar metric units

- find the perimeter of a large area, eg the school grounds
  - explain that the perimeters of squares, rectangles and triangles can be found by finding the sum of the side lengths (Understanding) [N]
- calculate and compare perimeters of squares, rectangles and triangles [CCT]
- find the relationship between the lengths of the sides and the perimeter for squares, rectangles and equilateral and isosceles triangles [CCT]

Background Information:

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. 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:

'Perimeter' comes from the Greek words that mean to measure around the outside.

Mathematics • Stage 3

Measurement and Geometry

Length 2

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology

3.7 selects appropriate units to calculate lengths, areas, volumes, capacities and masses

Students:

Connect decimal representations to the metric system

- record lengths or distances using decimal notation to three decimal places, eg 2.753 km [N]

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

- solve problems involving different units of length,
  eg Find the total length of three items measuring 5 mm, 20 cm and 1.2 m (Problem Solving) [N]
- 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? (Problem Solving) [N]

Convert between common metric units of length, mass and capacity

- convert between metres and kilometres [N]
- convert between millimetres, centimetres and metres to compare lengths or distances [N]

Background Information:

Refer to background information in Length 1

Mathematics • Stage 3

Measurement and Geometry

Area 1

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.7 selects appropriate units to calculate lengths, areas, volumes, capacities and masses

Students:

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

- recognise the need for a unit larger than the square metre
- identify situations where square kilometres are used for measuring area [CCT] [N], eg a suburb
- recognise and explain the need for a more convenient unit than the square kilometre
- use the abbreviations for square kilometre (km^2) and hectare (ha) [L]
- select the appropriate unit to calculate area [CCT] [N]
  - apply measurement skills to everyday situations, eg determining the area of the basketball court (Fluency, Understanding) [N] [CCT]

Calculate the perimeter and area of rectangles using familiar metric units

- measure an area in hectares, eg the local park
- recognise that one hectare is equal to 10 000 square metres
  - equate 1 hectare to the area of a square with side 100 m (Understanding) [CCT]
- read and interpret scales on maps and simple scale drawings to calculate an area [L] [N]
- find the surface area of rectangular prisms by using efficient strategies [CCT] [N], eg a square centimetre grid overlay or by counting rows and columns of unit squares
  - investigate connections with multiplication when finding area (Understanding, Fluency) [CCT] [N]

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. For example, use rectangles that are blank inside when calculating perimeter and use rectangles with grid lines or that are shaded/ coloured inside when calculating area. If there is no distinction between the visual representation of the rectangles in questions or problems, students will often just add the side lengths regardless of what the question has asked them to do.

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 formulae are described in words and not symbols.

Mathematics • Stage 3

Measurement and Geometry
Area 2

Outcomes
A student:
3.1 describes and represents mathematical situations using appropriate terminology and conventions
3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology
3.7 selects appropriate units to calculate lengths, areas, volumes, capacities and masses

Students:

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

- find the relationship between the length, breadth and area of squares and 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 (Understanding) [L]
- find the relationship between base, perpendicular height and area of triangles [CCT]
- investigate the areas of rectangles that have the same perimeter (Problem Solving) [CCT]
  - 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?' (Understanding, Problem Solving) [CCT]
- use efficient strategies to solve problems involving comparisons of areas, eg 'When measuring the area of the garden, I made the largest rectangle I could and then added the partial area that was left over' (Problem Solving) [N] [L] [CCT]

Background Information:

Refer to background information in Area 1

Mathematics • Stage 3

Measurement and Geometry

Volume and Capacity 1

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.3 gives a valid reason for supporting one possible solution over another

3.7 selects appropriate units to calculate lengths, areas, volumes, capacities and masses

Students:

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

- construct rectangular prisms using blocks and count to determine volume [N]
  - use scale to represent volume, eg one multilink cube represents one cubic centimetre (Understanding) [N]
- estimate then measure the volume of rectangular containers by packing with cubic centimetre blocks [N]
- use repeated addition to find the volume of rectangular prisms
  - explain the advantages and disadvantages of using centimetre cubes as a unit to measure volume (Reasoning) [CCT]
- recognise the need for a more efficient way to measure volume than using centimetre cubes
  - 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, eg base layer x height (Understanding) [N]
- find the relationship between the length, breadth, height and volume of rectangular prisms [CCT]
- use the cubic metre as a formal unit for measuring larger volumes
- estimate the size of a cubic metre, half a cubic metre and two cubic metres [N]
- demonstrate that a cube of side 10 cm will displace 1 L of water
- demonstrate, by using a medicine cup, that a cube of side 1 cm will displace 1 mL of water
- find the volume of irregular solids in cubic centimetres using a displacement strategy [N]

Background Information:

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 and then begin to generalise their method for calculating the volume.

The *cubic metre* can be introduced and 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.

Mathematics • Stage 3

Measurement and Geometry
Volume and Capacity 1

Language:

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:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.3 gives a valid reason for supporting one possible solution over another

3.7 selects appropriate units to calculate lengths, areas, volumes, capacities and masses

Students:

Connect volume and capacity and their units of measurement

- select the appropriate unit to measure volume and capacity [N]
- calculate the volume of rectangular prisms
- construct different rectangular prisms that have the same volume [N] [CCT]
  - explain that objects with the same volume may have different shapes (Understanding)
- recognise the need for a unit larger than the cubic centimetre
- use the abbreviation for cubic metre (m^3) [L]
  - explain why volume is measured in cubic metres in certain situations, eg wood bark, concrete (Reasoning) [CCT]
- estimate the number of cubic metres in a variety of objects such as a cupboard, a car, a bus, the classroom [N]

Connect decimal representations to the metric system

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

Convert between common metric units of length, mass and capacity

- equate 1 cubic centimetre to 1 millilitre and 1000 cubic centimetres to 1 litre [N]
- convert between millilitres and litres [N]

Calculate volumes of rectangular prisms

- calculate the volume of rectangular prisms
  - explain that the volume of rectangular prisms can be found by finding the number of cubes in one layer and multiplying by the number of layers (Understanding) [N]
- find the relationship between the length, breadth, height and volume of rectangular prisms [CCT]

Background Information:

Refer to background information in Volume and Capacity 1

Mathematics • Stage 3

Measurement and Geometry
Volume and Capacity 2

Language:

Refer to language in Volume and Capacity 1

Mathematics • Stage 3

Measurement and Geometry
Mass 1

Outcomes
A student:
3.1 describes and represents mathematical situations using appropriate terminology and conventions
3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology
3.7 selects appropriate units to calculate lengths, areas, volumes, capacities and masses

Students:

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

- choose appropriate units to measure mass [N] [CCT]
  - associate gram measures with familiar objects, eg a standard, egg has a mass of about 60 g (Understanding) [N]
- recognise the need for a unit larger than the kilogram
- use the tonne to record large masses, eg sand, soil, vehicles
- use the abbreviation for tonne (t) [L]
- select and use the appropriate unit and device to measure mass [N] [CCT]
  - 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?' (Problem Solving) [CCT]

Background Information:

Gross mass is the mass of the contents and the container. Nett 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:

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

Mathematics • Stage 3

Measurement and Geometry

Mass 2

Outcomes

A student:

3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology

3.7 selects appropriate units to calculate lengths, areas, volumes, capacities and masses

Students:

Convert between common metric units of length, mass and capacity

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

Connect decimal representations to the metric system

- measure mass using digital scales and record using decimal notation to three decimal places, eg 1.325 kg [N]

Background Information:

Refer to background information in Mass 1

Language:

Refer to language in Mass 1

Mathematics • Stage 3

Measurement and Geometry

Time 1

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.8 uses twenty-four hour time and twelve-hour notation, interprets timetables and constructs timelines

Students:

Compare 12- and 24-hour time systems and convert between them

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

Investigating duration of events

- determine the duration of events using starting and finishing times to calculate elapsed time [N]
- use a stopwatch to measure and compare the duration of events [N] [PSC]

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.

The terms 'am' and 'pm' are used only for the digital form of time recording and not with the 'o'clock' terminology. The abbreviation am stands for the Latin words 'ante meridiem' which means 'before midday'. The abbreviation pm stands for 'post meridiem' which means 'after midday'.

Midday and midnight need not be expressed in am or pm form. '12 noon' or '12 midday' and'12 midnight' should be used, even though 12:00 pm and 12:00 am are sometimes seen.

It is important to note that there are many different ways of recording dates, including abbreviated forms.

Different notations for dates are used in different countries, eg 8 December 2002 is recorded as 8.12.02 in Australia but as 12.8.02 in America.

Mathematics • Stage 3

Measurement and Geometry

Time 2

Outcomes

A student:

3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology

3.8 uses twenty-four hour time and twelve-hour notation, interprets timetables and constructs timelines

Students:

Interpret and use timetables

- 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 [N] [PSC] [ICT] [CCT]

– use a number of strategies to solve unfamiliar problems (Problem Solving) [CCT]

Investigating timelines

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

Background Information:

See background information in Time 1

Mathematics • Stage 3

Measurement and Geometry

Three-Dimensional Space 1

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.3 gives a valid reason for supporting one possible solution over another

3.9 identifies and constructs three-dimensional objects, applies properties of two-dimensional shapes, measures angles and uses grid reference systems

Students:

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

- identify and describe the properties of three-dimensional objects: [L] [N]
  - number of faces
  - shape of faces
  - number and type of identical faces
  - number of vertices
  - number of edges
  - convex or non-convex
- identify any pairs of parallel faces of a three-dimensional object
  - explain why particular three-dimensional structures are used in the built environment or appear in the natural environment (Reasoning) [CCT]
- 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 (Understanding, Reasoning) [CCT] [PSC]
- visualise and sketch nets for three-dimensional objects [N] [CCT]

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.

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.

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.

Mathematics • Stage 3

Measurement and Geometry
Three-Dimensional Space 1

Language:

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:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.9 identifies and constructs three-dimensional objects, applies properties of two-dimensional shapes, measures angles and uses grid reference systems

Students:

Construct simple prisms and pyramids

- recognise similarities and differences between pyramids or prisms,
  eg between a triangular prism and a hexagonal prism
- name prisms or pyramids according to the shape of their base [L],
  eg rectangular prism, hexagonal prism
- create prisms and pyramids using a variety of materials,
  eg plasticine, paper or cardboard nets, straws and tape, multilink cubes, computer drawing programs [ICT] [CCT]
- construct three-dimensional models given drawings of different views [CCT]
- construct a three-dimensional model and sketch the front, side and top views [CCT]
  - describe to a peer how to construct or draw a three-dimensional object (Understanding) [L] [CCT]
- show simple perspective in drawings by showing depth [CCT]

Background Information:

Refer to background information in Three-Dimensional Space 1

Mathematics • Stage 3

Measurement and Geometry

Two-Dimensional Space 1

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.9 identifies and constructs three-dimensional objects, applies properties of two-dimensional shapes, measures angles and uses grid reference systems

Students:

Classify two-dimensional shapes

- select and classify a shape from a description of its properties [N]
  - explain the difference between regular and irregular shapes (Understanding) [CCT]
  - explain classifications of two-dimensional shapes (Understanding)
- identify and name right-angled triangles [L] [N]
- manipulate, identify and name isosceles, equilateral and scalene triangles [L] [N]
- identify and draw regular and irregular two-dimensional shapes from descriptions of their side and angle properties

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

- use templates, rulers, set squares and protractors to draw regular and irregular two-dimensional shapes
- make enlargements and reductions of two-dimensional shapes, pictures and maps
- compare and discuss representations of the same object or scene in different sizes, eg student drawings enlarged or reduced on a photocopier [N] [CCT]
- enlarge or reduce a graphic or photograph using computer software [ICT]

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

- recognise that the properties of shapes do not change when shapes are rotated
- describe the effect when a two-dimensional shape is translated, reflected or rotated [L], eg when a vertical arrow was rotated 90° the resulting shape points horizontally
  - rotate a graphic or object through a specified angle about a particular point, including using the rotate function in a computer drawing program (Fluency) [ICT]
- identify shapes that have rotational symmetry, determine the order of rotational symmetry
  - construct designs with rotational symmetry, including using computer drawing tools (Fluency, Understanding) [ICT]

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

Mathematics • Stage 3

Measurement and Geometry
Two-Dimensional Space 1

- 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
- use the symbol for degrees (°) [L]
- use a protractor to construct an angle of a given size and to measure angles [N]
  - construct a shape using computer drawing tools, from a description of its side and angle properties (Fluency) [ICT]
  - explain how an angle was measured (Understanding) [N]
- estimate and measure angles in degrees [N]
  - describe side and angle properties of two-dimensional shapes (Understanding)
- compare angles in different two-dimensional shapes [CCT]
- explore by measurement angle properties of isosceles, equilateral and scalene triangles [CCT] [N]
- explore by measurement angle properties of squares, rectangles, parallelograms and rhombuses [CCT] [N]

Background Information:

A shape is said to have rotational symmetry if a tracing of the shape matches it after the tracing is rotated part of a full turn.

Language:

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:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.3 gives a valid reason for supporting one possible solution over another

3.9 identifies and constructs three-dimensional objects, applies properties of two-dimensional shapes, measures angles and uses grid reference systems

Students:

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

- identify if a two-dimensional shape has been translated, reflected or rotated and how many times [CCT],
  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° each time [CCT]
  - explain why a pattern was chosen as correct from a number of options when given information about a combination of transformations (Understanding, Reasoning) [CCT]

Applying properties of two-dimensional shapes

- identify and draw diagonals on two-dimensional shapes
- compare and describe diagonals of different two-dimensional shapes [CCT]
- compare and describe side properties of isosceles, equilateral and scalene triangles [CCT]
- create circles 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]
  - inscribe squares, equilateral triangles, regular hexagons and regular octagons in circles (Fluency)

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

- classify angles as right, acute, obtuse, reflex, straight or a revolution [N] [L]
- identify angle types at intersecting lines, establishing and using the equality of vertically opposite angles
- identify and name adjacent angles, vertically opposite angles, straight angles and angles of complete revolution [L]
- use knowledge of interior angles of two-dimensional shapes to find unknown angles [CCT]

Mathematics • Stage 3

Measurement and Geometry
Two-Dimensional Space 2

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°. There are 360° in an angle of complete revolution. A rebound could be created by rolling a tennis ball towards a wall at an angle and tracing the path with chalk to show the angle.

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

Adjacent angles are two angles with a common vertex and a common arm that do not overlap.

Mathematics • Stage 3

Measurement and Geometry

Position 1

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.9 identifies and constructs three-dimensional objects, applies properties of two-dimensional shapes, measures angles and uses grid reference systems

Students:

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

- find a place on a map or in a directory, given its coordinates [N]
  - use street directories, including those accessed on the internet, to find the route to a given place (Fluency, Understanding) [N] [ICT] [L]
  - describe the direction of one place relative to another, eg Perth is west of Sydney (Understanding) [L] [N]
- use a given map to plan or show a route [N] [L],
  eg route taken to get to the local park
- draw and label a grid on a map
- recognise that the same location can be represented by maps or plans using different scales
- locate a place on a map which is a given direction from a town or landmark [N] [L],
  eg locating a town that is north-east of Broken Hill

Language:

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

Measurement and Geometry
Position 2

Outcomes
A student:
3.1 describes and represents mathematical situations using appropriate terminology and conventions
3.9 identifies and constructs three-dimensional objects, applies properties of two-dimensional shapes, measures angles and uses grid reference systems

Students:

Introduce the Cartesian coordinate system using all four quadrants

- recognise that a Cartesian plane is a visual way of describing location
- recognise the number plane formed from the intersection of a horizontal *x*-axis and a vertical *y*-axis
  - recognise that the *y*-axis is a number line rotated 90° in an anti-clockwise direction creating four quadrants on the number plane (Understanding)
- identify the point of intersection of the two axes as the origin, having coordinates (0,0) [L] [N]
- describe and locate given coordinates of dot points in all four quadrants [L] [N], eg the point (2,3) is in the first quadrant
- read and plot a sequence of coordinates to create a picture [N]
  - use coordinates in computer software (Fluency) [ICT]

Background Information:

In this topic, the notion of locating position and plotting coordinates that was established in Stage 2 is further developed 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.

Mathematics • Stage 3

Statistics and Probability

Data 1

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology

3.3 gives a valid reason for supporting one possible solution over another

3.10 uses appropriate data collection methods, constructs and interprets a range of data displays and analyses small data sets

Students:

Pose questions and collect categorical or numerical data by observation or survey

- collect data through observation or by conducting surveys,
  eg observing insect diversity in a one-metre-square of the playground or garden bed over time [N]
- pose questions that can be answered using the information from a table or graph
  - use a database to organise information collected from a survey (Fluency, Understanding) [L] [ICT]
  - use a spreadsheet to tabulate and graph collected data (Understanding, Fluency) [L] [ICT]

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

- determine a suitable scale for data and record the scale in a key, eg ♥= 10 people [N]
- draw picture or column graphs using a key or scale [N]
- draw a line graph to represent any data that demonstrates a continuous change [N],
  eg hourly temperature
- name and label the horizontal and vertical axes
- determine a suitable scale for the data and record the scale on the vertical axis [N]
- use the scale to determine the placement of each point when drawing a line graph [N]
- construct dot plots to communicate information [N],
  eg collecting and displaying data on the height of students or comparing resting and active heart rates of students before and after exercise

Describe and interpret different data sets in context

- use the term ‘average’ and find the average for a small set of data
- interpret a given line graph using the scales on the axes [N] [L]
- determine what type of graph is the best one to display a set of data [N] [CCT]
  - justify the choice of data display used to represent results from an investigation (Reasoning) [CCT]

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Statistics and Probability

Data 1

- interpret and evaluate a set of data as part of an investigation, including data collected using the internet, eg Rugby League tackle counts for various teams; 'Does a low tackle count result in the team winning?' (Problem Solving) [N] [ICT] [CCT]

Background Information:

In picture graphs involving numbers that have a large range, one symbol cannot represent one real object. A key is used for convenience, eg ☺ = 10 people.

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

Divided bar graphs are used to show how a total is divided into parts.

Column graphs are useful in recording the results obtained from simple probability experiments.

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 value can easily be counted.

Advantages and disadvantages of different representations of the same data should be explicitly taught.

Data may be quantitative (discrete or continuous) or categorical, eg gender (male, female) is categorical. Height (measured in cm) is quantitative, continuous quality (poor, average, good, excellent) is categorical, eg school population (measured in individuals) is quantitative, discrete.

Students need to be provided with opportunities to discuss what information can be drawn from the data presented.

Language:

Students need to think about the meaning of the information and to put it into their own words.

Language to be developed would include superlatives, comparatives and other language such as 'prefer ….over' etc

Mathematics • Stage 3

Statistics and Probability

Data 2

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.3 gives a valid reason for supporting one possible solution over another

3.10 uses appropriate data collection methods, constructs and interprets a range of data displays and analyses small data sets

Students:

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

- interpret a given picture or column graph using the key or scale [N] [L]
- compare and interpret side-by-side column graphs [N] [L] [CCT],
  eg graphs comparing heights of girls and boys in year 6
- name a divided bar graph or sector (pie) graph and the category represented by each section
- interpret divided bar graphs and sector (pie) graphs [N] [L],
  eg a graph showing what a student does with their time after school- sport, homework, music, watch television etc
- compare different student-created data displays, giving reasons as to which one best displays the data [CCT]
  - discuss the advantages and disadvantages of different representations of the same data (Understanding) [CCT]

Interpret secondary data presented in digital media and elsewhere

- explain information presented in the media that uses the term ‘average’ [N] [L],
  eg ‘The average temperature for the month of December was 24 degrees’
- discuss and interpret graphs found in the media and in factual texts [N] [L]
  - identify misleading representations of data in the media and critically discuss claims made (Understanding, Reasoning) [N] [L] [CCT]
- compare the effectiveness of different data displays, considering if data representations provide a biased or unbiased view [N] [L] [CCT]
  - recognise how variations in measurements can result in misleading information (Understanding) [N] [CCT]

Background Information:

Refer to background information in Data 1

Language:

Refer to language in Data 1

Mathematics • Stage 3

Statistics and Probability

Chance 1

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.11 orders the likelihood of simple events on a number line from 0 to 1

Students:

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

- interpret data on various spinners to represent each number's probability as a fraction, eg a six-segment spinner with numbers 1, 2 and 3 would result in each number having a probability of $\frac{1}{3}$
- conduct chance experiments with simple games by considering the number of possible outcomes and the consequent chance of winning, eg rock-paper-scissors
  - investigate probability in real-life situations using the internet, eg lotto, lotteries etc (Understanding) [N] [ICT] [CCT]

Recognise that probabilities range from 0 to 1

- use data to order chance events from least likely to most likely [N], eg roll two dice twenty times and order the results according to how many times each total is obtained
- order commonly used 'chance words' on a number line between zero (impossible) and one (certain) [L] [N], eg 'equal chance' would be placed at 0.5

Background Information:

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

Chance events can be ordered on a scale from zero to one. A chance of zero describes an event that is impossible. A chance of one describes an event that is certain. Therefore, events with an equal chance of occurring can be described as having a chance 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 2

Outcomes

A student:

3.1 describes and represents mathematical situations using appropriate terminology and conventions

3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology

3.3 gives a valid reason for supporting one possible solution over another

3.11 orders the likelihood of simple events on a number line from 0 to 1

Students:

Describe probabilities using fractions, decimals and percentages

- describe the likelihood of events as being more or less than a half (50% or 0.5) and order the events on a number line [N]
- use knowledge of equivalent fractions and percentages to assign a numerical value to the likelihood of a simple event occurring,
  eg there is a five in ten, $\frac{5}{10}$, 50% or one in two chance of this happening
  - assign numerical values in real-life contexts, eg 'My football team has a fifty-fifty chance of winning the game' (Understanding, Reasoning) [N]
  - design a spinner or label a die so that a particular outcome is more likely than another and discuss the probability of outcomes using fractions (Problem Solving, Understanding) [N] [CCT]

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

- use samples to make predictions about a larger 'population' from which the sample comes, eg predicting the proportion of cubes of each colour in a bag after taking out a sample of the cubes [CCT] [N]
  - question whether a prediction about a larger population, from which a sample comes, would be the same if a different sample was used, eg 'Would the results be the same if a different class was surveyed? (Understanding, Reasoning) [N] [CCT]

Compare observed frequncies across experiments with expected frequencies

- conduct experiments with equally likely outcomes and compare results [CCT],
  eg roll a dice 20 times, graph results and compare with other student's recordings discussing the frequency of certain numbers
  - discuss and give reasons why results vary in probability experiments with similar expected frequencies (Reasoning) [CCT]
- make predictions and compare results from experiments with expected frequencies,
  eg compare graphed results from rolling two dice and finding the total [CCT]

Background Information:

Refer to background information in Chance 1