Brookstead State School

Mathematics Program

This program is designed around the premise that it will need regular review and modification as our students who have completed the Preparatory Year move through the school.
Our beliefs about teaching mathematics

The staff of Brookstead State School believe that mathematics:
• is highly important for successful life beyond schooling
• should be taught everyday
• focuses on the development of higher order thinking within our students
• includes the explicit teaching of mathematical strategies and ways of working
• incorporates the use of materials at all year levels
• should be connected to the students’ real lives
• includes opportunities for teachers to continue learning.

Teaching mathematics at Brookstead State School includes:
• a balanced mathematical learning approach which consists of
  o learning basic facts
  o applying basic facts and procedures to solve familiar problems
  o solving specific problems in novel situations
  o investigating issues and problem situations
• differentiated learning to meet the varied needs of our students
• embedding the effective use of information and communication technologies
• embedding Indigenous perspectives
• focusing on all forms of computation (mental, written and technology-assisted)
• *First steps in mathematics* strategies.

Cross-curricular priorities

**Numeracy**
We improve the numerate capabilities of students at Brookstead State School by:
• fostering students to be confident in their use of mathematics
• encouraging students to be flexible in their mathematical thinking
• promoting higher-order thinking through a working mathematically approach
• applying mathematics through a range of contexts and key learning areas
• encouraging risk-taking in the use of mathematical knowledge, skills and thinking
• instilling persistence when problem-solving in mathematics.

**Literacy**
We improve the literacy capabilities of students at Brookstead State School by:
• explicitly identifying and teaching the language demands of mathematics at all year levels
• ensuring students are exposed to and taught the conventions used by mathematicians
• applying skills learned at literacy training to the interpretation of word problems in mathematics (in particular, functional grammar)
• identifying the different visual representations used in mathematics e.g. number lines, tables, graphs, maps, networks, nets and 3D objects (refer to notes in the term breakdown for further details).

**Year level plan**

Our mathematics year level plans were developed from the Essential Learnings and Standards. Supporting information was gained from the 2004 syllabus elaborations, Education Queensland Mathematics Scope and Sequence, QSA Scope and Sequence for Mathematics, Year 1 Learning Statements and First Steps in Mathematics resource books. A detailed overview of what is to be taught in each juncture can be found in the Whole School Mathematics Plan. Details for each organiser, plus ideas for resources, can be found in the Year Level Overviews.
We believe that the developmental sequence of mathematics learning can be compared to bricks in a wall. Each brick represents knowledge or understanding, or a way of working, that students need to develop. The Essentials described at the juncture points indicate what learning ‘bricks’ need to have been developed by that time. Like bricks in the wall, learning is built upon other learning and, at Brookstead State School, we ensure that our program is consistent and thorough.

End of Year 9
End of Year 7
End of Year 5
End of Year 3

Mathematics Knowledge and understanding, and Ways of working within the different organisers of mathematics.

Time allocations: Years 1 to 7 5 hours per week

Pedagogy

At Brookstead State School we encourage learning as an active process, and have designed our mathematics program around the inclusion of interesting, fun and relevant learning experiences that will help students develop a positive disposition towards mathematics.

To meet this aim, our program, planning, teaching and assessment include:

- a range and balance of learning experiences from focused skill development activities through to open-ended investigations and inquiry
- the provision of multiple opportunities for students to explore concepts so they can develop a deep knowledge and understanding
• planning units and lessons that are relevant and responsive to the needs, interests and capabilities of our students. This is achieved by starting with real world problems → materials and representations → language → symbolic representations and abstract concepts
• an emphasis on challenging problems that promote higher order thinking skills, and the critical analysis of data and issues
• teaching a range of calculation strategies, such as mental computation (see note below), formal and informal jottings, calculators, computers and written algorithms
• a range and balance of teaching approaches, such as whole class–directed lessons, group/team work and individual work
• an embedded use of ICTs into all classrooms
• Indigenous perspectives embedded into all classrooms (further detail provided in the term breakdown)
• explicit teaching of specific mathematics language, diagrams, models and conventions used by mathematicians
• the provision of multiple opportunities for students to confidently, willingly and capably transfer their mathematics learning to a variety of contexts
• explicit advice to students about expected standards of achievement.

Mental computation
‘Mental computation is the most common form of computation used in everyday life. It is used for quick calculations and estimations, and to check reasonableness of answers obtained with calculators or other resources. Mental computation is integral to mathematics learning.’

At Brookstead State School, mental computation is built into the mathematics curriculum through specification of key strategies for particular years of learning. The teaching of mental computation concentrates on the use of repeated and varied physical and visual number-based activities. The aim is to encourage students to analyse and develop their own conceptual understanding of mathematical operations.

Assessment and reporting

Monitoring learning
Monitoring of student learning is integral to informing our planning so we develop students that have a deep understanding of the concepts that make up number, algebra, measurement, chance and data, and space.

At Brookstead State School, monitoring occurs in the following ways:
• classroom observations
• checklists
• homework
• diagnostic tasks (First steps in mathematics and Developing mathematics understanding through cognitive diagnostic assessment tasks)
• anecdotal records
• knowledge gained from assessment for reporting.

Immediate feedback to students is a priority, as this builds student confidence and a positive disposition. It also assists students to manage their own learning.

Assessment for reporting (assessment of learning)
We believe that to learn mathematics, children must construct concepts, and relationships among concepts, in their own minds. To do this, we must allow our children to explore and investigate, and discuss and justify. As such, we have designed our teaching and assessment programs using these tenants. The assessable elements (knowledge and
understanding, thinking and reasoning, communicating, reflecting) are considered, but not all are assessed on every task.

Each semester in each year level, we aim to have a range and balance of different types of tasks. As such, our minimum assessment requirements for each class are listed below.

### School-based assessment requirements

<table>
<thead>
<tr>
<th>Assessment type</th>
<th>Frequency</th>
<th>Other notes</th>
<th>Assessable elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short answer test</td>
<td>1 per term</td>
<td>Term 2 and Term 4 tests will be moderated within a phase</td>
<td>• Knowledge and understanding</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Communicating</td>
</tr>
<tr>
<td>Open-ended investigation</td>
<td>1 per semester</td>
<td>Moderated within a phase</td>
<td>• Thinking and reasoning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Communicating</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Reflecting</td>
</tr>
<tr>
<td>Oral presentation</td>
<td>2 per year</td>
<td>Not to be completed in the same semester as the report</td>
<td>• Knowledge and understanding</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Communicating</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Reflecting</td>
</tr>
<tr>
<td>Report</td>
<td>2 per year</td>
<td>Teaching and assessing to occur over a 4–6 week period. In the early years,</td>
<td>• Knowledge and understanding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the use of ICTs will support students</td>
<td>• Thinking and reasoning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Communicating</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Reflecting</td>
</tr>
<tr>
<td>QCAT (semester 2 only)</td>
<td>1 per year</td>
<td>Moderated within the cluster</td>
<td>As per QCAT design brief — this will vary every second year</td>
</tr>
</tbody>
</table>

### External assessment requirements

| NAPLAN                | To be completed in May of each year |

This data is to be included in the student’s portfolio so that progress can be tracked.

Notes:
- In the early years of schooling, there will be a greater emphasis on the use of oral presentations, portfolios and checklists. As students progress through the school, there will be more balance between spoken and written forms of assessment.
- Task specific criteria sheets will be written for each assessment task.
- The standards listed within QCAR will be the basis for developing task-specific criteria sheets.

National Assessment Program — Literacy and Numeracy (NAPLAN) data will be used to review our program, and identify strengths and weaknesses, and professional development priorities for staff and resource purchasing. Students that require targeted teaching can be identified.

**2008 NAPLAN results**

(Reading, writing, spelling, grammar and punctuation, and numeracy results for Years 3, 5, 7 and 9)

<table>
<thead>
<tr>
<th>Numeracy</th>
<th>Year 3</th>
<th>Year 5</th>
<th>Year 7</th>
<th>Year 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. score for Brookstead SS</td>
<td>377</td>
<td>465</td>
<td>465</td>
<td>537</td>
</tr>
<tr>
<td>Avg. score for Australia</td>
<td>396.7</td>
<td>475.7</td>
<td>544.9</td>
<td>582.2</td>
</tr>
<tr>
<td>Percentage of students at Brookstead SS above benchmark</td>
<td>93</td>
<td>100</td>
<td>91</td>
<td>73</td>
</tr>
</tbody>
</table>
Year 2 Diagnostic Net Results (2008): Percentage of students not requiring additional support in Number: 63%

**Reporting**

At Brookstead State School, we will report student achievement and learning to parents on a regular basis. This will include both written and oral reporting.

Specifically:

- twice yearly written reports on a 5-point scale (end of Semester 1 and end of Semester 2)
- twice yearly oral reporting (end of Term 1 and end of Term 3)
- informal reporting to parents (on a needs basis for those students requiring special programs, such as intervention or extension)

Note: Special programs may take a variety of forms (i.e. intensive and specialised teaching within the classroom, targeted programs with specialist teachers or intensive one-to-one tutoring).
Through daily interactions with students across the five contexts for learning from the Early Years Curriculum Guidelines — play, real-life situations, investigations, routines and transitions, and focused learning and teaching — teachers are to capture inquiry-based learning experiences that enhance children's active engagement in learning.

### Early mathematical understandings about number

**Investigating and communicating about quantities and their representations, and attributes of objects and collections**

<table>
<thead>
<tr>
<th>Conceptual understandings</th>
<th>Representations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Number names to 20</td>
<td>Materials</td>
</tr>
<tr>
<td>• Count using one-to-one correspondence</td>
<td>Computers</td>
</tr>
<tr>
<td>• The last number counted tells us ‘how many’ in the collection</td>
<td>Oral</td>
</tr>
<tr>
<td>• Number of any collection can be made up of smaller collections</td>
<td>• Counting</td>
</tr>
<tr>
<td>• The number in a collection will be the same regardless of the order in which they are counted or the starting point.</td>
<td>o forwards to 20</td>
</tr>
<tr>
<td>• Identifying quantities by seeing familiar arrangements (subitising).</td>
<td>o backwards in 1s from 10</td>
</tr>
<tr>
<td>• Comparing collections (small and extreme differences) (e.g. more, less, same, different)</td>
<td>o the next number in the counting sequence (e.g. 1, 2, 3, 4)</td>
</tr>
<tr>
<td>• Parts of a whole everyday object (e.g. slice of cake)</td>
<td>• More and less; same and different</td>
</tr>
<tr>
<td>• Sharing collections</td>
<td>• Everyday language (e.g. slice, piece, number names)</td>
</tr>
<tr>
<td>• Names of coins ($1, $2) and notes ($5, $10)</td>
<td>Visual</td>
</tr>
<tr>
<td>• Money for goods or services (e.g. bus fare, saving, spending)</td>
<td>• Picture of collections</td>
</tr>
<tr>
<td>• Comparison and sorting of coins by different attributes (e.g. colour, shape)</td>
<td>• Five-frame</td>
</tr>
<tr>
<td>• Everyday language (e.g. names of dollar coins, $5 and $10 notes)</td>
<td>• Blank number line</td>
</tr>
<tr>
<td>• Money for goods or services (e.g. bus fare, saving, spending)</td>
<td>• Number chart to 20</td>
</tr>
<tr>
<td>• Comparison and sorting of coins by different attributes (e.g. colour, shape)</td>
<td></td>
</tr>
<tr>
<td>• Everyday language (e.g. names of dollar coins, $5 and $10 notes)</td>
<td></td>
</tr>
</tbody>
</table>

### Early mathematical understandings about algebra

**Investigating and communicating about order, sequence and pattern**

<table>
<thead>
<tr>
<th>Conceptual understandings</th>
<th>Representations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Make own patterns using two or more types of materials</td>
<td>Materials</td>
</tr>
<tr>
<td>• Match and copy patterns that have a discernible unit of repetition</td>
<td>Computers</td>
</tr>
<tr>
<td>• Balance on scales</td>
<td>Manipulatives (e.g. everyday objects, balance scales)</td>
</tr>
<tr>
<td>• Sameness of collections procedures</td>
<td>Actions and sounds</td>
</tr>
<tr>
<td>• Comparing collections with respect to quantity and/or size</td>
<td>Oral</td>
</tr>
<tr>
<td>• Sorting</td>
<td>• Language (e.g. after, next, match, sort, classify, copy, repeat)</td>
</tr>
<tr>
<td>• Estimation</td>
<td>• Increasing and decreasing sequences in songs and rhymes</td>
</tr>
<tr>
<td></td>
<td>• Predictions of change</td>
</tr>
<tr>
<td></td>
<td>• Pattern rules</td>
</tr>
<tr>
<td></td>
<td>• Pattern descriptions</td>
</tr>
<tr>
<td></td>
<td>• Descriptions of same collections</td>
</tr>
<tr>
<td></td>
<td>Written</td>
</tr>
<tr>
<td></td>
<td>• Recording patterns (e.g. drawings)</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
</tr>
<tr>
<td></td>
<td>• Photographic records of patterns</td>
</tr>
</tbody>
</table>
# Early mathematical understandings about measurement

**Investigating and communicating about quantities and their representations, and attributes of objects and collections**

**Investigating and communicating about order, sequence and pattern**

<table>
<thead>
<tr>
<th>Conceptual understandings</th>
<th>Representations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sort objects measurement attributes (e.g. length, mass, area, volume)</td>
<td>Materials</td>
</tr>
<tr>
<td>• Compare similarities and differences of objects according to measurement attributes (e.g. longer, shorter)</td>
<td>• Computers</td>
</tr>
<tr>
<td>• Sequence significant events linked to time</td>
<td>• Manipulatives</td>
</tr>
<tr>
<td>• Order and sequence familiar points in time (e.g. we go to the library after lunch)</td>
<td>• Analog and digital clocks</td>
</tr>
<tr>
<td>• Times of day</td>
<td>Oral</td>
</tr>
<tr>
<td></td>
<td>• Everyday language</td>
</tr>
<tr>
<td></td>
<td>o long and longer</td>
</tr>
<tr>
<td></td>
<td>o short and shorter</td>
</tr>
<tr>
<td></td>
<td>o heavy and heavier</td>
</tr>
<tr>
<td></td>
<td>o light and lighter</td>
</tr>
<tr>
<td></td>
<td>o empty and full</td>
</tr>
<tr>
<td></td>
<td>o lunchtime</td>
</tr>
<tr>
<td></td>
<td>o going home time</td>
</tr>
<tr>
<td></td>
<td>o library day</td>
</tr>
<tr>
<td></td>
<td>o school day</td>
</tr>
<tr>
<td></td>
<td>Written</td>
</tr>
<tr>
<td></td>
<td>• Data display as classified objects and images</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
</tr>
<tr>
<td></td>
<td>• Drawings of sequences in routines</td>
</tr>
<tr>
<td></td>
<td>• Photographs of everyday objects and seasons</td>
</tr>
<tr>
<td></td>
<td>• Calendars</td>
</tr>
</tbody>
</table>

## Early mathematical understandings about chance and data

**Investigating and communicating about quantities and their representations, and attributes of objects and collections**

<table>
<thead>
<tr>
<th>Conceptual understandings</th>
<th>Representations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sort objects and pictures into categories (e.g. might happen, might not happen, never happen)</td>
<td>Materials</td>
</tr>
<tr>
<td>• Chance experiences in familiar situations</td>
<td>• Computers</td>
</tr>
<tr>
<td>• Collect data to answer student generated questions, issues to be resolved (e.g. how tall will the bean grow?)</td>
<td>• Manipulatives</td>
</tr>
<tr>
<td></td>
<td>Oral</td>
</tr>
<tr>
<td></td>
<td>• Everyday language (e.g. might/might not/never happen)</td>
</tr>
<tr>
<td></td>
<td>Written</td>
</tr>
<tr>
<td></td>
<td>• Data display as classified objects and images</td>
</tr>
<tr>
<td></td>
<td>Visual</td>
</tr>
<tr>
<td></td>
<td>• Photographs</td>
</tr>
<tr>
<td></td>
<td>• Pictorial of chance events</td>
</tr>
</tbody>
</table>

## Early mathematical understandings about space

**Investigating and communicating about quantities and their representations, and attributes of objects and collections**

**Investigating and communicating about position, movement and direction**

<table>
<thead>
<tr>
<th>Conceptual understandings</th>
<th>Representations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Classify by shape</td>
<td>Materials</td>
</tr>
<tr>
<td>• Classify by shape name (e.g. circle) or by a single attribute (e.g. things that can roll)</td>
<td>• Computers</td>
</tr>
<tr>
<td>• Compare similarities and differences of shapes based on attributes (e.g. straight sides and curved sides on a square and a die)</td>
<td>• Manipulatives (familiar shapes and objects)</td>
</tr>
<tr>
<td>• Positional language (e.g. on the chair, under the roof, behind Zac, in front of the playground)</td>
<td>Oral</td>
</tr>
<tr>
<td>• Plan or follow pathways</td>
<td>• Everyday language</td>
</tr>
<tr>
<td></td>
<td>o straight lines</td>
</tr>
<tr>
<td></td>
<td>o curved lines</td>
</tr>
<tr>
<td></td>
<td>o straight sides</td>
</tr>
<tr>
<td></td>
<td>Written</td>
</tr>
<tr>
<td></td>
<td>• Straight and curved lines within drawings</td>
</tr>
<tr>
<td><strong>Visual</strong></td>
<td><strong>Materials</strong></td>
</tr>
<tr>
<td>------------</td>
<td>--------------</td>
</tr>
<tr>
<td>• Photographs and drawings of familiar shapes and objects</td>
<td>• Manipulatives</td>
</tr>
<tr>
<td>• Mind pictures of different shapes</td>
<td>• Familiar environments</td>
</tr>
<tr>
<td></td>
<td>• Computers</td>
</tr>
<tr>
<td><strong>Oral</strong></td>
<td><strong>Written</strong></td>
</tr>
<tr>
<td>• Directions using position language (e.g. to describe where something is or to give directions on how to find something)</td>
<td>• Simple line drawings</td>
</tr>
<tr>
<td>• Everyday language</td>
<td>• Representing a map</td>
</tr>
<tr>
<td>o here and there</td>
<td>• Visual</td>
</tr>
<tr>
<td>o on and off</td>
<td>• Photographs of the familiar environment</td>
</tr>
<tr>
<td>o forward and backward</td>
<td></td>
</tr>
<tr>
<td>o on and under</td>
<td></td>
</tr>
</tbody>
</table>
### Ways of working

#### Identify mathematics in everyday situations
- Talks about where they see numbers, shapes and measurements, and gives examples of some of the ways they and their families use numbers (e.g. says ‘There are numbers on our phone and on footy jumpers’)
- Knows that numbers are used for different purposes: some to tell how many (cardinal), others as labels (nominal) and others to describe order (ordinal)
- Identifies and describes some of the ways they, and their friends and families, use numbers, shapes and measurements (e.g. says ‘We use the numbers on the clock to tell us when to have lunch’ and ‘Mum measures the flour when she makes a cake’)

#### Pose basic mathematical questions and identify simple strategies to investigate solutions
- Poses questions (with prompting) that can be answered using numbers (e.g. asks ‘How old are you?’)
- Poses questions that can be answered by counting, ordering, matching and classifying (e.g. asks ‘How many jars are on the shelf?’ and ‘Why have you put this shape with these other shapes?’)
- Represents questions using objects, pictures, symbols or mental images (e.g. for ‘Sam was picking 4 teams with 3 players. How many people will Sam need?’, represents Sam’s teams with shells or toy people)

#### Plan activities and investigations to explore mathematical concepts, questions, issues and problems in familiar situations
- Represents a problem with concrete materials (e.g. given a bag of marbles, can share them out between a group of friends, or can attempt to find out how many children are at the school by using a box to represent every classroom and putting stones into each box to represent the children)

#### Use everyday and mathematical language, mental computations, representations and technology to generate solutions and check for reasonableness of the solution
- Asks ‘What if…?’ questions, makes simple conjectures about them and attempts to explain their reasoning (e.g. says ‘What would happen if we covered the plate with bigger biscuits? I think we wouldn’t need as many biscuits because they are bigger’)

#### Make statements and decisions based on interpretations of mathematical concepts in familiar, everyday situations
- Shows some self-correcting behaviour during mathematical activities (e.g. when sharing out lollies, realises when one person has too many and takes lollies away)
- Explains reasoning (e.g. when prompted, checks their calculations by repeating what they have done and asking ‘Does this make sense?’ and ‘Can this be right?’)

#### Communicate thinking and reasoning, using everyday and mathematical language, concrete materials, visual representations, and technologies
- When prompted, describes a single action that they have done when working in a mathematical context (e.g. says ‘I put the yellow one behind the red one’)
- Responds to ‘What would happen if…?’ questions during mathematical activities (e.g. says ‘It would be heavier’)
- When asked, gives an answer and explains why (e.g. says ‘The time is 3 o’clock because the big hand is on 12 and the little hand is on 3’, and ‘There are 13 shells because that’s what I got when I counted them’)
- Represents a problem with concrete materials and manipulates these to find a solution
- Represents a problem with a drawing, number sentence or mathematical language
- Describes a sequence of acts that leads up to a result and explains why they did it that way (e.g. says ‘We put the shells in the jar until it was full, and then tipped them out and counted them to find out how many shells the jar would hold, because we thought that would be quickest’)

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**Brookstead State School**

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<table>
<thead>
<tr>
<th>Reflect on and identify the contribution of mathematics to everyday situations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Identifies familiar mathematical features in their activities and those of their community</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reflect on learning to identify new understandings</th>
</tr>
</thead>
<tbody>
<tr>
<td>• How else might I use this mathematics?</td>
</tr>
</tbody>
</table>
Knowledge and understandings — Number

Whole numbers, simple fractions and the four operations are used to solve problems

Whole numbers (to 999) have position on a number line and each digit has place value (e.g. use a number line to show that 70 is placed between 50 and 100 but is closer to 50; use a place value chart to represent 28 as having 2 tens and 8 ones)

- Counts, reads, writes, says and orders whole numbers 0 to 10 and makes collections up to 10
- Arranges four counting numbers (up to 10) in order of value
- Places 1-digit numbers on a number line correctly
- Counting forward in 1s to 100; in 2s to 20; backwards in 1s from 10
- Can use five-frames and ten-frames

Whole numbers (to hundreds)

- Whole numbers to hundreds
- Positions and orders numbers relative to other numbers
- Understands that numbers in the ‘teens’ have some special characteristics that don’t fit the patterns after 20
- Arranges four counting numbers (up to 100) in order of value
- Place value (i.e. tens and ones)
- Quantity (i.e. groups using place value)
- Places 2-digit and 1-digit numbers on a number line correctly
- Patterns in numbers
- Mental strategies
- Counts back in 1s, 2s and 3s
- Make to 100
- Skip counting in 2s, 5s and 10s
- Counting forwards in 2s, 5s and 10s to 100
- Counting on in 1s from any number to 100
- Counting backwards in 1s from any number to 100
- Verbalises number names to 100
- Can use number lines, five-frames, ten-frames and number charts to 100

Whole numbers (to 3-digit numbers)

- Counts, reads, writes, says and orders whole numbers to 100
- Makes collections up to 100 by thinking of these as groups of tens and ones
- Knows that numbers can be represented by words and symbols or digits (e.g. three = 3)
- Positions and orders numbers relative to other numbers

Whole numbers (to hundreds)

- Subitises (seeing groups of two or three objects and patterns of larger numbers without counting, such as domino five pattern)
- Subitises whole numbers to 6 (e.g. can tell by looking, not counting, that there are five stones in a group)
- Counts, reads, writes, orders and compares ordinal

Whole numbers (to 999) can be represented in different ways, including the use of concrete materials, pictorial materials, number lines and technologies

- Subitises (seeing groups of two or three objects and patterns of larger numbers without counting, such as domino five pattern)
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- Counts, reads, writes, orders and compares ordinal

Whole numbers (to 999)

- Whole numbers (to 999) have position on a number line and each digit has place value (e.g. use a number line to show that 70 is placed between 50 and 100 but is closer to 50; use a place value chart to represent 28 as having 2 tens and 8 ones)

Whole numbers (to 999)

- Whole numbers (to 999) can be represented in different ways, including the use of concrete materials, pictorial materials, number lines and technologies

Whole numbers (to 999)

- Counts, reads, writes, says and orders whole numbers to 100
- Makes collections up to 100 by thinking of these as groups of tens and ones
- Knows that numbers can be represented by words and symbols or digits (e.g. three = 3)
- Positions and orders numbers relative to other numbers

Whole numbers (to 999)

- Subitises (seeing groups of two or three objects and patterns of larger numbers without counting, such as domino five pattern)
- Subitises whole numbers to 6 (e.g. can tell by looking, not counting, that there are five stones in a group)
- Counts, reads, writes, orders and compares ordinal

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- Makes collections up to 100 by thinking of these as groups of tens and ones
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Whole numbers (to 999)

- Whole numbers (to 999) have position on a number line and each digit has place value (e.g. use a number line to show that 70 is placed between 50 and 100 but is closer to 50; use a place value chart to represent 28 as having 2 tens and 8 ones)

Whole numbers (to 999)

- Whole numbers (to 999) can be represented in different ways, including the use of concrete materials, pictorial materials, number lines and technologies

Whole numbers (to 999)

- Counts, reads, writes, says and orders whole numbers to 100
- Makes collections up to 100 by thinking of these as groups of tens and ones
- Knows that numbers can be represented by words and symbols or digits (e.g. three = 3)
- Positions and orders numbers relative to other numbers

Whole numbers (to 999)

- Subitises (seeing groups of two or three objects and patterns of larger numbers without counting, such as domino five pattern)
- Subitises whole numbers to 6 (e.g. can tell by looking, not counting, that there are five stones in a group)
- Counts, reads, writes, orders and compares ordinal
numbers (i.e. first, second, third…to tenth)
• Conservation of whole numbers 0–10. Understands that the last number said when counting tells you ‘how many’ and ‘trusts the count’ (i.e. knows that the number of objects counted remains the same even after being scattered or covered-up)
• Represents and compares 1-digit numbers with concrete materials, pictures, symbols, words and calculators
• Patterns in numbers (e.g. calculator displays created using constant function)
• Relationships between numbers (e.g. more, less, same as)

numbers to the nearest 5 or 10
• Represents 2-digit numbers with symbols, words, materials and calculators
• Knows relationships between numbers (e.g. more, less, equal to, not equal to, subtraction, addition)
• Uses non-standard and standard place value partitions for 2-digit numbers (e.g. 26 = 2 tens + 6 ones, or 26 ones) and uses concrete materials to demonstrate these groupings
• Understands that numbers in the ‘teens’ have some special characteristics that don’t fit the patterns after 20
• Compares odd and even numbers
• Knows ordinal numbers to 10

materials and calculators
• Knows and understands relationships between numbers (e.g. greater than, less than, equivalent to)
• Uses manipulative materials (number patterns, different combinations of numbers to equivalent value, sharing materials into groups and making groups)

Simple fractions, including half and quarter, and mixed numbers can be represented in different ways

• Knows portions of a whole (e.g. a cake can be cut into pieces for sharing, and they can be equal and unequal portions).
• Knows half of objects and collections
• Knows that quarter is half of half

• Knows and uses half, quarter (part of a whole, half of a half)
• Knows that half means two equal shares, and recognises and represents halves of collections and single objects/shapes. Reconstructs the whole from the half in multiple ways (e.g. given a rectangle and told it is ‘half’, places another rectangle on any side at any point along the side, knowing that symmetry is not an issue, and physically sets apart from the original rectangle to demonstrate half of a collection)
• Knows the relationship between one-half and one-quarter, and demonstrates this with materials

• Knows and understands one-half, one of two equal parts of a whole, one-quarter, one of four equal parts of a whole, and equal parts of a whole
• Reads and understands mixed numbers (whole number and a fractional part (e.g. 3\(\frac{1}{2}\))
• Recognises and represents halves, quarters and simple mixed numbers (e.g.\(1\frac{1}{2}\)) of collections, lines and single objects/shapes, and uses their symbolic representations (i.e. \(\frac{1}{2}\) and \(\frac{1}{4}\)), reading \(\frac{1}{2}\) as ‘one out of two equal parts’ and knowing that the two parts must be exactly the same amount but not necessarily look the same, and \(\frac{1}{4}\) as ‘one out of four equal parts’, and knowing that the four parts must be exactly the same amount
• Knows that for \(\frac{1}{2}\) and \(\frac{1}{4}\), the denominator tells the number of equal parts the whole has been divided into
• Accurately places \(\frac{1}{2}\) and \(\frac{1}{4}\) on a number line, and colours the line to show the equal parts represented by these numbers
Addition and subtraction involving single-digit whole numbers can be calculated using concrete materials, mental computation and written strategies

<table>
<thead>
<tr>
<th>Uses joining model for addition</th>
<th>Basic addition facts to 10 and subtraction facts as the inverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses take away and cover up model for subtraction</td>
<td>Addition and subtraction totals to 99 with two or more addends, or missing addends</td>
</tr>
<tr>
<td>Adds and subtracts whole number totals to 10 with two or more addends</td>
<td>Uses mental strategies to compute addition and subtraction of 1- and 2-digit numbers (e.g. count back in 1s, 2s and 3s; make to 100; doubles and near-doubles to 20; skip counting in 2s, 5s and 10s)</td>
</tr>
<tr>
<td>Partitions single-digit numbers using addition and subtraction (e.g. partitions 5 as 4 and 1, 3 and 2 or 7 take away 2)</td>
<td>Student-generated</td>
</tr>
<tr>
<td>Understands addition as a concept of ‘finding the total’ and the ‘+’ symbol as representing the operation</td>
<td>Understands addition and subtraction concepts and symbols, and words that indicate these, (e.g. ‘difference’, ‘total’, ‘sum’, ‘altogether’, ‘adding to’, ‘taking away’)</td>
</tr>
<tr>
<td>Uses technology for single operations involving single digit numbers (e.g. presses ‘4’ ‘+’ ‘2’ ‘=’ on a simple calculator)</td>
<td>Partitions 2-digit numbers using addition and subtraction (e.g. partitions 16 as 15 + 1, 14 + 2, 13 + 3) and shows this with materials</td>
</tr>
<tr>
<td>Uses mental strategies, such as</td>
<td>Writes symbols equal (=) and does not equal (≠)</td>
</tr>
<tr>
<td>Count on, count back in 1s, 2s and 3s</td>
<td></td>
</tr>
<tr>
<td>Commutativity of addition (turnaround) (e.g. When adding 2 + 7, start with the largest number 7 and add the 2)</td>
<td></td>
</tr>
<tr>
<td>Make to 10 (e.g. rainbow facts)</td>
<td></td>
</tr>
<tr>
<td>Breaking up numbers to make them manageable (e.g. for 7 add 5, break up 5, add 3, make to 10, then add 2; or use near-doubles to double 5 and add 2 more)</td>
<td></td>
</tr>
<tr>
<td>Student-generated methods</td>
<td></td>
</tr>
<tr>
<td>Can write and use symbolic add (+) and subtract (–)</td>
<td></td>
</tr>
</tbody>
</table>

- Extensions of basic Year 2 addition and subtraction facts, continuing to focus on inverse relationships
- Addition and subtraction totals to 999, including two or more addends
- Makes numbers bigger or smaller by 1, 10 and 100 (e.g. makes 13 bigger by 10)
- Works out and extends addition and subtraction facts, and recognises by words and situations when each is required (e.g. knows that ‘How much is 4 and 3?’ means add 4 and 3 together)
- Knows single-digit addition and related subtraction facts by partitioning (e.g. knows 9 + 7 = 9 + 1 + 6, so it must be 10 + 6 which is 16) and demonstrates this using symbols and materials
- Uses mental strategies to compute addition and subtraction of 1- and 2-digit numbers, and chooses between mental and written strategies to do the same, using estimates to check for reasonableness
- Mental strategies
  - Related facts (e.g. calculate 14 take 8 by recalling that 8 + 6 = 14)
  - Build up or build down to preferred reference point (e.g. to the nearest decade or 100)
  - Extensions of count on and count back strategies from single-digit facts to 2- and 3-digit numbers
  - Inverse operations
  - Student-generated ideas
### Multiplication and division of whole numbers to 10

Multiplication and division of whole numbers to 10 can be calculated using arrays, skip counting, doubles, double doubles, turnarounds and sharing of concrete materials

- Places up to 10 objects in equal groups (e.g. 2 lots of 5 pencils, 3 lots of 3 toys).
- Shares materials equally (e.g. given 10 objects for 5 people, gives each person 2).
- Skip counts in 2s to 10 forwards and backwards.
- Verbalises ‘groups of’

<table>
<thead>
<tr>
<th>Array, ‘rows of’</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Equal groups of</td>
<td>Equal groups of</td>
<td>Equal groups of</td>
</tr>
<tr>
<td>Sharing parts equally (partition)</td>
<td>Sharing parts equally (partition)</td>
<td>Sharing parts equally (partition)</td>
</tr>
<tr>
<td>Equal groups (quotation)</td>
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<td>Equal groups (quotation)</td>
</tr>
<tr>
<td>Uses words, drawings and representations of arrays to express ‘lots of’ in relevant contexts, such as two people having three pencils each, e.g. 2 lots of 3 is  # # #  # # #</td>
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</tr>
<tr>
<td>Shares and groups materials up to 100 (e.g. given 40 objects and 6 people, gives them out and notices there are some left over)</td>
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</tr>
<tr>
<td>Skip counts in 2s, 5s and 10s to 100</td>
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</tr>
</tbody>
</table>

### Mental strategies

- Mental strategies
  - Multiplication facts up to 10
  - Skip counts in 2s, 5s and 10s to 100, and relates this to multiplication (e.g. says ‘5, 10, 15, 20 is 4 lots of 5’).
  - Doubles (×2)
  - Double doubles (×4)
  - Inverse operations
  - Student-generated ideas

- Knows and understands division facts, using single-digit divisors as the inverse of multiplication facts
- Knows and understands relationships between multiplication and division
- Uses words and models of arrays to express ‘lots of’ and solve multiplication situations in relevant contexts (e.g. uses an array to determine how many apples each person will have if they get four each)
- Shares and groups materials for single-digit divisors (i.e. up to 10 shares) up to 1000
- Knows, understands and uses symbols and metalanguage (e.g. multiply (×), divide (÷), arrays, equal groups of

### Problems involving operations can be explored using concrete materials, sketches and diagrams

- Identifies addition and subtraction situations from simple number stories (e.g. the three bears) and draws a picture to represent the situation
- Estimation

<table>
<thead>
<tr>
<th>Represents mathematical questions using objects or pictures or symbols, or paraphrasing (e.g. when told there were 5 baby turtles and 3 of them were eaten by the birds, writes 5 – 3)</th>
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<tr>
<td>Estimation</td>
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<td>Estimation</td>
</tr>
</tbody>
</table>

- Explains and compares strategies for solving simple problems (e.g. says ‘I gave out the 20 lollies one at a time to each person until I ran out, but Natalie did it another way. She put the lollies in little groups on the table’), and uses materials, sketches and diagrams in solving
- Uses a calculator to explore what happens to the answer when changing the order that they enter numbers addition and multiplication (e.g. explores the results of 3 + 2 and 2 + 3, and 6 × 4 and 4 × 6)
- Knows, understands and uses estimation to solve
<table>
<thead>
<tr>
<th>Problems using a single operation can be planned and solved (e.g. multiplication can be used to determine how many eggs are in two egg cartons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Uses technology for single operations involving 2-digit numbers and explains what they have done</td>
</tr>
<tr>
<td>• Identifies addition and subtraction situations from simple number stories, and writes simple stories about single operations (e.g. for the operation 15 – 3, writes ‘There were 15 baby turtles and 3 of them were eaten by the birds’)</td>
</tr>
<tr>
<td>• Uses technology for single operations involving 2- and 3-digit numbers, and explains what they have done</td>
</tr>
<tr>
<td>• Interprets (and creates) problems based around a single operation and decides which operation is required: +, –, ×, ÷ (e.g. for ‘20 lollies are shared equally between 4 boys. How many will they each get?’, can determine that sharing is needed to solve)</td>
</tr>
<tr>
<td>• Uses words and models of arrays to express ‘lots of’ and solve multiplication situations in relevant contexts (e.g. uses an array to determine how many apples each person will have if they get four each)</td>
</tr>
<tr>
<td>Money can be used to buy goods and services (e.g. money to buy food and pay for a bus ticket)</td>
</tr>
<tr>
<td>• Knows money is needed to operate a vending machine (e.g. parking metre, drink fridge)</td>
</tr>
<tr>
<td>• Can use manipulative materials, coins and notes, and transaction cards in pretend situations</td>
</tr>
<tr>
<td>• Uses everyday language (e.g. coins, notes, advertised price, purchase price)</td>
</tr>
<tr>
<td>• Decides whether they have more or less money than the price of something and whether to expect to receive change</td>
</tr>
<tr>
<td>• Understands advertising (e.g. advertised price or purchased price)</td>
</tr>
<tr>
<td>Transactions for goods and services can use different combinations of notes and coins of equivalent value (e.g. a $5 note, or 4 × $1 coins and 5 × 20c coins can be used to make a purchase)</td>
</tr>
<tr>
<td>• Sorts and compares coins and notes</td>
</tr>
<tr>
<td>• Knows that notes have more value than individual coins</td>
</tr>
<tr>
<td>• Can verbalise everyday language (e.g. names of coins)</td>
</tr>
<tr>
<td>• Knows names of notes (i.e. cost and price)</td>
</tr>
<tr>
<td>• Can write dollars ($) and cents (c)</td>
</tr>
<tr>
<td>• Visually recognises coins to $2 and notes to $100</td>
</tr>
<tr>
<td>• Counts coins, including multiples of 5c, 10c, 20c, 50c, $1 and $2, and records total amounts</td>
</tr>
<tr>
<td>• Knows features of coins and notes</td>
</tr>
<tr>
<td>• Advertising</td>
</tr>
<tr>
<td>• Knows the value of notes and coins, and that different combinations of these can be used to make a given amount</td>
</tr>
<tr>
<td>• Estimates close value (e.g. $5 is used when the cost is $4.75)</td>
</tr>
<tr>
<td>• Knows and uses everyday names of coins and notes</td>
</tr>
<tr>
<td>• Understands and knows how to give change</td>
</tr>
<tr>
<td>• Uses written conventions for money</td>
</tr>
</tbody>
</table>
Knowledge and understandings — Algebra

Relationships between objects or numbers can be described using patterns and simple rules

Simple relationships between objects or numbers can be described in terms of order, sequence and arrangement (e.g. plot the hourly temperature during the day on a simple scale and observe that it rises between 8 in the morning and 12 midday, then stays the same until school finishes for the day)

- Identifies whether objects in a set with fewer than 10 elements are the same or different, and counts them
- Understands ‘put in order’ and can order three objects from one container by a simple criteria such as size
- Recognises variation in their lives, saying ‘Your dog is bigger than mine’ and ‘I am taller than you’
- Responds correctly to questions comparing number sizes (e.g. ‘Is two bigger than 3?’) and shows why using objects
- Identifies when two sets are not the same size (e.g. four children and three chairs)
- Orders up to 10 objects in a set given a simple criteria, such as size
- Knows that some quantities change over time (e.g. their own height and length of their hair)
- Uses bigger, smaller, the same when comparing the value of two numbers (e.g. says ‘Three is bigger than two’)
- Compares collections (e.g. balance, equal to, same as, different from, not equal to)
- Able to explain reasoning, calculation, strategies and reasonableness of solutions
- Input–output tables

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of apples</td>
<td>Cost</td>
</tr>
<tr>
<td>1</td>
<td>50c</td>
</tr>
<tr>
<td>2</td>
<td>$1.00</td>
</tr>
<tr>
<td>3</td>
<td>$1.50</td>
</tr>
</tbody>
</table>
- Establishes simple one-to-one correspondences between sets (e.g. writes students’ names with their favourite food next to them)
- Orders objects and lists, and explains the criteria chosen (e.g. says ‘I put these names in alphabetical order’)
- Records time-series data for quantities that change over time in a personal context including growing a plant (relating time and height of the plant) or their own height (relating age to time)
- Knows and understands simple relationships between numbers and objects (e.g. order, sequence, arrangement, equivalence)
**Simple relationships between objects or numbers, including equivalence, can be represented using concrete and pictorial materials (e.g. \(14 + 8\) can be changed to \(12 + 10\) without affecting the equivalence of number expressions such as \(5 + 6, 9 + 2\) and \(3 + 4 + 4\))**

- Recognises when a see-saw or balance beam is ‘balanced’ or not (i.e. whether the beam is horizontal or level)
- Recognises when a see-saw or balance beam is ‘balanced’ or not and, if not, can make suggestions about how to restore the balance (e.g. says ‘That side is too low and needs to come up a bit’ and ‘It’s too low because there are three people on that side and only two on the other side, so we need to put another person on that side to make it balanced’)
- Understands equivalent collections, i.e. different combinations and arrangements for the same number value (e.g. ‘5 and 3’ and ‘4 and 4’ are equivalent)
- Able to verbalise number sentences, and predictions and statements
- Uses balance or materials to describe equivalence where only addition is used (e.g. shows, using materials, that \(6 + 4\) is equivalent to \(3 + 3 + 2 + 2\) without calculating any answers)
- Knows and uses mental strategies (e.g. guess and check using addition and subtraction, and backtracking)
- Uses written symbols such as =, ≠ and unknowns (shapes, question marks, spaces, lines)
- Writes equations in words
- Finds a starting point by backtracking using addition and subtraction (e.g. says ‘My answer is 17 and the sequence was add 10, subtract 2 so I must have started with 9’)
- Follows the steps in a sequence, including following the steps in a ‘think of a number’ sequence (e.g. ‘Think of a number, add 2, take 1, and add 5, what is the number?’)
- Skip counts forwards and then backwards from any number (up to 3 digits) using a calculator and finishes at the same number
- Solves simple equations verbally with single-digit numbers (e.g. responds correctly to ‘What number do I add to 5 to get 8?’ and ‘What number do I take from 7 to get 3?’)
- Uses ‘think addition’ to solve unknown subtraction facts from known addition facts (e.g. solves \(28 – 7\) by thinking ‘\(20 + 1 + 7 = 28\), so \(28 – 7\) must be 21’)
- Able to verbalise explanations of reasoning, calculation strategies and reasonableness of solutions

<table>
<thead>
<tr>
<th>Inverse relationships between addition and subtraction can be applied to find unknowns and maintain equivalence in equations (e.g. (\square + 3 = 7, 4 = 7 – 3; 7 + 4 = 6 + 5))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knows the difference between ‘does’ and ‘undoes’ in terms of undoing what has been previously done as a set of two actions (e.g. wrapping or unwrapping a present, turning a tap on and off, putting shoes on and off, tying and untying shoelaces)</td>
</tr>
<tr>
<td>Can determine three or four sequential actions that can be performed in order and ‘undone’ in reverse order (e.g. ‘clap, stamp, click, stomp’ in reverse order becomes ‘stomp, click, stamp, clap’)</td>
</tr>
<tr>
<td>Skip counts forwards and then backwards (2s, 5s, 10s) using a calculator and finishes at the same number</td>
</tr>
<tr>
<td>Communicates problems and solutions using the language of ‘missing addend’</td>
</tr>
<tr>
<td>Uses mental strategies, such as guess and check, and backtracking (inverse relationship between addition and subtraction)</td>
</tr>
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<td>Finds a starting point by backtracking using addition and subtraction (e.g. says ‘My answer is 17 and the sequence was add 10, subtract 2 so I must have started with 9’)</td>
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<td>Solves simple equations verbally with single-digit numbers (e.g. responds correctly to ‘What number do I add to 5 to get 8?’ and ‘What number do I take from 7 to get 3?’)</td>
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<td>Uses ‘think addition’ to solve unknown subtraction facts from known addition facts (e.g. solves (28 – 7) by thinking ‘(20 + 1 + 7 = 28), so (28 – 7) must be 21’)</td>
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<td>Able to verbalise explanations of reasoning, calculation strategies and reasonableness of solutions</td>
</tr>
</tbody>
</table>
Number patterns and sequences based on simple rules involve repetition, order and regular increases or decreases (e.g. identify and continue the pattern in 2, 5, 8, 11…)

- Recognises patterns in their daily lives (e.g. sunrise and sunset, going to school for five days and having two days off)
- Identifies a repeating pattern made of actions or sounds, or objects, and performs these in the order identified (e.g. hears someone stamp, click and clap, stamp, click, clap, and can repeat that pattern)
- Patterns developmental sequence
- Participates in a pattern (using bodies — hands up, hands down), including copying a pattern, creating a pattern, extending a pattern and determining the missing element in a pattern

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</tr>
<tr>
<td>Patterns developmental sequence</td>
</tr>
<tr>
<td>Participates in a pattern (using bodies — hands up, hands down), including copying a pattern, creating a pattern, extending a pattern and determining the missing element in a pattern</td>
</tr>
<tr>
<td>Recognises, continues and describes repeating patterns and simple growing patterns, identifying the elements of the pattern cycle (e.g. says ‘There are three colours in the pattern: red, blue and green. It goes red, blue, green, red, blue, green, red…’ and says ‘There are two squares in the first drawing and four in the second, so there will be six in the third’) (see diagram)</td>
</tr>
<tr>
<td>Recognises increasing and decreasing patterns, including skip counting and repeated addition or subtraction</td>
</tr>
<tr>
<td>Identifies missing values in patterns</td>
</tr>
<tr>
<td>Identifies and communicates ‘elements’ or terms of pattern, and the position in the pattern e.g. 12th element in a ‘red, green’ pattern</td>
</tr>
<tr>
<td>Knows simple rules of a pattern of 2, 3, 4 or 5 objects (repeating pattern)</td>
</tr>
<tr>
<td>Recognises non-patterns and patterns with errors</td>
</tr>
<tr>
<td>Translation of patterns: objects to numbers</td>
</tr>
<tr>
<td>Uses and interprets drawings, calculators and hundreds boards</td>
</tr>
</tbody>
</table>

- Identifies and describes patterns as growing or repeating and what changes from one element of the pattern to the next (e.g. for the pattern, [ring], [ring, stamp, ring], [ring, stamp, ring, stamp, ring], says ‘There is another ‘ring, stamp’ each time’)
- Creates and continues patterns, and makes general statements of prediction about what comes next (e.g. says ‘The sixth one will be green’ and continues the pattern to see if they are right)
- Knows, understands and verbalises number patterns and sequences, including
  - Regular increases or decreases
  - Rules based on previous terms
  - Repetition and order
<p>| Knowledge and understandings — Measurement |  |
| <strong>Unique attributes of shapes, objects and time can be identified and described using standard and non-standard units</strong> |  |
| Hour, half-hour and quarter-hour times, and five-minute intervals, are read using analog clocks, and all times are read using digital clocks |  |
|  |  |
| • Knows there are 12 hours on an analog clock and 24 hours on some digital clocks | • Knows hour (hr) and minute (min) |
| • Reads and writes ‘o’clock’ on an analog clock and a digital clock | • Reads hours and half-hours on analog clocks |
| • Can draw an analog face | • Knows am and pm on analog and digital clocks |
| • Identify and sequence familiar daily events (e.g. 1 o’clock is lunchtime and it comes after we go swimming at 11 o’clock) | • Duration of time in minutes (e.g. estimates 1 minute by slowly counting up to 60) |
| • Writes sequence of daily events | • Understands the connection between half-hour as a fraction of the hour |
| • Start and finish | • Understands the connection between hour and minutes |
| • Duration of time | • Understands the connection between minutes and 5-minute intervals |
| • Verbalises later, earlier, slow, longer/shorter |  |
|  |  |
| Calendars can be used to identify specific information about days and dates (e.g. identify the dates of every Tuesday in a month; identify the date that is a week later or earlier than a given date) |  |
|  |  |
| • Knows the names and order of months in the year | • Knows how many weeks and months in a year |
| • Knows and writes names of days of the week | • Writes the names of the months in words |
| • Records familiar events on a simple classroom calendar | • Knows the names of longer periods of time (e.g. decade, century) |
| • Knows seasons | • Uses a calendar to identify specific information about days and dates for the current month and week (e.g. determines, on a week before, what day the 23rd of the month will fall on) |
|  | • Knows and understands the connection between days, weeks, months and a year |
|  | • Knows and can write abbreviations for months (e.g. Jan and J) |</p>
<table>
<thead>
<tr>
<th>Standard units, including centimetre, metre, kilogram (half and quarter) and litre (half and quarter), and non-standard units of measurement can be used to measure attributes of shapes and objects (e.g. centimetres and hand span may both be used to measure the length of a desktop)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Knows ways to measure length, area, volume, mass, time</td>
</tr>
<tr>
<td>- Knows attributes and ways to measure them</td>
</tr>
<tr>
<td>- Understands the concept of length and responds correctly to ‘find something longer or taller, or wider’</td>
</tr>
<tr>
<td>- Distinguishes between flat and curved surfaces</td>
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<tr>
<td>- Chooses things that have ‘length’ as an obvious attribute (e.g. pencil, stick)</td>
</tr>
<tr>
<td>- Makes non-numerical estimates of size using movements and actions (e.g. uses hands or arms when describing ‘how big’)</td>
</tr>
<tr>
<td>- Using non-standard units and can draw visual representations of these</td>
</tr>
<tr>
<td>- Estimation</td>
</tr>
<tr>
<td>- Decides which attribute a shape or object mainly displays (e.g. knows that a piece of string has length and a stone has mass).</td>
</tr>
<tr>
<td>- Knows ways to measure (e.g. mass, hefting, measuring instruments)</td>
</tr>
<tr>
<td>- Knows ways to measure with no gaps, overlaps or spillage when measuring</td>
</tr>
<tr>
<td>- Knows that you talk about kilograms when lifting and weighing things</td>
</tr>
<tr>
<td>- Knows that you talk about litres when you talk about how much liquid</td>
</tr>
<tr>
<td>- Knows that length, width and height are about distances between two points</td>
</tr>
<tr>
<td>- Know standard units (e.g. centimetre (cm), metre (m), kilogram (kg) and litre (L))</td>
</tr>
<tr>
<td>- Can identify and use non-standard units</td>
</tr>
<tr>
<td>- Decides which uniform units (e.g. a sheet of paper or square tile used again and again) could best be used to measure flat surfaces, and talks about them in terms of ‘gaps’ and ‘overlaps’ (e.g. says ‘This table top can be covered with this sheet of paper over and over but the last ones hang over the edge’)</td>
</tr>
<tr>
<td>- Chooses and uses things that relate well to length to use as units for measuring (e.g. chooses and uses a piece of string for ‘measuring’ length)</td>
</tr>
<tr>
<td>- Estimates length using body parts, such as fingers, spans, feet and other personal referents (e.g. says ‘The pencil is about three fingers long’ and ‘The door is about the same height as I am’)</td>
</tr>
<tr>
<td>- Uses a metre ruler, trundle wheel, tape measure, balance, kitchen and bathroom scales, area grids and litre jugs</td>
</tr>
<tr>
<td>- Identifies and distinguishes the attributes of shapes and objects with respect to length, area, volume and mass (e.g. selects the most appropriate attributes to describe a shape or object; knows that the ‘amount of heaviness’ is about mass)</td>
</tr>
<tr>
<td>- Knows roughly what a kilogram (and half a kilogram) and litre (and half a litre) are in the context of familiar items (e.g. identifies a 1-kg packet of sugar and a 1-L carton of milk)</td>
</tr>
<tr>
<td>- Uses appropriate language to describe length, width and height, and the distance between two points. Measures these using informal units, such as straws, string and paces, and formal units, including centimetres and metres (estimates number of units first)</td>
</tr>
<tr>
<td>- Understands area is about coverage of a surface, and measures the area of flat regions using pieces of paper, and curved regions, such as a ball, using curved hands, for example</td>
</tr>
<tr>
<td>- Visualises the size of a square metre and can ‘show’ it using their arms</td>
</tr>
<tr>
<td>- Knows and understands half and quarter of a metre (m), kilogram (kg) and litre (L)</td>
</tr>
<tr>
<td>- Knows strategies for estimation and calculations</td>
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</tbody>
</table>
Measurements of length, area, volume and mass of shapes and objects are compared and ordered, using instruments (e.g. use scales to compare the mass of a range of objects; use a 1-L measuring jug to fill and compare the volumes of other containers)

- Makes direct comparisons (e.g. heavier/lighter, empty, lighter/shorter)
- Orders and sequences measurements
- Correctly decides which of two containers contains more or less, demonstrating understanding of these two ideas
- Hefts two objects (lifts and holds them) and correctly says which is heavier or lighter
- Knows comparable measurement language. (e.g. bigger, smaller, taller, tallest, heavy, heaviest, longest, shorter, same length, near, far)
- Explains and shows why a particular container holds more than another one, and is not confused by which one ‘looks bigger’ (e.g. fills two containers using a third container to demonstrate that one container holds more)
- Arranges three objects in terms of mass and is not confused by which looks heavier or lighter
- Makes direct comparisons of two objects (compares with each other) for length, width, height, width and mass
- Makes indirect comparisons (e.g. measuring the first length with a piece of string, then using the measured string and comparing it to the second length)
- Orders and sequences measured items
- Measures how much a container holds, and compares and orders up to three containers according to their volume (amount they hold when full), using liquid estimates first
- Measures how much a box holds, and compares and orders up to three boxes according to their volume (amount they hold when full), estimating first
- Uses words such as ‘light’ and ‘heavy’ to describe and compare mass by first hefting (e.g. says ‘This book is really light and this one is heavy, so the light one has more mass’)
- Makes direct comparisons between objects for a given attribute (e.g. arranges people in order of height or hefts three or more objects and puts them in order of mass)
- Chooses and uses the appropriate metric unit to measure different lengths and different masses (e.g. centimetres and metres for length, and grams and kilograms for mass)
- Estimates whether containers hold more, less or the same as a litre (e.g. says ‘The jug holds a bit more than a litre’); expresses their measurements using ‘between’, using everyday objects as their reference (e.g. says ‘The doorway is between five and six books wide’)
### Knowledge and understandings — Chance and data

**Chance events can be explored using predictions and statements. Data can be collected, organised and explored.**

#### Predictions about chance events can be made using simple statements (e.g. it is likely/unlikely that this will happen)

- Knows the difference between ‘will happen’ and ‘won’t happen’ (e.g. knows that it definitely won’t snow on Thursday Island and that it definitely will be night time soon)
- Understands randomness (a lack of predictable order and pattern in an event eg. tossing a coin)
- Uses classifications of the likelihood of daily events
- Knows everyday language (e.g. always, sometimes, never, will, will not, might happen, maybe, fair, not fair, lucky, unlucky)
- Uses the word ‘might’ appropriately to distinguish between ‘will’ and ‘will not’, acknowledging an element of chance (e.g. says ‘My Mum might pick me up from school if she’s got time’)
- Understands uncertainty of occurrence of chance events
- Uses personal opinions as predictions of chance events
- Makes a range of statements about the likelihood of events using words including ‘impossible’, ‘certain’, ‘could’, ‘might’, ‘likely’, ‘unlikely’ (e.g. says ‘It is impossible for you to turn into a frog’) and knows the difference between reality and fantasy
- Knows and understands connections between classifications of occurrence and predictions

#### Data can be collected using simple surveys and observations to respond to questions (e.g. survey students in class for favourite television program)

- Gathers or provides a small amount of data to support a class decision (e.g. says ‘Put your hand up if you’d rather draw or watch a video’) and counts the number of hands
- Observes to collect data to resolve questions and issues of interest
- Student-generated data recording sheets
- Uses photographs
- Answers questions about themselves and draws pictures to produce a set of data about themselves (e.g. pictures of their pet or favourite food, or eye colour)
- Uses the web to find information about areas of personal interest
- Develops questions
- Refines questions for data collection
- Data collection (e.g. how, when, how much) and conditions
- Classification of the likelihood of daily events
- Surveys and observations responding to questions to be explored
- How data collection can cause variations and adequacy in data collection
<table>
<thead>
<tr>
<th>Data can be organised in lists, tables, picture graphs and bar graphs (e.g. construct a bar graph of distribution of eye colour of students in the class)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Classifies and sorts objects and pictures, and talks about the basis for their classification (e.g. says “These are all pointy”)</td>
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<tr>
<td>• Student-generated data recording sheets</td>
</tr>
<tr>
<td>• Written observations, lists, data displays, pictures (eg. objects, people)</td>
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<tr>
<td>• Uses data displays</td>
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<tr>
<td>• Data display has a title and labels</td>
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<tr>
<td>• Creates lists, tables, picture and bar graphs</td>
</tr>
<tr>
<td>• Collects and classifies data to investigate particular situations (e.g. shows on TV watched the night before by class members)</td>
</tr>
<tr>
<td>• Organises their own information in a simple class display, including simple tables, tallies and lists (e.g. having each drawn a picture of their favourite animal, decides which animal group on a chart it belongs with)</td>
</tr>
<tr>
<td>Organises data in a simple format depending its purpose, using lists, tables, tallies, and simple graphs, including pictographs bar graphs (e.g. to find out who brings what lunch to school, lists likely foods and then puts peoples’ names next to them)</td>
</tr>
<tr>
<td>Uses technology to access, retrieve and present data and information about things that interest them (e.g. creates a folder to store files, uses the ‘favourites’ list to store URLs and organises emails in email folders)</td>
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<thead>
<tr>
<th>Data can be explored for variation and adequacy (e.g. count the number of cars outside school at drop-off and lunch times, and determine if there is sufficient data or whether more should be collected)</th>
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<tbody>
<tr>
<td>• Sources of variation and error</td>
</tr>
<tr>
<td>• Connections between collected data and interpretations</td>
</tr>
<tr>
<td>• Explanations of reasoning (data collection, data display, variation)</td>
</tr>
<tr>
<td>• Mathematical language (e.g. likely, unlikely, impossible, variation)</td>
</tr>
<tr>
<td>Collects and interprets data relating to their own questions of interest (such as ‘What are the most popular pets of students in the class’?) where there is one piece of information for each student (one-to-one data)</td>
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<tr>
<td>Explores and makes qualitative judgments about data collected and presented (e.g. says ‘Heavy black clouds means it might rain today’ and ‘There are more people with green eyes than brown eyes’)</td>
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<tr>
<td>Understands connections between collected data, displayed data and interpretations</td>
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<tr>
<td>Knowledge and understandings – Space</td>
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<td>-------------------------------------</td>
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<tr>
<td>Geometric names and properties are used to sort, describe and construct common 2D shapes, including squares, rectangles, triangles and circles, and 3D objects, including prisms, pyramids, cones, cylinders and spheres (e.g. 3D objects can be created using modelling material; pinwheels, paper planes and flowers can be created by folding and cutting paper)</td>
</tr>
</tbody>
</table>

- 2D shapes (e.g. circle, triangle, rectangle, squares)
- 2D simple properties (e.g. straight and curved lines and surfaces, number of sides, number of corners)
- Verbally names and describes 2D shapes
- 3D objects (e.g. cube rectangular prism, sphere, cone, pyramid, cylinder)
- 3D simple properties (e.g. shapes, faces, pointy, smooth)
- Uses and classifies everyday objects (e.g. ice-cream cone, piece of paper)
- Pays attention to shape in making and drawing things (e.g. knows that a wheel is round with no ‘bumpy bits’)
- Sorts ‘boxes’, cones and spheres, and makes simple statements about their differences (e.g. says ‘These boxes are long and these ones aren’t’)
- Classification of shapes using one or two defining features
- Comparison of shapes (e.g. defining features, common features, different features)
- Sorts squares, circles and triangles, not necessarily knowing their names
- Construction of 3D objects

- 2D — identifies number of sides and corners, and talks about length and width
- 3D — identifies number of shapes and number of faces and function, and can talk about length, width, depth and height
- Geometric properties of shapes (e.g. angles in turns, nets of a cube, and depth in 3D objects)
- Recognises and names circles, squares and triangles in the built and natural environment
- Uses spatial features and characteristics to sort, compare and describe common 3D shapes and objects (e.g. says ‘These ones have flat sides and corners but these have curvy sides and they roll’)
- Uses spatial features to sort, compare and describe common 2D shapes and objects (e.g. says ‘These ones have got three corners and these have got five’).
- Knows that circles don’t have corners but boxes do
- Draws an object from an oral description which implies shape such as ‘Draw a skinny hat with a pointy top’, by first imagining it and selecting a shape most like a tree trunk, for example.

- 2D shape names and properties (e.g. angles, sides) of squares, rectangles, triangles and circles
- Identifies and describes common 2D shapes (squares, rectangles, triangles and circles) and draws them using technology by focusing on their characteristics
- 3D shape names and properties (e.g. angles, sides) of prisms, pyramids, cones, cylinders, and spheres
- Identifies, sorts and describes by name families of 3D shapes (prisms, pyramids, cones, cylinders and spheres), and makes models and sketches of them
- Recognises and describes familiar 2D and 3D shapes in the built and natural environment (e.g. cones and rectangles), and represents them by drawing, making and/or using technology
- Can identify and describe the differences between 3D and 2D shapes using simple language (e.g. says ‘2D shapes are flat but 3D shapes aren’t’, and can pick out 3D shapes from a collection that holds 2D and 3D shapes)
- Geometric properties of 2D and 3D shapes (e.g. angle, line of symmetry)
- Recognises angles in shapes, objects and turns (e.g. box, turning book pages, pizza slices)
- Makes comparisons between shapes (e.g. angles (bigger/smaller than), line of symmetry)
<table>
<thead>
<tr>
<th>Flips, slides and turns are particular ways of moving shapes to explore symmetry (e.g. complete simple visual puzzles; create repeat patterns)</th>
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</thead>
<tbody>
<tr>
<td>• Draws pictures by first imagining them (e.g. imagines a book or a dog and draws it)</td>
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<tr>
<td>• Turns simple shapes to match other shapes</td>
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<tr>
<td>• Folds shapes that have line symmetry across the line of symmetry so that one side fits exactly onto the other</td>
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<tr>
<td>• Demonstrates flips, slides and turns using materials, including pattern blocks.</td>
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<tr>
<td>• Sketches of 2D shapes and 3D objects from different viewpoints (3D objects have different orientations)</td>
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<tr>
<td>• Mind-pictures of different shapes</td>
</tr>
<tr>
<td>• Symmetry: a line or plane dividing images into two congruent shapes</td>
</tr>
<tr>
<td>• Knows what line symmetry is and folds shapes correctly along the ‘line of symmetry’ when directed to</td>
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<tr>
<td>• Folds or cuts images (e.g. partitions 2D shapes such as triangles within a square or rectangle)</td>
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<tr>
<td>• Identifies when flips, slides and turns have been used to change the position of 2D and 3D shapes (e.g. says ‘That shape has been turned around and that one has been pushed along’)</td>
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<tr>
<td>• Uses different orientations and viewpoints using drawings and electronic media</td>
</tr>
<tr>
<td>• Understands ‘mind pictures’ of different viewpoints of shapes and movement of shapes (e.g. predict and draw (or positions using objects) what the next position and orientation will look like in a border pattern)</td>
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<tr>
<td>• Visualises familiar shapes within other familiar shapes (e.g. draws what a square might look like if it was folded in half)</td>
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<tr>
<td>• Recognises line symmetry in nature (e.g. butterflies, faces), and uses mirrors and folding to explore and identify symmetry in a variety of shapes</td>
</tr>
<tr>
<td>• Uses the word ‘symmetry’ appropriately in a sentence (e.g. says ‘This shape has line symmetry and this one doesn’t’)</td>
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<tr>
<td>• Explores and describes the effect of a single flip, slide or turn on different shapes (e.g. says ‘If you turn that one around in a full circle, it comes back on itself’ and ‘If you flip that shape, it points the other way’)</td>
</tr>
<tr>
<td>• Uses symmetry and/or transformations to create or continue patterns, including tessellations</td>
</tr>
<tr>
<td>• Recognises symmetry in natural/built environment</td>
</tr>
<tr>
<td>• Makes ‘mind pictures’ of different viewpoints of shapes and movement of shapes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Obvious features in everyday environments can be represented and located on simple maps and plans (e.g. construct a map of a simple obstacle course around the school grounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Can use a simple sketch placement or drawing of objects to place the real objects relative to each other (e.g. shown a picture of three different bottles on a table in front of them, can place the bottles)</td>
</tr>
<tr>
<td>• Uses non-verbal information (e.g. simple treasure maps)</td>
</tr>
<tr>
<td>• Can use a simple sketch placement or drawing of objects to place the real objects relative to each other (e.g. shown a picture of three different bottles on a table in front of them, can place the bottles)</td>
</tr>
<tr>
<td>• Produces informal bird’s-eye view maps, paying attention to what things are between and pathways between locations (e.g. knows that the shop is between the school and the road, and shows that on their map)</td>
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<tr>
<td>• Uses technology to create electronic maps, including grids and plans</td>
</tr>
<tr>
<td>• Makes simple sketches of maps and plans on grids</td>
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<tr>
<td>• Explains construction and interpret directions</td>
</tr>
<tr>
<td>• Can use a simple sketch and grid to show placement or drawing of objects to place the real objects relative to each other (e.g. shown a picture of three different bottles on a table in front of them, can place the bottles)</td>
</tr>
<tr>
<td>• Identifies key features on simple maps, grids and plans (e.g. says ‘That is the toilets and this block here is the classrooms’)</td>
</tr>
<tr>
<td>• Makes sketches of, and interprets, maps of familiar environments, including the school yard or local shops</td>
</tr>
<tr>
<td>• Compares sketched maps and commercial maps of the same environment</td>
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</tbody>
</table>
Directions can be given for moving and for locating features within an environment (e.g. instruction to move a half, full, quarter and/or three-quarter turn)

| Uses appropriate language of position in simple sentences (e.g. over/under; up/down; left/right; forwards/backwards; sideways; on/below; between; beside; near; before/after; and full/half/quarter turns) | Knows left and right turns change direction |
|—|—|
| Can move forwards, backwards, left and right a given (small) number of paces in sequences (e.g. responds correctly to ‘Move forward 3 paces then left 2 paces’) | Uses everyday language (e.g. left/right of, long way from, close to) |
| Uses non-verbal information (e.g. gestures, mind pictures) | Estimates informal measurements in movements (e.g. steps, grid spaces) |
| Makes constructions from visual instructions, including those used for children’s construction toys | Uses positional language (e.g. to the right of, between) and reference points or landmarks to describe locations, arrangements and pathways (e.g. says ‘All the shops are in a row’ and ‘The school is between the post office and the police station’) |
| Follows simple directions for locating objects on a simple grid (e.g. 2 squares up, turn right, 3 down) | Follows simple directions for locating objects on a simple grid (e.g. 2 squares up, turn right, 3 down) |
| Uses ‘mind pictures’ to assist plans for movement | Uses ‘mind pictures’ to assist plans for movement |
| Identifies and verbalises factors assisting precisions and interpretation of direction | Identifies and verbalises factors assisting precisions and interpretation of direction |
### Year 4

**Ways of working**

**Identify and describe the mathematical concepts, strategies and procedures required to generate solutions**
- Identifies and distinguishes between different purposes for numbers and measurements (e.g. cardinal, nominal and ordinal numbers: starting times, finishing times and elapsed time)

**Pose questions and make predictions based on experience in similar situations**
- Poses questions prompted by a number sentence involving one operation (e.g. writes a story or question leading to $15 \times 3$ such as ‘How much will 15 CDs cost if they are $3 each?’)
- Poses questions suggested by data they have collected (e.g. having gone on a ‘shape walk’, they might ask ‘What shapes are mostly in buildings?’)
- Generates simple mathematical questions for themselves and others to investigate, stimulated by a familiar context such as a photo of a crowd at a football match (e.g. ‘How many people are in the crowd?’)

**Plan activities and investigations to explore concepts, pathways and strategies, and solve mathematical questions, issues and problems**
- Makes and tests simple conjectures (e.g. that every rectangle made using the same number of identical squares has the same perimeter), and explains the approach taken and the conclusions reached (e.g. says ‘The perimeter becomes smaller as the length and width become closer to each other in size’)
- Responds to questions such as ‘What do we know?’, ‘What do we want to know?’, ‘What are we trying to find out?’ and ‘Can you say it in your own words?’

**Identify and use mental and written computations, explanations, representations and technologies to generate solutions and check for reasonableness of solutions**
- Makes conjunctures about operations on numbers, shapes and measurements (e.g. says ‘I think this container will hold more than that one’, ‘If $3 + 6 = 9$, then $13 + 6$ must equal 19’ and ‘You can only make a triangle if you only have 3 sticks’).
- Represents a problem with an appropriate number operation (e.g. represents ‘There are three teams with four players in each. How many players are there?’ with $3 \times 4$)
- Uses a variety of methods, including estimating and technology, to check for reasonableness of results

**Make statements, predictions, inferences and decisions based on mathematical interpretations**
- Work with others to test simple conjectures made by others

**Evaluate their own thinking and reasoning, in relation to the application of mathematical ideas, strategies and ideas**
- Independently checks their calculations when performing operations by hand or with a calculator
- Checks that answers make sense in a given context and uses ‘because’ when explaining that they do or do not
- Reflects on learning strategies used to solve problems, considering their capacity to ‘do the job’

**Communicate and justify thinking and reasoning, using everyday and mathematical language, concrete materials, visual representations and technologies**
- Explains their reasoning when making a simple choice (e.g. says ‘We decided to use the big bucket to water the garden because it holds more water than the little bucket or the jug, and we wouldn’t have to make as many trips’)
- Explains their reasoning when justifying an answer (e.g. says ‘One-quarter of the counters are red because, when we counted them, we found that there is one red counter for every three green counters’)
- Uses mathematical language (e.g. number names to 9999, numerator, denominator, vinculum)
**Reflect on mathematics and identify the contribution of mathematics to personal activities**

- Identifies familiar mathematical features in their activities and those of their community (e.g. finds out about and reports on the mathematics used by people they know at home and at work, and identifies measuring tools from other cultures and times, such as abacus, sundials, systems of knots)

**Reflect on learning to identify new understandings and future applications**

- How else might I use this mathematics?
**Knowledge and understandings — Number**

*Whole numbers, simple and decimal fractions, and a range of strategies are used to solve problems.*

<table>
<thead>
<tr>
<th>Whole numbers (to 9999), decimal fractions (to at least hundredths), and common and mixed fractions have positions on a number line</th>
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</thead>
<tbody>
<tr>
<td><strong>•</strong> Counts, reads, writes, says and orders whole numbers to ten thousands and decimal fractions to tenths (e.g. reads 6.2 as ‘six point two’ or ‘six in words and two-tenths’ in words)</td>
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<tr>
<td><strong>•</strong> Compares 3-digit whole numbers and tenths using materials</td>
</tr>
<tr>
<td><strong>•</strong> Arrange four whole numbers (up to 3 digits) in order of value and two decimal fractions (tenths) in order of value (i.e. knows that 0.4 &gt; 0.2)</td>
</tr>
<tr>
<td><strong>•</strong> Uses non-standard and standard place value partitions for 3-digit whole numbers, i.e. counting numbers and zero (e.g. 405 = 4 hundreds + 0 tens + 5 ones, or 40 tens + 5 ones) and uses concrete materials to demonstrate these groupings</td>
</tr>
<tr>
<td><strong>•</strong> Uses place value to compare and order whole numbers to 3 digits and tenths, and locates them relative to zero on a number line</td>
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</table>

| **•** Counts, reads, writes, says and orders whole numbers to hundred thousands and decimal fractions to hundredths (e.g. reads 0.46 as ‘zero point four six’ not ‘zero point forty-six’)
| **•** Knows that numbers can be made up of digits and words (e.g. 36 thousand = 36 000)
| **•** Understands that the ones, tens and hundreds ‘thousands’ display the same relationships as the ones, tens and hundreds ‘ones’ (see diagram)

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<td>thousands</td>
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<td>3</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

**Place value of digits in whole numbers and decimal fractions changes when they are multiplied and divided by 10 and 100 (e.g. use a calculator to multiply 1.6 repeatedly by 10, record each change on a place value chart and describe the pattern of change)**

| **•** Understands that the pattern of numbers from 1 to 1000 is repeated for every thousand |
| **•** Rounds small decimal numbers up or down to the nearest 10 to facilitate calculation, and knows which two whole numbers the answer will be between and explains why (e.g. says ‘2.1 × 4.5 will be between 8 and 10 because 2 × 4 is less than 2 × 5’)

| **•** Compares 4-digit whole numbers, and tenths and hundredths, using objects and other materials, including drawings |
| **•** Arranges four whole numbers (up to 4 digits) and two decimal fractions (up to hundredths) in order of value (i.e. knows that 0.4 > 0.39) |
| **•** Uses non-standard and standard place value partitions for 4-digit whole numbers and decimal fractions to hundredths |
| **•** Places fractions and mixed numbers (e.g. $\frac{3}{8}$, $\frac{7}{4}$, $\frac{3}{2}$) accurately on a number line |
Common and mixed fractions involving denominators to tenths can be represented as a collection of objects on number lines and as parts of measure to solve problems (e.g. if a quarter of a game is 20 minutes long, how long is the game?)

- Reads, writes, says and understands the meaning of small unit fractions (i.e. those with a numerator of ‘1’ and denominator up to 10), estimating their relative size in shapes and their position on a number line
- Knows that more than ten tenths means more than one whole and can say, for example, ‘one whole and two tenths left over’
- Skip counts in tenths
- Knows that ten tenths make one whole and demonstrates this with materials

Equivalent fractions have easily related dominators that are used to assist mental calculations (e.g. \(\frac{1}{2} = \frac{1}{4} + \frac{1}{4}\))

- Addition and subtraction of common fractions, e.g. \(\frac{1}{2} + \frac{1}{2}\)
- Knows that in the symbolic representation of a fraction, there is a relationship between the numerator and denominator so that, for example, \(\frac{1}{5} < \frac{1}{4}\) even though 5 is greater than 4, because 1 out of 5 equal parts must be smaller than 1 out of 4 equal parts of the same whole
- Knows equivalent fractions have related denominators that are used to assist mental calculations (e.g. \(\frac{1}{2} = \frac{2}{4}\))
- Knows that percentage means ‘out of a hundred’, and so 3% = \(\frac{3}{100}\) and ‘three out of one hundred’, and can move flexibly between these representations

Whole numbers (to thousands) and decimal fractions (to hundredths) can be calculated using addition and subtraction

- Recalls or calculates mentally addition and multiplication facts for any pair of whole numbers up to 5 (i.e. 5 + 5 and 5 × 5)
- Knows that subtraction is not commutative (i.e. 7 – 3 ≠ 3 – 7)
- Uses technology for single operations for 2- and 3-digit numbers, and explains what they have done and found
- Recalls or calculates mentally addition and multiplication facts for any pair of whole numbers up to 10, and uses their inverse operations when needed (i.e. knows to use the fact that 3 × 5 = 15 to find 15 ÷ 3)
### Whole numbers can be multiplied and divided by whole numbers to 10

- Multiplies whole numbers up to 3 digits by numbers up to 10 using mental strategies as a first choice, and other written or calculator strategies for numbers beyond their mental scope.
- Understands that division is about repeated subtraction and uses drawings (by hand or with technology) to represent division of quantities up to 100.
- Uses the patterns in a hundreds chart to help understand multiplication tables (up to $10 \times 10$) and knows that, because of the property of commutativity of multiplication (i.e. $a \times b = b \times a$), they only have to learn half of them.
- Understands the commutativity and associativity of addition and multiplication, and uses these properties to assist in their calculations (e.g. $12 + 15 = 15 + 12$) and in learning their tables (e.g. $6 \times 4 = 4 \times 6$, so I only have to know $6 \times 4$).
- Knows, understands and uses mental strategies for
  - Doubles ($\times 2$)
  - Double doubles ($\times 4$)
  - Double double doubles ($\times 8$)
  - Multiplying and dividing by 10 and 100.

- Recalls addition and subtraction facts, and works out multiplication and related division, applying number properties and mental computation strategies to larger numbers (e.g. says ‘3 eights is 24, so 6 eights will be double that, so $6 \times 8 = 48$’).
- Knows and uses relationships for multiplication facts (2s, 4s and 8s; 3s, 6s and 9s).
- Multiplies and divides numbers by 10 and 100 mentally, and shows ‘what’s changing’ when they do this using a place value chart or calculator.
- Multiplies whole numbers up to 6 digits by numbers up to 10 using mental strategies as a first choice, and other written or calculator strategies for numbers beyond their mental scope (e.g. says ‘$4530 \times 3$ is 12 000 plus 1500, which is 13 500, and then add another 90, so the answer is 13 590’).
- Uses technology including a calculator for single operations, and explains and shows what they have done and found (e.g. knows that $3 \times 15$ is 3 lots of 15, and can prove it by adding $15 + 15 + 15$).
- Uses a calculator to divide and knows that $35 ÷ 4$ is entered as $35 ÷ 4$.
- Knows and uses mental strategies for
  - Inverse (backtracking)
  - Doubles ($\times 2$)
  - Double doubles ($\times 4$)
  - Double double doubles ($\times 8$)
  - Build up ($\times 7$)
  - Build down ($\times 9$)
  - Halving
  - Student-generated ideas.
- Uses symbols (e.g. multiply ($\times$) and divide ($\div$)).

### Whole numbers have factors, prime numbers have only two distinct factors and composite numbers have more than two factors (e.g. 1, 2, 3, 4, 6, 8, 12, and 24 are factors of 24; 1 and 7 are the only factors of 7)

- Knows that prime numbers are numbers that divide evenly (with no leftovers or remainders) only by themselves and 1, and knows these up to 19.
- Knows factors and multiples for 2- and 3-digit numbers (e.g. knows the first six multiples of 25 and the factors of 80).
- Knows prime numbers up to at least 20, and that they have only two distinct factors.
Problems can be made manageable by using strategies involving estimation, inverse operations, doubles, double doubles and halving (e.g. use $23 \times 7$ to check $161 \div 7$)

- Knows that subtraction is the inverse (i.e. ‘undoes’) of addition and vice versa, and that division is the inverse of multiplication, and can show these relationships for numbers using drawings
- Uses mental and written strategies to estimate computations involving a single operation (e.g. $45.3 + 190$ is about $50 + 200$, or $250$)
- Reads and interprets practical problems, identifies which operations ($+,-,\times,\div$) to use, expresses it mathematically and then solves it

<table>
<thead>
<tr>
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| **Uses mental and written strategies to estimate computations involving a single operation (e.g. $45.3 + 190$ is about $50 + 200$, or $250$)**
| **Reads and interprets practical problems, identifies which operations ($+,-,\times,\div$) to use, expresses it mathematically and then solves it** |

Financial records, and simple spending and saving plans, are ways to check on available money and income (e.g. record incoming and outgoing money to help monitor the budget for a class cooking project)

- Reads a money amount and makes up an amount with different combinations of coins
- Solves problems involving spending and saving money (e.g. budgets for a class project)

<table>
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</tr>
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</table>
| **Reads a money amount and makes up an amount with different combinations of coins**
| **Solves problems involving spending and saving money (e.g. budgets for a class project)** |
| **Enters and reads money amounts on a calculator (e.g. when calculating money amounts, knows that a display of 3.6 is read as $3.60$)** |

Money can be saved and borrowed, and interest and fees may apply (e.g. interest applies to money that is borrowed to purchase a house)

- Creates savings plans and spending plans

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Creates savings plans and spending plans</strong></td>
</tr>
</tbody>
</table>
| **Realises that fees may be charged when money is borrowed**
| **Understands and knows about simple household budgets, saving; borrowing, interest and fees, household income, spending and transaction fees on cards** |
Knowledge and understandings — Algebra

**Patterns and relationships can be identified, described and applied with the conventions of the four operations.**

Simple relationships are used to predict results of change (e.g. changes in perimeter occur when the length of the sides increases)

- Makes simple ‘trades’ given one or two rules (e.g. 1 red counter trades for 2 green counters, and 3 red counters trade for 1 black counter. Therefore, can trade 3 reds for 6 greens, and 10 greens for 5 reds, and 1 black for 6 greens)
- Uses language and can write symbols for same/different, more/less, equal/not equal (=, ≠), greater than/less than (> , <)

- Has a simple understanding of proportion through trading (e.g. knows and can explain that if 1 red counter is worth 4 green counters, then 3 red counters must be worth 12 green counters; and that if there are 5 20c pieces in 1 dollar, there are 15 in 3 dollars) and can show these relationships in a table of values:

<table>
<thead>
<tr>
<th>Red</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>4</td>
<td>8</td>
<td>12</td>
</tr>
</tbody>
</table>

- Makes statements about variation in changes over time (e.g. says ‘I grew more during April than May’ and ‘The plant grew more last week than this week’)

Patterns in space and number, and relationships between quantities, including equivalence, can be represented using concrete and pictorial materials, lists, tables and graphs (e.g. represent the relationship between side and perimeter of squares in tables, pictures and graphs)

- Shows some understanding of when it makes sense to ‘join up the dots’ on a time-series graph and when it doesn’t
- Uses balance or materials to describe equivalence where addition and subtraction are used (e.g. shows that 6 + 4 is equivalent to 3 + 5 – 4 + 6 without calculating any answers)
- Uses materials to represent number and spatial patterns for both growing and repeating patterns, and describes what is changing from one element to the next

- Uses balance or materials to describe equivalence where addition and multiplication are used (e.g. for 20 counters in a 4 × 5 array, writes 4 × 5 = 20 and 2 × 2 × 5 = 20 and (3 × 5) + (1 × 5) = 20)
- Uses materials to represent number and spatial patterns (e.g. uses counters to model and identify triangular and square numbers, and matchsticks to make growth patterns)
Rules can be developed to interpret a pattern and predict further elements (e.g. identify the relationship between the numbers 0, 1, 1, 2, 3, 5 and 8 in order to continue the sequence)

- Given the first five elements of a pattern, predicts the next five and explains the basis for their prediction, particularly for growing patterns, and continues the pattern showing their prediction to prove they are right
- Shows what is common (or generalisable) in a repeating pattern by using a different form (e.g. shows the colour pattern ‘green, blue, green, blue’ using actions such as ‘clap, jump, clap, jump’ by first recognising there are two elements in the pattern and they repeat alternately)
- Follows the steps in a sequence, including following the steps in a ‘think of a number’ sequence, and can also remember them in inverse (reverse) order
- Follows the steps in a sequence (such as following the steps in a ‘think of a number’ sequence) and can remember them in inverse (reverse) order to arrive at an answer

Generalisations associated with the four operations are built upon commutative, associative and distributive properties and inverse operations

- **commutative:** $7 \times 4 \times 5$ is the same as $4 \times 5 \times 7$
- **associative:** $2 \times (3 \times 4)$ is the same as $(2 \times 3) \times 4$
- **distributive:** $2(3 + 4)$ is the same as $2 \times 3 + 2 \times 4$
- **inverse:** $23 \times 7$ is used to check $161 \div 7$

- Uses balance or materials to describe equivalence where addition and subtraction are used (e.g. shows that $6 + 4$ is equivalent to $3 + 5 - 4 + 6$ without calculating any answers)
- Uses ‘think multiplication’ to solve unknown division facts from known multiplication facts (e.g. solves $56 \div 7$ by thinking ‘I know that 7 lots of 8 is 56 so that means 56 $\div 7$ must be 8’).
- Solves simple equations with double-digit numbers by inspection (e.g. solves $24 = \Delta - 5$ saying ‘24 is the same as what number take 5?’ or ‘What number do I take 5 from so that I’m left with 24?’)
- Identifies situations that are ‘unbalanced’ (including $2 + 3 + 3$ is greater than $4 + 1 + 1$) or ‘unequal’ (including $6 - 4$ does not equal $10 - 5$)
- Identifies where letters are used in mathematics to represent words (e.g. ‘3c’ represents ‘three cents’ and ‘20 m’ represents ‘twenty metres’)
- Predictions of change using relationships (e.g. Fibonacci sequence)

- Understands the relationship between an element in a pattern cycle and its position in that cycle, and can predict what comes next in the pattern (e.g. for the pattern below)

<table>
<thead>
<tr>
<th>F</th>
<th>E</th>
<th>F</th>
<th>E</th>
<th>F</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

- They can see that ‘E’ is in the ‘even’ positions, and can predict that the 16th position will be even, and hence ‘E’, if the pattern continues
- Identifies where letters are used in mathematics to represent words (e.g. ‘3c’ represents ‘three cents’ and ‘20 m’ represents ‘twenty metres’)
- Predictions of change using relationships (e.g. Fibonacci sequence)
- Solves simple equations using inverses and informal backtracking (e.g. says ‘If $\Delta + 3 = 12$, then $\Delta$ must equal $12 - 3$’). Solves simple equations using inverses and informal backtracking (e.g. says ‘If $\Delta + 3 = 12$ then $\Delta$ must equal $12 - 3$’)
- Solves simple equations using inverses and uses reasoning to solve for more complex numbers (e.g. reasons that $4 + \Delta = 7$ can be solved using subtraction and uses the same reasoning to solve $26 + \Delta = 70$)
- Uses ‘guess and check’ strategies to solve equations involving multiplication and division (e.g. $\Delta \times 3 = 120$ or $3 = 150 \div \Delta$)
### Knowledge and understandings — Measurement

**Length, area, volume, mass, time and angles can be estimated, measured and ordered using standard and non-standard units of measure.**

**Analog and digital clocks can be used to read time to the nearest minute**

- Understands the nature of 24-hour time — that there are 24 hours in a day, so afternoon and night are numbers greater than 1200
- Recognises equivalent forms for times at the hour, half-hour and quarter-hour (e.g. knows that four thirty is half past four, that noon and midday are 12 o’clock, and that quarter past three is 3:15)
- Reads analog clocks and understands why the ‘small hand’ is halfway between 1 and 2 at 1:30
- Reads, says and records the time of day to the nearest minute on a digital and analog clock, and recognises equivalent forms (e.g. 9:56 am is nine fifty-six or four minutes to ten in the morning)
- Uses the conventions of am and pm without prompting
- Calculates the duration of events that last minutes, hours, days, weeks, months and years

**Timelines, clocks, calendars and timetables are used to sequence, schedule and calculate timed events (e.g. use a calendar to calculate the number of school days until holidays)**

- Uses a calendar to identify specific information about days and dates for the current month, week and year (e.g. determines whether the 5th November will fall on a weekend this year)
- Interprets and uses a range of calendars, timetables (including electronic and digital formats) and timelines to record and locate specific information (e.g. finds dates occurring in eight weeks, locates specific information about past events, illustrates sequences of events over time or organises a schedule of forthcoming events)
- Knows and understands time conventions, such as ante meridiem (am); post meridiem (pm)

**Standard units, including centimetre, metre, square centimetre, square metre, gram, kilogram, minute, degree, millilitre and litre, and a range of instruments are used to measure and order attributes of objects, including length, area, volume, mass, time and angles (e.g. use a protractor to measure the angles within a triangle)**

- Identifies and compares the attributes of shapes and objects with respect to length, area, volume and mass (e.g. knows that a suitcase has height, width, length, capacity and mass, and describes the difference, saying ‘The mass is how much it weighs when it is empty and the capacity is how much it will hold’)
- Measures lengths of straight and curved edges using simple straight edges (such as rulers), paying attention to the exact start and end of the length being measured to ensure they are measuring and not just counting units
- Uses measuring instruments, including rulers and tape measures
- Measures areas of surfaces using materials provided (such as grid transparencies and sheets of A4 paper), paying attention to gaps and overlaps (i.e. knows the gaps and overlaps are important and doesn’t ignore them)
- Uses measuring instruments, including litre-jugs and area grids
- Measures volumes of liquids (estimating first) using simple measuring instruments
- Chooses the appropriate attribute when comparing objects or solving practical problems (e.g. decides which suitcase is the ‘biggest’ in order to pack more clothes, knows it is the capacity that is important not the height or width of the suitcase)
- Knows that the larger the unit chosen, the fewer required to measure (e.g. if they use a sheet of A3 paper to measure the area of the table top, they will need fewer than if they used a sheet of A4 page), and that using a metre ruler to measure the length of the veranda will give a smaller amount than using a 30-cm ruler
- Measures and compares volumes of liquids (estimating first) by first choosing appropriate instruments and units, and reading scales as needed (e.g. choosing an eye dropper or teaspoon to measure 10 mL of medicine and a graduated measuring jug to measure 150 mL)
- Measures and compares masses of different objects by first choosing appropriate...
provided (e.g. jugs with 100-mL gradations) being careful to ensure the reading is exact

- Measures masses of different objects (estimating first) using simple measuring instruments provided (e.g. bathroom scales, with kilogram gradations) being careful to ensure their readings are exact

- Knows, understands and uses degree, metre (m), centimetre (cm), kilogram (kg), gram (g), litre (L), millilitre (mL), minute (min), second (sec), decade and leap year

<table>
<thead>
<tr>
<th>Links exist between different ways of recording the same measurement (e.g. $100 \text{ cm} = 1 \text{ m}, 1000 \text{ mm} = 1 \text{ m}$)</th>
</tr>
</thead>
<tbody>
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<td><strong>•</strong> Arranges recorded measurements in increasing or decreasing order of magnitude by first identifying different forms of recording these (e.g. $1\frac{1}{2} \text{ kilograms, 1700 grams, 175 kg, 200 g}$)</td>
</tr>
<tr>
<td><strong>•</strong> Knows equivalent forms of standard units (e.g. $1.5 \text{ km} = 1500 \text{ g}; 600 \text{ mL} = 0.6 \text{ L}$)</td>
</tr>
</tbody>
</table>

- Uses known measures of familiar objects to make reasonable estimates of length, area, mass and volume (e.g. volume of a drink can, mass of a margarine container, own height, area of sheet of A4 paper)

- Estimates, measures and compares angles to the nearest 10°

- Understands that perimeter is the length of the boundary of closed (joined) shapes, and determines the perimeter of polygons (closed shapes) including with curved edges. Measures these and identifies where short cuts can be used for calculation (e.g. for rectangles and squares)

- Knows circumference is a measure of length

- Knows, understands and uses degree, metre (m), centimetre (cm), kilogram (kg), gram (g), litre (L), millilitre (mL), minute (min), second (sec), decade and leap year

- Links exist between different ways of recording the same measurement (e.g. $100 \text{ cm} = 1 \text{ m}, 1000 \text{ mm} = 1 \text{ m}$)

- Arranges recorded measurements in increasing or decreasing order of magnitude by first identifying different forms of recording these (e.g. $1\frac{1}{2} \text{ kilograms, 1700 grams, 175 kg, 200 g}$)

- Knows equivalent forms of standard units (e.g. $1.5 \text{ km} = 1500 \text{ g}; 600 \text{ mL} = 0.6 \text{ L}$)
Reasonable estimates can be made using strategies that suit the situation (e.g. stepping out a backyard cricket pitch; applying a 1-cm grid to estimate area of a square)

- Chooses and uses the appropriate metric unit to measure different lengths and different masses (e.g. chooses and used centimetres for measuring the length of a desk and metres for measuring the length of the room)
- Estimates lengths and masses by making comparisons (e.g. says ‘I think it weighs about 4 kg because it’s about twice as heavy as this bottle that weighs 2 kg’ and ‘It’s about 2 m high because I’m 1 m tall’)
- Uses non-standard units (e.g. grids, floor tiles, paces, hand spans)

- Measures and compares different lengths using an appropriate instrument by first identifying the precision required for the context (e.g. to decide whether a table will fit through a doorway, chooses a centimetre tape measure and measures to the nearest centimetre)
- Measures and compares different areas or surfaces using a range of units, such as grids made of square units, A4 sheets of paper, square centimetres and square metres (e.g. to determine which book has the biggest cover, uses A4 sheets of paper but uses sheets of newspaper to determine which floor has the biggest floor space)
- Understands the concept of accuracy and knows that some measurements need to be more precise than others because of the context and purpose for measuring (e.g. knows that accuracy is needed when measuring quantities to make a cake, but that when cooking potatoes, ‘one for each person’ is accurate enough)
- Uses language such as ‘between’ to describe metric estimates (e.g. says ‘The book weighs between 1 and 2 kg’ using a 1-kg bag of sugar as their reference)
- Shows a sense of scale when making maps and models, and reading maps (e.g. knows the river is the same distance from the road as from the building; knows to make the model car proportional to the size of the road when working with plasticine)
## Knowledge and understandings — Chance and data

**Chance events have a range of possible outcomes that can be described using predictions. Data can be collected to support or adjust predictions.**

The likelihood of outcomes of events involving chance can be described using terms including ‘likely’, ‘more likely’, ‘most unlikely’ and ‘never’

**Orders events in order of likelihood**
- (e.g. knows that it is more likely they will go home after school than it will snow in January)

**Knows experimental probability**
- (e.g. 5 tails in 20 flips of the coin, 5 divided by 20)

**Compares the likelihood of events**

**Uses mathematical language**
- (e.g. likely; unlikely; more likely; most likely; never)

**Uses simple designs to experiment with chance**

- **Knows when situations have equally likely outcomes and when they do not**
  - (e.g. equally likely when tossing a coin or die but not equally likely when throwing a matchbox)

**Uses predictive language**
- (e.g. never, sometimes, highly unlikely) when making predictions and ordering events in order of likelihood

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### Data collected from experiments or observations can be organised in tables and graphs, and used to respond to questions about the likelihood of possible outcomes of events (e.g. record 100 tosses of two dice to predict the likelihood of rolling two sixes to begin a game)

**Collects and interprets data relating to their own questions of interest**
- (such as ‘What are the most popular pets of students in the school?’ and those that require many-to-one (frequency) organisation for larger numbers of students (e.g. ‘The number of students with a dog = 56’))

**Contributes to discussions about the best ways to collect data**
- (e.g. to find out about the cars that pass the school or the lunches students in the whole school buy in the tuck shop)

**Enters one-to-one data into a simple spreadsheet**
- by first allocating every student a number and then choosing ICT to display a simple graph of each student’s data-point

**Uses tally marks, lists and tables**

- **When asked a question including ‘How many red counters are you likely to draw out of a jar with the same number of red as green counters in 10 draws?’, can design a simple experiment to collect data and make predictions based on the data collected**
  - (e.g. draws 30 counters out of a jar and predict that about half will be red and half green, and explains their reasoning)

**Collects data to answer simple questions and issues presented**
- (e.g. ‘What is the most popular TV program?’) by first considering what data would help and then choosing from a range of data collection methods (including simple surveys, observations, experiments, and simulations), depending on the one most suited to the context; decides whether the collected data helps to answer the question or whether they need to use another method

**Uses a range of tables and graphs to represent their data**
- (including bar graphs and pictographs created by hand and technology) and discusses the effectiveness of those chosen

**Uses technology-generated graphs by first entering data into a spreadsheet and then viewing different displays to select the best way to display the information for their purposes**

**Manages electronic files and explains their folder system to someone else**
**Collected data can be used to justify statements and predictions (e.g. using data to justify a prediction about children’s views compared with adults’ views on the same television show)**

- Analyses displays of their data (i.e. simple pictographs, one-way tables and data-point or dot frequency graphs) and makes simple statements about the display (e.g. says ‘There are 15 students in Mrs White’s class’)
- Knows, understands and uses lists, tables, picture and bar graphs, and conventions for data displays (manual or electronic)

**Analyses data and displays of their data, and makes statements and predictions about the issues using their displays to support their arguments (e.g. predicts, fairly accurately, the height of someone joining their class next week)**

- Reads a two-way table and says ‘There were 20 cars — 8 were white and the other 12 were blue’; reads a bar graph and says ‘There were 15 students in Year 4 in 2005 and 12 in 2006, so there will probably be fewer than 20 in 2007’
- Knows and understands the importance of additional data, including the reasons for, amount required and impact on statements related to data
- Uses comparative and quantitative language (e.g. more likely/less likely, equally likely/most likely/least likely, certain, multiple outcomes, sample, space, randomness)

**Sets of data may contain expected or unexpected variation and this may mean that additional data is needed (e.g. variation in the time it takes to get to school during peak and off-peak times)**

- Makes connections between organised data, displayed data and interpretations
- Explores and compares different data collection methods

**Identifies and describes the variation within a set of data (e.g. says ‘Some of us really like that TV show and others really hate it’) and between sets of data (e.g. says ‘The parents really hate the TV show but the kids really like it’)**
### Knowledge and understandings — Space

*Geometric features are used to group shapes, and guide the accuracy of representation of 2D shapes and 3D objects. Mapping conventions apply to the structure and use of maps and plans.*

<table>
<thead>
<tr>
<th>Geometric features, including parallel and perpendicular lines, acute, right, obtuse and reflex angles, and vertex, edge and base, can be used to sort shapes and objects into broad family groups (e.g. group quadrilaterals based on their features)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Identifies and describes families of 3D shapes (prisms, pyramids, cones, cylinders and spheres), makes models and sketches of them, and uses appropriate spatial language when describing features, including parallel, perpendicular, vertex, edge, base and face</td>
</tr>
<tr>
<td>• Knows and understands parallelograms, rectangles, trapeziums and rhombuses (including diamonds)</td>
</tr>
<tr>
<td>• Knows, understands and uses geometric properties of shapes and lines (e.g. horizontal, vertical, oblique, parallel and non-parallel lines; equal sides; faces; angles, both straight 180° and right 90°)</td>
</tr>
<tr>
<td>• Knows, understands and uses conventions for labelling shapes</td>
</tr>
<tr>
<td>• Identifies the unique features of some shapes within families of 2D shapes and generalises about their features (e.g. says ‘All squares have two pairs of parallel sides’, and ‘A parallelogram is a quadrilateral with two pairs of parallel sides’)</td>
</tr>
<tr>
<td>• Identifies the unique features of some shapes within families of 3D shapes and generalises about their features (e.g. ‘All of the faces of triangular pyramids are triangles, and the two ends of cylinders are circles’)</td>
</tr>
<tr>
<td>• Uses the language of lines (e.g. vertical, horizontal, oblique and parallel)</td>
</tr>
<tr>
<td>• Knows and understands that polygons are plane figures with three or more sides</td>
</tr>
<tr>
<td>• Knows and understands non-polygons</td>
</tr>
<tr>
<td>• Knows triangles (e.g. right-angled, isosceles, scalene and equilateral)</td>
</tr>
<tr>
<td>• Knows geometric properties of shapes (e.g. vertex, edge, base; parallel sides, faces, lines; perpendicular sides and lines; and acute, obtuse, straight and reflex angles)</td>
</tr>
<tr>
<td>• Understands, knows and uses tessellations</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Defining features, including edges, angle sizes and parallel lines, are used to make accurate representations of 2D shapes and 3D objects</th>
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<tbody>
<tr>
<td>• Draws 2D and 3D shapes (using technology or by hand) from different positions (e.g. draws five drawings of a jug by moving around the jug and viewing it front-on and from a ‘bird’s-eye view’; draws a box, placed on a table, from different positions and shows some simple attention to perspective).</td>
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<tr>
<td>• Identifies and describes angles in the environment as right, acute, obtuse and reflex, and makes or draws them</td>
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<td>• Draws, from memory, an arrangement of several shapes (e.g. looks at an arrangement of four shapes drawn by their partner before covering it and sketching it)</td>
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<tr>
<td>• Identifies, sorts and describes common 2D shapes (squares, rectangles, triangles and circles), draws them using technology by focusing on their characteristics, and uses appropriate spatial language when describing features including side, angle, centre, circumference, parallel and perpendicular</td>
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<tr>
<td>• Knows, understands and uses conventions for arrows and lines to identify parallel lines (dotted lines to represent hidden lines in 3D objects)</td>
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<tr>
<td>• Makes drawings or models that accurately reflect the size and significant features (e.g. draws a human head with eyes halfway up the head instead of at the top)</td>
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<tr>
<td>• Draws a 2D shape when given a verbal or written description of it</td>
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<tr>
<td>• Represents and describes 2D shapes in different orientations, and 3D shapes and objects from different perspectives, highlighting relevant features and using technology as appropriate</td>
</tr>
<tr>
<td>• Draws a 3D shape when given a verbal or written description of it</td>
</tr>
<tr>
<td>• Draws and recognises right angles in a range of different orientations</td>
</tr>
<tr>
<td>• Uses written conventions of geometric properties (e.g. letters for naming 2D shapes (ABC...); marks to identify equal sides of shapes; marks to identify equal angles and marks to identify right angles)</td>
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</table>
3D objects can be visualised or constructed using nets (e.g. accurately construct a square-based or triangular-based pyramid using a base and triangular side (lateral) faces)

- Knows and understands nets of prisms, nets of pyramids, nets of cylinders and nets of cones
- Imagines and draws cross-sections of simple 3D shapes (e.g. slices of carrots at different angles)
- Visualises and constructs 3D objects using nets

Symmetry and transformations involving flips, slides, turns, enlargements and reductions provide a basis for creating patterns, designs and tessellations (e.g. use of parquetry pattern in tiling)

- Uses mirrors and folding to show why some shapes are not symmetrical about a given line (asymmetrical)
- Explores and describes the effect of multiple or consecutive flips, slides or turns one after the other on different shapes, and talks about their results using appropriate mathematical terms (e.g. says 'If you turn that shape around in a half circle and then flip it, it comes back to where it was at first')
- Knows and understands that a tessellation is made by completely covering a surface with one or more shapes in a repeated pattern so there are no gaps or overlaps, and can recognise and explain whether a pattern is a tessellation
- Recognises tessellations in the built environment (e.g. tiles, pavings, brick wall)
- Uses mind pictures of different viewpoints of shapes and movement of shapes (e.g. directional north N)
- Imagines a single flip, slide or turn and draws what it might look like
- Identifies symmetrical shapes and designs, creates some using transformations (e.g. flips) and explains why others are not symmetrical (asymmetrical)
- Describes the result of combinations of transformations, including enlargements and reductions, on a shape (e.g. a slide then a turn, a reduction then a flip), and creates patterns and designs using these combinations
- Uses multiple copies of different shapes to observe that some shapes will always tessellate (e.g. triangles and quadrilaterals) and some will not (e.g. pentagons)

Mapping conventions, including symbols, scales, legends and alphanumeric grids, are used to represent and interpret movements, and identify locations on maps and plans (e.g. using the north symbol (N) and a scale of 1 cm represents 10 m on a street map)

- Interprets and develops simple keys or legends for their own maps, and maps of peers, of familiar and local locations
- Develops their own informal scales when making sketches of familiar environments (e.g. 1 cm on the map = 10 steps in real life)
- Uses mapping conventions, symbols, legends and alphanumeric grids
- Makes plans of rooms and treasure maps
- Uses mapping conventions, symbols, legends and alphanumeric grids
- Uses visual electronic maps and plans
- Draws from different viewpoints (e.g. bird’s-eye view) with mapping conventions
- Uses mapping conventions (e.g. symbols, compass points labels and directional arrow for North; scale such as 1 cm represents 10 m; legends and alphanumeric grids)
- Interprets and uses symbols (e.g. the north symbol and the key or legend) and conventions (e.g. B4 on grids) when planning directions or placing features on maps and when reading a map
- Estimates lengths and distances on maps, grids and plans with respect to a straightforward scale (e.g. uses a scale of 1 cm = 10 m to estimate the length of a street)
- Uses visual electronic maps and plans
### Mapping conventions, including the four major compass points, are used to give direction and movement, and can be linked to turns (e.g. descriptions for locations of treasures on a ‘scavenger map’ could include the idea that a half-turn from facing north is facing south)

<p>| • Uses the position of their body to understand quarter, half, three-quarter and full turns (i.e. knows that a full turn will bring them back to their original position after turning on the spot) | • Makes links between the four major compass points and quarter, half, three-quarter and full turns when following or giving directions (e.g. knows that if they are facing south and turn right a quarter turn, they will be facing west) |</p>
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<thead>
<tr>
<th></th>
<th>Year 6</th>
<th>Year 7</th>
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<tbody>
<tr>
<td><strong>Ways of working</strong></td>
<td><strong>Analyse situations to identify mathematical concepts, and the relationships between key features and conditions necessary to generate solutions</strong></td>
<td><strong>Analyse situations to identify mathematical concepts, and the relationships between key features and conditions necessary to generate solutions</strong></td>
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<td></td>
<td>• Compares the ways that familiar mathematics is done in their own and other communities (e.g. compares how time is experienced in western cultures — by measuring start and finish times — compared with those in some Indigenous cultures — by the quality of the experience; the year divided into four ‘western’ seasons compared with that divided into six seasons; wet and dry seasons)</td>
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<td></td>
<td><strong>Pose questions that draw on familiar examples to clarify thinking and support predictions</strong></td>
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<td></td>
<td>• Explains their questioning when communicating their problem-solving processes both independently and collaboratively (e.g. says ‘The problem asked which container is ‘bigger’ and we didn’t know whether that meant ‘wider’, ‘taller’ or ‘longer’, so we looked at what it was going to be used for and made an assumption’)</td>
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<td></td>
<td><strong>Plan activities and investigations to explore concepts through selected pathways, and plan strategies to solve mathematical questions, problems and issues</strong></td>
<td><strong>Plan activities and investigations to explore concepts through selected pathways, and plan strategies to solve mathematical questions, problems and issues</strong></td>
</tr>
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<td></td>
<td>• When making and testing conjectures, collects data to help them when making and testing conjectures about numbers (e.g. to find what happens when you add two odd numbers, tries different odd numbers and conjectures that they always give a sum that is even)</td>
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<td>• When examining mathematical situations, makes organised lists (e.g. when examining and classifying some 3D shapes, labels each shape using digits 1 to 10, and examines the shapes one by one using tabular headings: ‘faces, edges, vertices/corners’ without being asked to do so</td>
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<td></td>
<td><strong>Develop arguments to justify predictions, inferences, decisions and generalisations from solutions</strong></td>
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<td>• Recognises and crosses out irrelevant information in a problem</td>
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<td></td>
<td><strong>Evaluate thinking and reasoning to determine whether mathematical ideas, strategies and procedures have been applied effectively</strong></td>
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<td></td>
<td>• When given a list of their own or someone else’s mathematical questions generated in an attempt to make sense of a situation, can eliminate those that won’t provide information that helps</td>
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<tr>
<td></td>
<td>• Explains their questioning when communicating their problem-solving processes both independently and collaboratively (e.g. says ‘The problem asked which container is ‘bigger’ and we didn’t know whether that meant ‘wider’, ‘taller’ or ‘longer’, so we looked at what it was going to be used for and made an assumption’)</td>
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<td></td>
<td><strong>Thinking and justify reasoning and generalisations using mathematical language, representations and technologies</strong></td>
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<td></td>
<td>• Responds confidently to questions such as ‘How confident are you about the solution that you got?’ When asked if their method is sensible in the context, draws on their own experience to justify the method they used (e.g. says ‘It’s not possible to walk 3 km in 4 minutes’)</td>
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<td><strong>Reflect on and identify the contribution of mathematics to their life</strong></td>
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<td>• Identifies familiar mathematical features in their activities and those of their community (e.g. ‘What mathematics will I need when planning the schedule for the school stall at the rodeo?’)</td>
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<td></td>
<td>• Knows and respects differences between Western mathematics and other ways of imposing order in society through naming, ordering, valuing and pattern</td>
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<td></td>
<td><strong>Reflect on learning, apply new understandings and identify future applications</strong></td>
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<td></td>
<td>• Asks clarifying questions and, on reflection, suggests questions left unanswered by their mathematical work (e.g. ‘What if my assumption were incorrect?’)</td>
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<td></td>
<td>• Discriminates between important and incidental information in a context or situation, and states related assumptions and conditions, varying these in a context if needed (e.g. questions the level of accuracy needed and decides, as a result, to calculate to four decimal places when working with currency conversions)</td>
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</tbody>
</table>
### Knowledge and understandings — Number

**Numbers, key percentages, common and decimal fractions, and a range of strategies are used to generate and solve problems**

<table>
<thead>
<tr>
<th>Whole numbers, including positive and negative numbers, common and decimal fractions can be ordered using a number line</th>
<th>Counts, reads, writes, say and orders integers and decimal fractions; counts forwards and backwards from any integer</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Counts, reads, writes, says and orders whole numbers to hundred millions and decimal fractions to thousandths; counts forwards and backwards from any whole number</td>
<td>• Knows that numbers can be made up of digits and words (e.g. ‘4 million’ is a number)</td>
</tr>
<tr>
<td>• Knows that numbers can be made up of digits and words (e.g. ‘4 million’ is a number)</td>
<td>• Arranges four integers (whole numbers and their opposites) and three decimal fractions (up to thousandths) in order of value</td>
</tr>
<tr>
<td>• Understands that the ones, tens and hundreds ‘millions’ display the same relationships as the ones, tens and hundreds ‘thousands’ and ‘ones’</td>
<td>• Represents integers on a number line and determines the difference between them as length (e.g. the distance between –3 and 2 is 5 units). Orders rational numbers on a suitably scaled part of the real number line</td>
</tr>
<tr>
<td>• Arranges four whole numbers and three decimal fractions (up to thousandths) in order of value</td>
<td>• Counts forwards and backwards with the same denominator, and knows equivalent fractional representations for whole numbers (e.g. says ‘Three and two-thirds, three and one-third, three or nine-thirds, two and two-thirds…’)</td>
</tr>
<tr>
<td>• Counts forwards and backwards in decimal fractions (e.g. says ‘zero point three eight, zero point three nine, zero point four zero — or zero point four’)</td>
<td>• Orders fractions with different denominators and explains the order using diagrams or representations (e.g. ( \frac{2}{5} &gt; \frac{2}{3} ))</td>
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<tr>
<td>• Uses skip counting to label a scale (e.g. marks from 0–5 on a number line and calibrates using 0.2, 0.4, 0.6, 0.8, 1.0, 1.2…)</td>
<td>• Uses a number line or materials to solve practical problems involving addition and subtraction of integers (e.g. uses a number line to show that an overnight temperature drop of 12 °C from 5 °C results in a minimum of –7 °C)</td>
</tr>
<tr>
<td>Common fractions can be represented as equivalent fractions, decimals and percentages</td>
<td>Knows and uses the relationships between positive and negative integers, common fractions, decimal fractions and percentages</td>
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</table>

<table>
<thead>
<tr>
<th>Common fractions can be represented as equivalent fractions, decimals and percentages for different purposes (e.g. ( \frac{2}{5} = \frac{4}{10} = 0.4 = 40% ))</th>
<th>Knows the relationship between decimal fractions and money (i.e. knows that $2.43 is the same as ‘two point four three’ dollars, which is ‘two dollars and forty-three cents’)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Compares 6-digit whole numbers, and tenths, hundredths and thousandths, using a variety of methods and models</td>
<td>• Uses the symbols ‘&lt;, &gt; and =’ to state money comparisons (e.g. in explaining why $40 is enough to pay for 5 items worth $7.85, writes 5 × $8 &gt; 5 × $7.85)</td>
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<tr>
<td>• Writes a decimal as a fraction (e.g. 0.16 = ( \frac{16}{100} ))</td>
<td>• Represents a part-to-part relationship (e.g. number of boys to girls) or part-to-whole relationship (e.g. boys to class) as a ratio and expresses it in simplest form (e.g. 2:4 = 1:2); calculates proportions of a given ratio using multiplication or division (e.g. converts a recipe for 4 people to a recipe for 1, 2, 6, 8 or 12, or uses a scale of 1 cm to 100 m on a map to know that 3 cm on the map is 300 m in real distance)</td>
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<tr>
<td>• States fractional equivalents in words and diagrams (e.g. says ‘Two-sixths are the same as one-third’) and can show these using diagrams. Uses concrete representations to compare and order them (e.g. uses diagrams to show why ( \frac{2}{3} ) is less than ( \frac{1}{2} ) and ( \frac{7}{6} ) is more than ( \frac{1}{2} )) including when two fractions are equivalent</td>
<td>• Knows and can show on a hundreds square that ( \frac{12}{20} ) as a percentage is 12 out of every 20 squares on the hundreds square; calculates with fractions and percentages based on multiples of 10% and 25% of a given unit or quantity (e.g. 60% of a 1-kg</td>
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</tbody>
</table>
representations in a table with columns ‘words, symbols, fractions, decimals’)

- Knows and understands equivalent fractions
  - Common fractions
  - Decimal fractions
  - Percentages
  - Vinculum as divisor (A vinculum is a horizontal line placed over a mathematical expression, used to indicate that it is to be considered a group. *Vinculum* is Latin for ‘bond’)
- Uses key percentages, common and decimal fractions, and mixed numbers (e.g. equivalent fractions for 20%, 1/5, 0.20 and the words one-fifth)

**Percentages, rate, ratio and proportion can be used to describe relationships between quantities, and to solve problems in practical situations involving money, time and other measures**

- Knows and understands key percentages (10%, 20%, 25%, 30%, 40%, 50%, 100%)
- Uses the decimal point to represent money (e.g. uses $2.05 to represent two $1 coins and one 5c coin)
- Uses fractions to represent proportional relationships (e.g. explains that a mark of 7/10 means that they got 7 out of 10 and that, in this case, both the 7 and the 10 are whole numbers but 7/10 is not. It doesn’t make sense to say they got ‘seven-tenths’ for their test mark or that they got ‘seven-tenths’ of the test right; knows that if half the class watch a certain TV program and there are 14 students in the class, then 7 of them watch the program and 7 do not)
- Knows and can show that 50% of a hundreds square means that 50 of the 100 squares are shaded, and they can be any 50 of the squares
- Knows ratios express multiplicative relationships between like quantities
- Knows that ‘25% off’ the full price means they would save 1/4 of the price and that ‘50% off’ means they would save half the full price
- Direct proportion is the equivalence of two ratios

**Estimation strategies, including rounding and estimates based on powers of 10, assist in checking for reasonableness of calculations involving whole numbers, and common and decimal fractions (e.g. 38.25 × 52.88 rounds to 40 × 50, so the answer will be approximately 2000)**

- Multiplies whole numbers up to 6 digits by numbers up to 10 using rounding and mental strategies in order to estimate first, when written and calculator methods are needed (e.g. uses a calculator to multiply 62 350 by 5, estimating that the answer will be between 300 000 and 400 000) in order to judge whether the answer obtained on their screen is logical
- Uses rounding and powers of 10 to estimate calculations (e.g. estimates 43.7 × 531 to be about 40 × 500, which is 20 000) and knows whether the estimate will be more or less than the real answer because of the direction of the rounding when both numbers are rounded up or down (e.g. says ‘It will really be more than 20 000 because I rounded both numbers down’)
- Can read and write index notation for square numbers, e.g. 6 × 6 is (6²)
- Knows rates express multiplicative relationships between unlike quantities
- Estimates the result of a simple calculation involving whole numbers, decimals and fractions arising from a practical situation (e.g. total from a shopping bill, mean of a small set of numbers, proportion of a quantity such as 7/8 of 44 L) and interprets and justifies their reasoning (e.g. says ‘It will cost about $10 because the first item is about $2, the second is about $4.50 and the third is about $3.50’)
- Understands and uses small, whole powers (e.g. 23, 35, 103)
Problems can be interpreted and solved by selecting from the four operations and mental, written and technology-assisted strategies (e.g. find the price of a $68.00 shirt with 25% discount)

- Knows, understands and uses multiplication and simple division of whole numbers, common fractions and decimal fraction to hundredths
- Recalls most basic multiplication facts to $10 \times 10$, and mentally extends to multiply 1-digit numbers by multiples of 10 (e.g. says ‘$4 \times 90$ is 4 times 9 lots of 10, so it’s 36 lots of 10, which is 360’)
- Partitions double-digit numbers in order to mentally multiply by small single-digit numbers (e.g. realises that three 26s is the same as three 20s added to three 6s, which is 60 + 18, which is 78)
- Factorises 38 in order to make the computation of $38 \times 5$ easier; thus $38 \times 5 = 19 \times 2 \times 5 = 19 \times 10 = 190$)
- Multiplies by tenths and hundredths, and explains that multiplying by tenths is the same as finding one-tenth of it, and that multiplying by one hundredth is the same as finding one-hundredth of it
- Identifies prime factors of any whole number up to 100
- Understands the ‘rule of order’ for $+,-,\times,\div$ (i.e. that in a string of operations, multiplication and division are done first in the order in which they occur; $2 + 4 \times 3$ will be done as $4 \times 3$, with 2 added to the result); explores whether their calculator follows this rule of order or not and explains how they know; uses the memory to store the result of $4 \times 3$ and adds the number stored to 2 if their calculator doesn’t use the rule of order
- Reads and interprets practical problems, identifies which operation to use, expresses it mathematically, solves it, makes sure their answer makes sense in the context and explains their choice of operation.
- Applies the commutative, associative and distributive properties to help with their calculations, and chooses whether to calculate using mental, written or calculator/other technology methods or a combination of these, and explains their methods (e.g. knows that $5 \times 26$ is the same as $5 \times (20 + 6)$, which is $(5 \times 20) + (5 \times 6)$ and, having written this down, can calculate the answer mentally

- Mentally multiplies double-digit by single-digit numbers using partitioning strategies (e.g. says ‘six 38s is six 30s and six 8s, which is 180 and 48, which is 228’)
- Partitions double-digit numbers in order to mentally divide by small, single-digit numbers (e.g. realises that $97 \div 3$ is 90 divided by 3 and 7 divided by 3, which is 30 and 2 with a leftover, or 32 and one leftover)
- Divides by tenths and hundredths, and explains that dividing a number by one-tenth makes it ten times larger (since there are ten tenths in every whole number), and similarly for hundredths
- Applies effective written methods (not necessarily algorithms) to carry out computations with decimals to at least thousandths (e.g. $2.852 \times 12.3$) by mentally estimating the result first in order to judge the reasonableness of the answer obtained
- Identifies and uses factors, including prime factors, to assist mental computation (e.g. $27 \times 3 = 9 \times 3 \times 3 = 9 \times 9 = 81$)
- Uses a calculator or spreadsheet to carry out complex, repetitive computations, paying attention to rule of order or order of operations (e.g. adds amounts for items from a mail order catalogue, and includes GST and postage; uses a calculator to carry out and check calculations involving rational numbers and justifies the size of the answer (e.g. $\frac{43}{4} - \frac{21}{3} = 2.41666\ldots$), based on knowledge of the order of the numbers used
- Uses a calculator memory or brackets to calculate expressions such as $(4.1 \times 1.2) + (3.5 \times 3)$
- Interprets problem situations to choose and use an appropriate sequence of operations, and applies suitable methods of computation (e.g. chooses to calculate a 20% discount using multiplication and subtraction
- Applies commutative and associative properties to expressions to explore general mathematical properties of numbers (e.g. shows how 6 lots of 15 000 could be calculated as 3 lots of 30 000, and generalises this principle to other calculations including $6 \times 12 = 3 \times 24$. Says ‘If I halve one number and double the other one, and then multiply, I get the same answer’) and knows that this can be written as $n \times m = 2 \times n \times \frac{1}{2} \times m$, where $n$ and $m$ represent any two numbers
### Financial decisions and transactions are influenced by a range of factors, including value for money, discounts, method of payment, and available income or savings (e.g. interest earned is reduced when savings are spent)

- Knows and understands factors influencing financial decisions, transactions and spending
  - Value for money
  - Budget
  - Percentage discounts
  - Methods of payment (e.g. EFTPOS, credit and debit cards)
  - Available income or savings

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  - Value for money
  - Budget
  - Percentage discounts
  - Methods of payment (e.g. EFTPOS, credit and debit cards)
  - Available income or savings
  - Interest

### Budgets and financial records are used to monitor income, savings and spending (e.g. using bank statements and ATM slips to review and manage a personal budget)

- Reads, writes and uses budgets and financial records (e.g. table of savings, expenses and balances, electronic spreadsheets) and conventions for percentage discounts

- Knows that personal decisions about money can be monitored by budgets and financial records (e.g. bank statements, ATM slips)

- Reads, writes and uses simple budgets, financial records (e.g. table of savings, expenses and balances), cheques and conventions for percentage discounts

### Cashless transactions include the use of cheques, EFTPOS, credit and debit cards, and money orders

- Knows that payments can be made by different methods, including cheques, credit cards and cash

- Can read and write words and abbreviations (e.g. 20K/20 000; $1.5m/1.5 million; $3b/3 billion)

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### Knowledge and understandings — Algebra

**Algebraic expressions and equations can be applied to describe equivalence and solve problems**

Expressions and relationships, including formulas and simple equations, can be demonstrated using words, diagrams, materials and symbols to represent variables (e.g. perimeter = twice the length add twice the width = 2xl + 2xw)

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<td><strong>Solves simple equations involving + and – using a variety of methods, including with a calculator, and substitutes the solution back into the equation to show their answer is correct (e.g. in solving ‘Find the value of the number represented by g’ if 3 + g = 7 determine that g must be the number that you get when you subtract 3 from 7 and finds the solution by using a calculator, storing the solution in the memory, and finding 3 plus the solution stored in the memory to check the answer is 7)</strong></td>
<td><strong>Determine whether or not numbers satisfy a given equation involving + and – (e.g. determines that 4 and 6 satisfy the equation ‘the sum of two numbers equals 10’ but not ‘The second number is twice the first number’)</strong></td>
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<tr>
<td><strong>Determines whether or not numbers satisfy a given equation involving + and – (e.g. determines that 4 and 6 satisfy the equation ‘The sum of two numbers equals 10’ and ‘The difference between the two numbers is 2’)</strong></td>
<td><strong>Uses a letter or variable to represent a variable quantity and explains why the letter does not stand for the word but for a number (e.g. given the statement ‘Mary is three years older than John’ is represented by M = J + 3, can explain why M does not represent Mary but Mary’s age — a number; given the formula P = 2 × l + 2 × w, knows that l represents the number measurement of the length and not the word ‘length’, and reads this as ‘Perimeter is equal to two times the measurement of the length plus two times the measurement of the width’)</strong></td>
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<td><strong>Identifies where letters are used in formulae to represent different quantities (e.g. l = 2 × w can be used to represent the formula ‘length equals two times the width’, and that the two quantities length and width can vary depending on the size of the quadrilateral)</strong></td>
<td><strong>Translates simple word statements involving one variable, and addition and subtraction, into symbols by representing the variable quantity with a letter (e.g. writes ‘4 more than a number’ as g + 4 (or 4 + g) and ‘8 less than a number’ as f – 8)</strong></td>
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<tr>
<td><strong>Tells the difference between two statements using letters: one where the letter represents a word (e.g. 5c) and one where the letter represents a quantity that varies</strong></td>
<td><strong>Can compare simple algebraic expressions and relationships (e.g. constant walking speed at 4 km/h)</strong></td>
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<tr>
<td><strong>Uses the language (e.g. discrete, continuous, trends)</strong></td>
<td><strong>Knows and uses symbols and letters, tables, ordered pairs, graphs (manual and electric), calculations, diagrams and arrow diagrams</strong></td>
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#### Equations and expressions involving addition, subtraction, division and multiplication can be solved to establish equivalence (e.g. use materials, diagrams and number examples to explain why (2 × 6) + (3 × 6) = 5 × 6 and generalises to (2 × n) + (3 × n) = 5 × n)

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</tr>
</thead>
<tbody>
<tr>
<td><strong>Writes equivalent statements, recognising that the ‘=’ symbol represents equivalence, and is not compelled to ‘close’ the statement by performing the calculations indicated (e.g. writes 3 + 5 = 12 – 4 and is content that both sides are equivalent, leaving it at that)</strong></td>
<td><strong>Writes equivalent statements using algebraic variables and is content to leave the statements ‘open’, knowing that both sides are equivalent and that the variable used represents the same number each time it occurs (e.g. given the expression ‘3 + a =?’ and being told that the value of a is 5, writes ‘3 + a = 4 + a – 1 = 12 – a – 2 = a – 3 + 6’)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Can justify reasoning and calculation strategies and reasonableness of solutions</strong></td>
</tr>
</tbody>
</table>
The order of operations identifies the appropriate sequence of operations used in calculations to obtain solutions (e.g. the order of operations is applied to solve $5 + 4 \times 6 = 29$)

- Understands that in order of operation problems, multiplication and division come before addition and subtraction, and they work from left to right

- When completing order of operation tasks, uses first, followed by multiplication and division, and then addition and subtraction. Understand that they must work from left to right unless the brackets are on the right-hand side of the equation (e.g. $2 \times 7 + (4 – 1) = 15$)

- Employs mental strategies (e.g. guess and check, commutative property, associative property, distributive property, inverse property)

### Tables of values for functions using input–output rules can be constructed and the resulting ordered pairs graphed (e.g. use a rule that explains the relationships between pairs of terms in a sequence to calculate the value of the 12th term of the sequence)

- Constructs their own simple input–output (function) tables using simple rules involving single operations (e.g. given the rule ‘add 4’ and the input numbers 2, 3, 4, 5, generates a table with an input column showing 2, 3, 4, 5 and corresponding output column for numbers generated (i.e. adds 4 to 2, 3, 4 and 5 and gets corresponding output numbers 6, 7, 8, and 9 shown in the output column next to their input number)

- Given two points on a graph without a scale, can match the points with two given ordered pairs (e.g. given the points (1,6) and (5,3), can indicate which of the points on the graph is which)

- Identifies and continues number patterns and describes what is changing in words (e.g. continues 3, 6, 9, 12… and says ‘The pattern is ‘add 3’ each time’, and continues 2, 5, 10, 17…saying ‘The difference between the first two numbers is 3, the next two numbers is 5, and the next two 7. This makes a new number pattern where the difference is 2 each time’). Writes the points generated as ordered pairs [e.g. (1,3), (2, 6), (3, 9),… and (1,2), (2,5), (3,10)…]

- Explores and interprets functions shown in a graph and predicts from them (e.g. graphs the price for taxi fares for various distances and uses the graph to predict for various distances not shown on the graph)

- Given three points on a graph without a scale, can determine which point represents which value by knowing what the points represent (e.g. knowing that one axis represents height and the other weight, can determine which point might represent Sarah and which might represent Fred given a picture of Fred and Sarah)

- Solves simple equations (involving +, −, ×, ÷) using a variety of methods and substitutes the solution back into the equation to show their answer is correct (e.g. in solving ‘Find the value of the number represented by ‘h’ if $2 \times (h – 3) = 11$’ solves by reading this as ‘$2$ times ‘something’, take 3 is 11 so the ‘something’ take 3 must be equal to 5 and a half. That means the ‘something’, or ‘h’ must be 8 and a half’, and then writes the equation again replacing the ‘h’ with 8.5, calculating to show it equals 11)

- Identifies number patterns that are ‘linear’ by examining the difference pattern and recognising that linear patterns have a constant difference term between the elements of the pattern, and that when these number patterns are graphed in the first quadrant, the points form a straight line (e.g. (1,3), (2, 6), (3, 9),… will form a linear pattern while (1,2), (2,5), (3,10) will not) and plots these points by hand and with a graphing calculator
Knowledge and understandings — Measurement

Relationships between units of measure and the attributes of length, area, volume, mass, time and angles are used to calculate measures that may contain some error.

Timetables and duration of events involving both 12- and 24-hour time cycles in Australian time zones can be calculated (e.g. calculate the length of a flight between the east and west coasts of Australia, taking into account the time difference)

- Knows and uses 12-hour and 24-hour times
- Uses straightforward timetables and programs with both 12- and 24-hour times (e.g. reads a TV program and converts to 24-hour time in order to set a video or DVD recorder)
- Reads and makes straightforward schedules (e.g. makes a time plan for the school sports day by estimating how long events will take)
- Able to convert minutes to hours and reverse

- Knows key times in 24-hour time, that 0000 is midnight; that times between 0000 and 1200 are am and that times after 1200 are pm
- Calculates time elapsed in terms of hours, minutes and seconds from analog and digital timepieces, for both 12- and 24-hour cycles (e.g. time of travel during a flight across different time zones)
- Knows Australian time zones and Australian daylight savings times
- Uses diaries, timetables and timelines to organise data

Appropriate instruments, technologies and scales are used when exploring measurement of length, area, volume, mass, time and angles, where not all of the graduations are numbered (e.g. reading a speedometer between 60 and 70 km/h)

- Understands that to adequately compare and describe something, two or more attributes are better than one (e.g. when comparing two people’s builds, heights and masses provides more information than just height)
- Uses commonsense in the choice of units of length for familiar practical measurement tasks (e.g. uses hand spans for the first rough measure of whether a bookcase will fit through a doorway)
- Understands that a unit of area can be cut and rearranged and still be the same unit (i.e. knows that a square metre is a size and doesn’t have to be a square; a circle or a triangle can have an area of a square metre)
- Uses a grid to enlarge or reduce a figure in a specified way (e.g. given a fish drawn on a square grid, draws another fish three times as long and three times as wide by making all measurements three times longer)
- Knows, understands and uses
  - Millimetre (mm) and kilometre (km)
  - Square metre (m²) and square centimetre (cm²)
  - Cubic metre (m³) and cubic centimetre (cm³)
  - Tonne (t) and kilogram (kg)

- Knows and understands rules for perimeter, area and volume based on relationships between attributes of regular 2D (regular polygons, triangles, circles) and 3D objects
- Chooses and uses an appropriate unit and instrument (or other technology) to measure a required attribute or characteristic (e.g. chooses a tape measure or blackboard ruler to measure heights of students in the class, and knows that this will provide measurements that are ‘accurate enough’ for filling in a personal form)
- Chooses and uses various units of length as being more suitable for various contexts, and measuring tools as giving greater accuracy (e.g. a trundle wheel for measuring the distance of a 400-m running track or a ruler with millimetre gradations to measure the length of a needle)
- Specifies area in terms of units² by first visualising the shape and estimating its area based on the known size of a square centimetre or square metre
- Knows the relationship between length, width and area of a rectangle (e.g. says ‘Two rectangles can have the same perimeter but different areas’)
- Measures and makes angles to a specified size using a protractor or other equipment
- Attends to scale when enlarging figures and objects on grids and with cubes, and understands that for the final object to look the same shape as the original, all lengths have to be scaled by the same amount (e.g. uses a square grid to enlarge a drawing by three times, where one square long in the original equals three squares long in the image, and one cube in the original equals four cubes in the image, even though it’s only twice as big because the length, width and height are all twice as long)
• Uses the language of simple rates to compare (e.g. says ‘My Dad’s car will go 120 km/h, whereas my Mum’s car will only go up to 80 km/h’)
• Knows and understands the duration of time in fractions of a minute or a second

Relationships exist within the International System (SI) of measures, including between millimetres, centimetres, metres and kilometres; kilograms and tonnes; square centimetres and square metres; cubic centimetres and cubic metres (e.g. a load of mulch has a mass of 2500 kg = 2.5 t)

- Adds length and mass measurements in order to calculate total size (e.g. to make up 1 kg of bananas with a scale that only goes to 500 g, weighs a few bananas at a time and adds their weights)
- Knows how many of one size unit there are in the next size unit (bigger and smaller) (e.g. knows there are 1000 mg in a gram and 1000 g in a kilogram)
- Uses equivalent measurements e.g. 6 mm = 0.6 cm = 0.006 m
- Knows and understands that the International System (SI) has seven base units
- Is familiar with SI units of measurement and can distinguish them from ‘older units’, such as tons, inches and pints, and pinch, smidgen and tad
- Can select appropriate measuring instruments (e.g. speedometer)
- Can identify relationships between metric units (e.g. 2.75 kL = 2750 L) and can convert from one size unit to the next size unit (e.g. metres to centimetres). Converts 3.4 m to 340 cm and vice versa; 4.1 cm to 41 mm and vice versa)
- Knows angles in terms of what fraction of a whole turn they are (e.g. half a turn is 180°)
- Knows the names of longer periods of time, including decade and century
- Knows and uses the relationships and equivalence of measures
  - Kilometre and metre (1 km = 1000 m)
  - Centimetre and millimetre (1 cm = 10 mm
  - Tonne, kilogram and gram (1 tonne = 1000 kg = 1 000 000 grams)

Relationships between attributes of regular 2D shapes and 3D objects can be used to develop rules that allow perimeter, area and volume to be calculated (e.g. using base area height to find the volume of a triangular prism)

- Measures the volume of prisms made up of cubes by counting the number of cubes in one layer of the prism and multiplying by the number of layers
- Knows the relationship between the length of a side of a square and its perimeter (e.g. says ‘Since a square has four sides of the same length then one side is a quarter of the perimeter’)
- Rules for calculations of area, (e.g. counting squares and part squares)
- Understands and uses relationships between
  - Length of side and perimeter
  - Length, width and area of rectangles
  - Perimeter and area
- Calculates the surface area of shapes and objects, such as cubes and rectangular and triangular prisms, and makes a judgment about the reasonableness of the result based on estimation
- Specifies volume in terms of units by first visualising the container or space and estimating its volume based on the known size of a cubic centimetre or a cubic metre
- Calculates the volume of cubes, rectangular and triangular prisms (using base × perpendicular height) and makes a judgment about the reasonableness of the result
- Develops and applies formulae for the perimeter (and area) of triangles and parallelograms, given the relevant lengths of sides, and judges the reasonableness of results by estimating perimeters and areas before applying the formula to particular shapes
- Knows understands and uses mathematical language (e.g. diameter, circumference, base of triangles, base of prisms)
- Knows equivalent forms of standard units (e.g. 1.5 km = 1500 g; 600 mL = 0.6 L)
Measurement involves error, which can be reduced through the selection and use of appropriate instruments and technologies (e.g. if several students use a stopwatch to time a 100-m race, the winner’s time is only likely to be accurate to the nearest one-tenth of a second because of different reaction times)

- Chooses an appropriate unit and instrument or other technology to measure a required attribute or characteristic (e.g. chooses a tape measure or blackboard ruler to measure height of students in the class, and knows that this will provide measurements that are ‘accurate enough’ for filling in a personal form)

- Finds or make things with one measurement the same but another different (e.g. two objects with mass of 300 g but different volumes)

- Understands that all measurement involves some error as all measurements are approximations, and determines this by engaging in independent measurement tasks and comparing results with peers

Estimation strategies are used to identify a reasonable range of values for a measurement (e.g. the liquid left in a partially full 1-L bottle is estimated to the nearest 50mL)

- Recognises when an estimate is sufficient and when they need to measure (e.g. to order a new bookcase over the phone they need to measure rather than describe by saying ‘It’s about 1 m wide’)

- Estimates whether an angle is greater or less than 90° and can ‘make’ angles of more, equal to or less than 90° using their arms

- Estimates the circumference of a circle by exploring the relationship between the circumference and diameter (i.e. realises that the circumference is about three times as long as the diameter) and uses ‘×3’ as a rough approximation for estimating the length of a circumference if they know the diameter

- Reads and records measurements from calibrated scales in which intermediate gradations are not numbered (e.g. a medicine glass, a speedometer)

- Identifies unreasonable estimates of measurements based on their ability to ‘see’ the unit in their mind’s eye (e.g. says ‘There is no way our backyard is 2 ha’)

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Knowledge and understandings — Chance and data

**Probability of events can be calculated from experimental data. Data can be summarised and represented to support inferences and conclusions.**

Events have different likelihoods of occurrence, and estimates of probability can be expressed as percentages, common fractions or decimal fractions between 0 and 1 (e.g. the likelihood of drawing a red card from a 52-card pack can be represented as 50%, ½ or 0.5)

- Orders some easily understood statements (e.g. ‘Tomorrow is Monday’, ‘My teacher will come to school with her head shaved’, ‘In three days it will snow’) from least likely to most likely
- Becomes familiar with a pack of cards and knows that each card is equally likely to be drawn in a random selection, and that there is 1 in 4 chance that a card from a given suit will be drawn, and can explain why
- Uses mathematical language — (e.g. impossible/certain, bias, more/less spread out, dumped, majority, average (colloquial use with visual estimate), maximum/minimum, frequency/relative frequency, theoretical probability, discrete data)
- Describes probabilities in terms of a number between 0 (impossible) and 1 (certain), and places informal expressions of chance (e.g. good chance, even chance) on the scale between these two extremes
- Identifies events as more or less likely or equally likely (e.g. although each card is equally likely to be drawn at random from a 52-card pack, an ace is less likely to be drawn than a red card)
- Determines empirical estimates of probability (e.g. uses last season’s performance data to estimate that a player has 50% chance — or 1 in 2 — of scoring on a single free shot during a basketball game)
- Uses language (e.g. equally/unequally likely, spread, range, extremes (maximum and minimum), frequency/relative frequency)

**Experimental data for chance events can be compared with theoretical probability** (e.g. comparing the data gathered from tossing a six-sided dice 50 times with the theoretical probability of how many times the dice would land on a 6)

- Understands that chance can be measured theoretically but that, in reality, these results are not always found (e.g. knows theoretically that there is equal chance of getting as many heads as tails when tossing a coin a number of times, but that in reality this is not always the way it turns out)
- Can make suggestions about possible bias if the real results are too far from the predicted results (e.g. if they get 80 heads in 100 tosses of the coin, they might suggest that the coin is biased or ‘weighted’ in some way)
- Probability using experimental data
- All possible outcomes within an activity or experiment — sample spaces
- Frequency: the count of occurrences of an event occurring (e.g. rolling an even number on a die)
- Compares experimental data from simple trials with theoretical probability (e.g. knows that theoretically one should get equal numbers of heads as tails when tossing a coin a number of times, but is not surprised when tossing a coin four times results in three heads)
- Can determine the sample space for an experimental ‘event’ (e.g. knows there are six possibilities when throwing a 6-sided die, there are two possibilities when tossing a coin or kicking a goal, and there are 52 possibilities when drawing a card from a pack of playing cards)
- Uses language (e.g. subjective and numerical judgements, probability expressed as per cent, fraction, decimal)

**Data may be discrete and can be allocated to categories or numbered** (e.g. gender is a discrete variable — the numbers of male and female students in a class)

- Realises that it is sometimes helpful to group data and, given the class intervals, can group data involving whole numbers into class intervals (e.g. each student, having estimated the number of shells in a jar, can organise the estimates in intervals such as 41–45, 46–50, 51–55…)
- Knows and understands discrete data (e.g. numerical, categorical, count)
- Knows the difference between sample and population data (e.g. knows that the ages of students in a Year 7 class is a sample of the ages of all Year 7 Queensland students)
- Knows the difference between discrete (e.g. eye colour, number of sandwiches brought to school) and continuous data (e.g. height, weight) where these measures can take on any value on a continuum
Data may be continuous and described as distributions of quantities (e.g. growth of a plant; time elapsed)

- Knows and explains the difference between discrete (e.g. eye colour, number of sandwiches brought to school) and continuous data (e.g. height, weight) where these measures can take on any value on a continuum

Sample data drawn from a given population can be summarised, compared and represented in a variety of ways (e.g. two-way tables, pie charts, bar or line graphs)

- Revises a survey question so it can be answered with yes/no or a simple multiple choice (e.g. changes ‘Which foods do you like?’ to ‘Which two foods should be included for the class picnic?’) and provides a choice from which to choose
- Uses technology-generated graphs by first entering data on a spreadsheet, viewing different displays to select the best way to display the information for their purposes, and making simple statements about why they chose a certain type of graph (e.g. says ‘A pie chart is best because you can see at a glance that there are more people who like that type of film and you don’t need details about how many in each group’)
- Analyses information presented in tables, bar and line graphs, and diagrams, and asks questions about that data for a peer to answer, providing suitable answers to the questions as well
- Uses verbal skills to make informal inferences developed, justified and critiqued
- Uses written
  - Spreadsheets
  - Calculations of probability as key percentages between 0% (impossible), 50% and 100% (certain)
  - Plans and methods for data collection
  - Summarised and represented data
  - Design of data record templates according to question and type of data
  - Scatter graphs (dot plots)

- Infers things about a population from a given sample (e.g. if all students in their Year 7 class are 12 years old, they infer that most Year 7 children in Queensland are 12)
- Develops a simple survey to generate yes/no answers and trials it with classmates (e.g. uses questions including ‘Do you think year 7s should do homework?’)
- Uses two-way tables to represent categorical data (e.g. the proportion of boys/girls with blue/green eyes)
- Displays data in bar graphs where the frequency axis is scaled with multiples such as 5, 10, 15, … and grouped measurement data is treated in categories (e.g. graphs frequencies for the groups 23–25, 26–28…)
- Uses technology-generated graphs by first entering data on a spreadsheet, viewing different displays to select the best way to display the information for their purposes, and justifies their choice in the context (e.g. says ‘We chose a line graph because we needed to show what was happening over time in order to answer the question about whether the number of people going to the movies is decreasing’)
- Reads and makes sensible statements about the information provided in tables, bar and line graphs, and diagrams, and comments on how well the data answers their own questions, informally describing any trends in their data (e.g. says ‘We wanted to know which foods to take on the camp but the question we asked just told us people’s favourite foods. Next time we would…’ and ‘This shows that we raised most of the money in the first three weeks and then the amount dropped off during the last two weeks’). Conclusions from data are developed, justified and critiqued
- Understands and uses written spreadsheets, frequency tables, calculations of probability, data representations (pie chart, two-way table, bar or line graph), plans and methods for data collection and recording, and displays to illustrate data features and variation
<table>
<thead>
<tr>
<th>Measures of location, such as mean, median and mode, and frequency and relative frequency, can be used to explore distributions to sample data (e.g. the mean is the average, the median is the middle value in ascending order, the mode is the most common number, relative frequency is the chance of landing on red with spinner)</th>
</tr>
</thead>
</table>
| **•** Describes variation within a data set acknowledging a sense of what the numbers might mean (e.g. says ‘More than half of us like that show’ and ‘Less than a quarter of the parents like it’)
| **•** Uses ‘average’ in a colloquial, vernacular way (e.g. says ‘My average score was five’) knowing that average is used as a measure of ‘centredness’
| **•** Can find mean |
| **•** Can use measures of location such as mean, median and mode (for discrete data)
| **•** Describes variation in data in terms of relative frequency (e.g. over 80% of students in the basketball team are taller than 1.7 m compared with less than 20% of students in the soccer team) and interprets variation between data sets (e.g. having noted that one football team has older, more experienced players than the other they explain the possible effect of this difference)
| **•** Calculates the mean, median and the mode (measures of location or ‘centeredness’) by first estimating, knowing that these result in a single figure that is ‘central’ to the set of numbers, and discusses the usefulness of each of these three measures for particular contexts (e.g. mode for shoe size, median for a set of house prices and mean for a set of numbers evenly spread)
| **•** Uses measures of location to make general statements about data sets (e.g. knowing that the mean rainfall in January is 30 cm more than the mean rainfall in June, says ‘It rains more in January than in June’)

<table>
<thead>
<tr>
<th>Variation and possible causes of bias can be identified in data collections (e.g. the method of collection may exclude possible participants; the personal opinions of participants may obscure data collection)</th>
</tr>
</thead>
</table>
| **•** Students create a variety of graphs to show that data can be manipulated in a number of ways. Students will need to alter the axis to show that bias can be shown in representing data (e.g. show a scale of 0–100 in 20s and a scale of 0–100 in 5s. (e.g. fuel and house prices)
| **•** Students create a variety of graphs to show that data can be manipulated in a number of ways. Students will need to alter the axis to show that bias can be shown in representing data (e.g. show a scale of 0–100 in 20s and a scale of 0–100 in 5s (e.g. fuel and house prices)
## Knowledge and understandings — Space

**Geometric conventions can be used to classify, represent and manipulate geometric shapes. Mapping conventions can be applied in the construction and use of maps and plans.**

Geometric conventions, including length, angle size and relationships between faces, are used to classify 2D shapes and 3D objects, including part and composite shapes (e.g. isosceles triangles have two equal sides and two equal base angles)

- Knows and uses regular and irregular polygons (e.g. triangles, quadrilaterals, pentagons, hexagons, octagons and dodecagons)
- Knows and uses specialised names of prisms and pyramids by their base shape (e.g. square-based pyramids and tetrahedrons)
- Knows and understands spheres and hemispheres
- Knows and uses geometric properties (e.g. equal base angles, diagonals of a polygon)
- Knows and uses symmetry (e.g. lines, planes, points, rotational and angle of rotation)
- Knows that the sum of the internal angles of a triangle is 180°, and can demonstrate by making a template of each angle and laying them next to each other on a straight line)
- Explains why a triangle cannot have two right angles

- Identifies prisms, pyramids, spheres and cylinders, and describes part and composite shapes and objects in terms of their properties (e.g. says ‘That tent looks like a triangular prism, so the two ends must both be congruent triangles’)
- Describes and classifies triangles and quadrilaterals in terms of sides and angles (e.g. says ‘An isosceles triangle has two equal sides and two equal base angles, and the sum of the three internal angles is 180 degrees’)
- Identifies properties of squares, rectangles, parallelograms, trapezia, pentagons, hexagons, octagons and circles, and describes parts (e.g. semi-circles) and composite shapes (e.g. star shapes)
-Knows 2D shapes such as circles (e.g. concentric, non-polygons, including ellipse) and parts of 2D shapes (e.g. semicircle, quadrant)
- Knows 3D objects, plans, nets and isometric view (three-dimensional view that shows the height, width, and depth of an object)
- Knows that composite shapes (e.g. 4-, 5- and 6-pointed stars) are made of a number of distinct shapes
- Knows that the sum of the angles of the internal angles of a quadrilateral is 360°, and demonstrates this by tearing/cutting each of the internal angles from a quadrilateral drawn on paper and placing them around a point

### 2D shapes can be sketched or accurately represented using drawing instruments and software to reflect their geometric properties (e.g. using a pair of compasses and a straight edge, or geometry software, to draw a plan for a kite)

- Describes a 2D shape to a peer so that they can draw or recognise it (e.g. over the phone or in writing), referring to the properties of the shapes and correct names of the shapes (squares, rectangles, parallelograms, trapezia, pentagons, hexagons, octagons and circles)
- Sketches or accurately draws 2D shapes using drawing instruments or software

- Draws squares, rectangles, parallelograms, trapezia, pentagons, hexagons, octagons and circles using their properties (using compasses and technological drawing software) and pays attention to the conventions of drawing, including the use of perspective
- Knows geometric properties of circles (e.g. radius, diameter, centre, circumference, chord, tangent)

### 3D objects can be constructed from plans, nets and isometric diagrams (e.g. constructing a model of the buildings in a street using multi-link cubes)

- Recognises and matches a bird’s-eye view, front view and side views of a 3D shape with the actual shape and explains why it is a match

- Draws the nets of prisms, pyramids and cylinders by hand or with drawing software, or, given their nets, constructs the shapes using materials or drawings
• Recognises and draws the net of a cube and knows that there are many different nets that can be drawn for this object
• Describes a 3D shape to a peer so that they can draw or recognise it (e.g. over the phone or in writing), referring to the properties of the shapes and using the correct words to describe the faces and angles, including the correct names of the faces
• Inspects a 3D shape (pyramid or prism), puts it aside and then selects 2D shapes to match the faces of the 3D shape
• Uses drawing conventions, including dotted lines, to indicate what they can’t see in reality but what they can visualise

<table>
<thead>
<tr>
<th>Congruent shapes are the same shape and size, and can be superimposed on one another through a sequence of transformations, involving reflections, rotations and translations (e.g. constructing a mosaic pattern from a plan drawn to scale)</th>
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<tbody>
<tr>
<td>• Decides whether a rotation, reflection, or translation is involved in producing a symmetrical arrangement and describes it using spatial language (e.g. says ‘The logo for that business is based on a triangle that is repeated three times and then fits back on itself and so it has rotational symmetry’)</td>
</tr>
<tr>
<td>• Knows that two shapes are congruent if one flips, slides or turns (or a combination of these) exactly onto another. Knows that if it folds exactly onto itself over a mirror line, it is symmetrical and the original shape and its image are congruent and have a line of symmetry, and can explain and show why using an example</td>
</tr>
<tr>
<td>• Knows and uses the word ‘congruence’, and the written symbol (≅) and congruent markings on segments and angles</td>
</tr>
</tbody>
</table>

• Combines what they see with what they think is there based on their knowledge of shapes, and describes it (e.g. describes a cube from a 3D drawing, using their knowledge of the properties of cubes and reasoning)
• Drawings of 3D objects and composite shapes from different viewpoints and orientations

• Identifies lines of symmetry for 2D shapes using mirror lines, and identifies points and angles of rotational symmetry (e.g. says ‘A snowflake (or pentagon) has a point of central rotation and an angle of rotation of 72 degrees about the point’)
• Comparison of shapes by superimposing them through a sequence of transformations
• Connections between transformations, tessellations of suitable shapes in the plane and points, lines and planes of symmetry
• Uses mirrors, geometric drawing tools, geometry software and manipulative materials to make shapes and transformations
• Makes mosaic patterns from plans drawn to scale
### Points, lines and planes of symmetry

- Uses single, congruent, regular shapes to produce tessellations on a flat surface (e.g. makes/draws a brick pattern for paving)
- Knows and understands tessellations using iterative single transformations

- Knows and uses lines and planes of symmetry, including:
  - Lines of
  - Point of
  - Planes of
    - Rotational (including angle of rotation)
- Identifies lines of symmetry for 2D shapes using mirror lines, and identifies points and angles of rotational symmetry (e.g. says ‘A snowflake (or pentagon) has a point of central rotation and an angle of rotation of 72 degrees about the point’)
- Identifies lines and planes of symmetry for 3D objects, and tests whether 2D and 3D shapes are symmetrical; applies symmetry to construct 2D and 3D shapes using paper folding and/or technological drawing software
- Recognises symmetry and congruence, and relates these to transformations and patterns involving shapes in the plane; describes these relationships using correct terminology (e.g. says ‘All of the triangles in that border pattern are congruent and the next one along is found by rotating the one before it 90 degrees’)
- Uses two regular shapes to produce a tessellation on a flat surface (e.g. makes/draws a brick pattern for paving) by using one different shape that fits inside another a number of times with no overlaps, including a square and the two triangles that symmetrically fit inside it

### Maps and plans

- Holds a map with the north point in front of them and can determine whether to turn left or right in real life based on the position on the map
- Calculates distance between grid reference points; accurately uses simple scales, including 1 cm = 10 cm on a drawing, to determine the exact length of an object; uses 1 cm = 10 m on a plan to determine the exact length of a room or other part of the school grounds
- Provides and follows instructions for moving from one location to another based on plans and maps, referring to distance, left and right, and angles in degrees (e.g. says ‘To get to the shop go down this road about 200 m, and turn left’ and ‘Go straight and then turn to the right 45 degrees’)
- Accurately draws maps and plans that include scale in familiar contexts (e.g. places a bus stop closer to a school than a shop on a map using straight-forward scales, including 1 cm = 100 m accurately, and, given that a 20-m wall of a house measures 5 cm on a plan, calculates that the scale is 1 cm = 4 m)
- Accurately calculates distance between locations
Mapping conventions, including coordinates, compass points and scales, are used to specify and identify locations on maps and plans (e.g. applying coordinates, compass points and scale when orienteering)

- Knows and uses mapping conventions
  - grid references, poles, key lines of reference on globe and flat map of earth (e.g. equator, prime meridian, international date line)
  - coordinates
  - compass points (north (N), south (S), east (E), west (W), south-east (SE), north-west (NW), south-west (SW))
  - basic orienteering conventions
- Knows how to read coordinates on a map, going left or right along the horizontal axis first and then up or down the vertical axis, and that a coordinate point (e.g. D5) describes a whole grid square not a point
- Can read and understand simple orienteering maps and directions

<p>| • Uses distance, compass points (including NE, NW, SE, SW), fractions of a turn ((\frac{1}{2}), (\frac{1}{4}), (\frac{1}{8}) and multiples of these), angles in degrees, grids and coordinates to read and follow simple maps |
| • Uses mapping conventions (e.g. coordinates, compass points, scales) |
| • Uses manual (flat maps and globes) and electronic maps |</p>
<table>
<thead>
<tr>
<th>Ways of working</th>
<th>Year 8</th>
<th>Year 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyse situations to identify the key mathematical features and conditions, strategies and procedures that may be relevant in the generation of a solution</td>
<td>• Produces a systematic approach to solving a problem (e.g. for getting a group of people over a river)</td>
<td>• Makes assumptions about a context based on the situation (e.g. when asked which container is ‘bigger’, assumes that they are determining capacity since it is a container, and computes based on that assumption, drawing attention to their assumption in communicating their result)</td>
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<tr>
<td></td>
<td>• Chooses and uses aspects of mathematics to carry out investigations, model situations and solve problems (e.g. analyses data from a data logger or video to model the distance travelled by a falling rock in a given time), and discusses the limitations of the model</td>
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<tr>
<td>Pose and refine questions to confirm or alter thinking, and develop hypotheses and predictions</td>
<td>• Asks clarifying questions and, on reflection, suggests questions left unanswered by their mathematical work</td>
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<tr>
<td></td>
<td>• Systematically generates and lists possibilities, and explains why they think they have listed them all</td>
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<tr>
<td>Plan and conduct activities and investigations using valid strategies and procedures to solve problems</td>
<td>• Plans and conducts inquiries that require them to pose questions and formulate propositions, hypotheses or conjectures related to a given context, and uses a range of strategies (e.g. considers the safety of surf conditions at a given location on a particular day and time in terms of wind and current strength, and direction and tide height)</td>
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<tr>
<td>Select and use mental and written computations, estimations, representations and technologies to generate solutions and check for reasonableness of the solution</td>
<td>• Students identify and create representations of patterns and functions, and apply backtracking to solve simple equations that involve combinations of the four operations</td>
<td>• Alters answers obtained mathematically to make them fit the realities of the situation by rounding appropriately (e.g. stating that the number of buses needed for an outing is 6 even though calculated result is 5.334)</td>
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<td>• Uses technology to explore patterns and structures, and general representations of these (e.g. cycles in calendars, computer-generated designs, Escher-type prints or snowflakes)</td>
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<tr>
<td>Use mathematical interpretations and conclusions to generalise reasoning and make inferences</td>
<td>• Provides a clear account of their mathematical reasoning behind a particular result or application</td>
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<tr>
<td>Evaluate their own thinking and reasoning, considering their application of mathematical ideas, the efficiency of procedures and opportunities to transfer results into new learning</td>
<td>• Generates new mathematical questions and conjectures based on their results.</td>
<td>• Evaluates their working and solution to the question posed by checking that their solutions both fulfil each of the original problem ‘givens’ and ‘do the job’ (e.g. checks that the carton they have made actually holds 1 L)</td>
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<td></td>
<td>• Checks results for accuracy at each stage of solving problems</td>
<td>• Tests and checks the validity of propositions by identifying counter examples (e.g. tests the claim that all dice being used are biased, or all numbers, such as $4n – 1$, are odd)</td>
</tr>
<tr>
<td>Communicate thinking, and justify and evaluate reasoning and generalisations, using mathematical language, representations and technologies</td>
<td>• Evaluates, reflects on and communicates the processes used during an investigation, exploration and other inquiry situation by describing their analysis of the situation; decisions about what is required; assumptions about what technologies, models, strategies, tools and methods they used; the effectiveness of their application of these; results obtained; and appropriateness of their choices and applications, following the analysis/interpretation of their results in context</td>
<td>• Communicates findings and processes in various formats, making choices depending on the purpose of their presentation and their audience</td>
</tr>
<tr>
<td>Reflect and identify the contribution of mathematics to their own and other people’s lives</td>
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<td>----------------------------------------------------------------------------------------</td>
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<tr>
<td>• Researches and reports on different ways numbers are used in society (e.g. Dewey system, labelling sections in a paper, cricket overs, petrol prices, 10-point type face), and explains why they are different and yet appropriate for different circumstances)</td>
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<tr>
<td>• Knows and respects differences between Western mathematics and other ways of imposing order in society through naming, ordering, valuing and pattern (e.g. using perimeter to delineate boundaries for ownership compared with using physical features, such as rivers and mountains, to delineate territory; using latitude and longitude to locate places compared with an affinity with the land)</td>
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</table>

<table>
<thead>
<tr>
<th>Reflect on learning, apply new understandings and justify future applications</th>
</tr>
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<tbody>
<tr>
<td>• Asks clarifying questions and, on reflection, suggest questions left unanswered by their mathematical work (e.g. says ‘The method worked for all the shapes I used but I’m not sure it would work for triangles’)</td>
</tr>
<tr>
<td>• Discriminates between important and incidental information in a context or situation, and states related assumptions or conditions, varying these in a context if needed (e.g. questions the level of accuracy needed and decides, as a result, to calculate to four decimal places when working with currency conversions)</td>
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</table>
### Knowledge and understandings — Number

**Number properties and operations, and a range of strategies, can be applied when working with integers and rational numbers.**

**Rational numbers (integers, fractions and decimals) can be represented and described in different ways, including using scientific notation and index notation, for a variety of purposes**

- Understands that $10^{-1}$ is the same as $\frac{1}{10}$ and 0.1
- Knows the place value interpretations for uncommon number representations (e.g. ‘3.45 tens’ is the same as 34.5)
- Understands place and face value concepts for large and small numbers (e.g. reads 34 507 628 as ‘thirty four million, five hundred and seven thousand six hundred and twenty-eight’, and explains that the ‘3’ tells you there are three ‘ten millions’ and ‘0’ tells there are no ‘ten thousands’)
- Reads 4.205 as ‘four point two zero five’ and explains the 0 tells us there are no hundredths’, while the 0 in 3.540 tells us there are no thousandths
- Explains why money and measures use decimal notation (e.g. says ‘5 dollars and 16 cents is written as $5.16, and 5 m 16 cm is written as 5.16 m because there are 100 cents in a dollar and 100 cm in a metre’)
- Draws or visualises a diagram to compare two fractions of the same unit (e.g. draws $\frac{2}{3}$ of a circle and $\frac{3}{5}$ of a circle the same size to compare which has the greater area, and locates each fraction on a number line)
- States fractional equivalents in words and symbols (e.g. says ‘We found one quarter of the chocolate was the same as two eighths of it’)
- Uses scientific notation to interpret very large or very small numbers in practical situations including results arising from the use of technology (e.g. where a total national debt of $234 billion = 234 000 000 000 = 2.34 \times 10^{11}$ is represented as 2.34 E11, or the diameter of superfine micron wool is $11 \times 10^{-6}$m, which is expressed as 1.1 E-6)
- Partitions decimals in standard ways (e.g. $0.345 = 0.3 + 0.04 + 0.005$) and uses place value to partition decimals flexibly (e.g. $0.48 = 0.3 + 0.18$)
- Expresses any natural (counting) number as a product of powers of prime numbers (e.g. the factor tree for 36 000 is $25 \times 3^2 \times 5^3$)

**Rational numbers (integers, fractions and decimals) can be used to describe and solve problems involving rate, ratio, proportion and percentage (e.g. if the exchange rate for one Australian dollar is 0.7624 US dollars, find how many US dollars A$550 buys)**

- Understands that percentage is about fractional values as ‘out of 100 equal parts’
- Estimates a fraction of a whole and explains their reasoning (e.g. says ‘$\frac{2}{5}$ of 32 is about 13 because $\frac{2}{5}$ of 30 is 6, and so $\frac{2}{5}$ is 12 so it’s a bit more’)
- Interprets published ratios and rates in order to make comparisons (e.g. uses mortality rates to compare illnesses; compares prices in junk mail including 375 g for $2.50 compared with 500 g for $4.25 for the same product)
- Expresses any natural (counting) number as a product of powers of prime numbers (e.g. the factor tree for 36 000 is $25 \times 3^2 \times 5^3$)
- Uses equivalent fractional, decimal and percentage forms (e.g. $\frac{1}{8} = 0.375 = 37.5\%$; $2\% = 2.444\ldots \approx 244\%$)
- Distinguishes common fractions that show the ratio of parts to the whole from ratios that describe parts to parts (e.g. says ‘The cordial to water was 1 to 4 so the fraction of cordial is $\frac{1}{5}$’)
- Recognises percentage as a way of describing a ratio of part to whole, where all the denominators have been made 100 to allow easier comparison
- Interprets and uses percentages to make straightforward comparisons (e.g. says ‘Yesterday I got 26 balls from 50 tries, which is 52%. Today I got 24 from 40 tries, which is 60%, so I might be improving a bit’)
- Uses the more common equivalences between common fractions and percentages when comparing quantities (e.g. says ‘50% off is the same as $\frac{1}{2}$ off’, and ‘30% off..."
the price isn’t as good as \( \frac{1}{3} \) off’ and explains why)

- Given a ratio of two or more decimal numbers, determines corresponding proportions, percentages or rates in order to solve problems (e.g. given the exchange rate for one Australian dollar is 0.7304 US dollars can determine how many US dollars 550 Australian dollars will buy)

- Critically interprets published percentages by deciding what the ‘whole’ is first (e.g. knows what ‘Increased by 200%’ means and determines whether it is correctly used in an advertisement)

### Rational numbers and decimal approximations of irrational numbers, including \( \pi \), can be represented on the real number line

- Knows what irrational numbers are
- Arranges four numbers of any size in order of value
- Represents any integers, and halves and quarters (e.g. \( 2\frac{3}{4}, -3\frac{1}{2} \)) on a number line, and approximations for some irrational numbers including 0.333… and 0.666…
- Expresses two fractions with a common denominator in order to decide which is greater (e.g. \( \frac{2}{3} \) is smaller than \( \frac{3}{4} \) because \( \frac{14}{21} \) is greater than \( \frac{15}{22} \))

- Locates integers, decimals, fractions and decimal approximations to some irrational numbers on the real number line (e.g. 3.5, \(-\frac{2}{5}\), \( \pi \), \( \sqrt{90} \))
- Finds a number between two decimals using a number line (e.g. between 2.34 and 2.35)
- Converts one form of a rational number to another in order to interpret practical situations (e.g. converts 67% to approximately \( \frac{2}{3} \) to make sense of a sign saying ‘67% full’)

### Decimal approximations of irrational numbers can be used in geometric contexts (e.g. when finding the area of a circle, represent \( \pi \) as 3.14)

- Determines a decimal approximation to a given degree of accuracy in a practical situation (e.g. determines the side of a square with area given in square metres, to the nearest centimetre)

### Estimates with upper and lower boundaries can be formed (e.g. when splitting a $245 restaurant bill between 6 people, each share will be between $40 and $50)

- Estimates the result of a calculation based on their knowledge of numbers and operations, and justifies their estimate (e.g. estimates that 38 × 495 will be about 40 × 500, which is 4 × 5 with three zeros, saying ‘The answer will be in the thousands because tens multiplied by hundreds gives thousands’)

- Finds upper and lower estimates for calculations, and forms closer estimates within this interval for computation in a given context (e.g. for splitting a restaurant bill among several people). Forms estimates for square roots (e.g. says ‘\( \sqrt{500} \) is between 20 and 30 because the square root of 400 is 20 and 30 squared is 900’ and ‘2 times \( \pi \) is a bit more than 6 because \( \pi \) is just more than 3’).
Problems can be interpreted and solved using rational and irrational numbers, including integers, simple powers and square roots, and conventions of the four operations to generate solutions using mental, written and technology-assisted strategies (e.g. 20 billion divided by 350 000; (67.43 + 104.512 – 89.99) ÷ 241)

- Uses an efficient method to evaluate powers on a calculator (e.g. uses the $xy$ key)
- Knows how to divide when the divisor is less than 1 (e.g. knows that to calculate how many pieces of string 0.3 metres long can be cut from a roll of string 2 m long, they need to divide 2 m by 0.3 m)
- Knows to multiply when the multiplier is a fraction or decimal less than 1 (e.g. when given the cost of 1 m of ribbon, knows to multiply it by 0.75 to find what 0.75 m will cost)
- Multiplies and divides decimals by 1-digit numbers, interpreting remainders for division and deciding whether to round up or down depending on the context (e.g. divides 39.5 by 6 to share $39.50 among 6 people, calculates the answer as 6.5833... and knows to round the answer to $6.55 because if they round up to $6.60 there will not be enough money to share equally)
- Calculates and recalls simple powers and square roots (e.g. $3^4 = 3 \times 3 \times 3 \times 3$ and $\sqrt{169} = 13$) mentally and uses technology for more difficult cases (e.g. $\sqrt{4509}$)
- Uses a calculator to express one quantity as a percentage of another, and to find fractions and percentages of numbers (e.g. can find 38% of 4500), estimating first to gain a sense of the reasonableness of the answer produced
- Knows how to use the ‘+/-’ key on a calculator when entering a subtraction and erroneously entering the smaller number first
- Applies number facts and properties to carry out mental calculations (e.g. says ‘The GST on $156 is $15.60, which gives a total of $171.60’)
- Understands the effect of multiplying and dividing by fractional and decimal numbers less than 1 (e.g. when given a number such as 220 and challenged to find a number to multiply it by to get 200 using a calculator, selects a number slightly less than 1)
- Understands that dividing a fraction by a fraction will result in a number greater than the initial fraction (e.g. recognises that $\frac{2}{5} \div \frac{3}{4}$ could not possibly be $\frac{1}{5}$).
- Calculates problems involving two integers and a single operation using effective written methods (e.g. calculating 20 billion divided by 350 000, or $546 \times -389$) by estimating first (e.g. says ‘546 × 389 is about 550 × 400, which is about 22 000, so I’m expecting about –22 000’). Understands that the written method will not necessarily be an algorithm but may be based on their understanding of numbers and number properties (e.g. $546 \times 300 + 546 \times 80 + 546 \times 9$)
- Knows how to increase numbers by a percentage using a calculator (e.g. knows that to increase a value by 20%, they need to multiply it by 1.2)
- Uses technological calculation tools to carry out efficient computations (e.g. $\sqrt{27.43 – 18.62}$, $4 800 \times (1.05)^{10}$ to calculate compound interest), giving answers to a reasonable level of accuracy
- Using technology, carries out computations involving decimal approximations to irrational numbers in measurement contexts and to given degrees of accuracy (e.g. says ‘The diagonal of a rectangle with side lengths 10 m and 5 m is $\sqrt{125} \approx 11.18$ or 11.2 metres to 1° of accuracy’ and ‘A circle with a circumference of 100 m has a diameter of $100 \div \pi$, which is about 31.8 m’)
- Understands that the sequence of operations used by simple technologies (e.g. a four-function calculator) may differ, and checks and interprets these when using them
- Explains the sequence of operations needed to duplicate the sequence of operations used by a calculator (e.g. says ‘To show using a calculator that $(3 \times 4) \div (2 \times 6)$ is equal to 1, I need to press the $\div$ key twice because I’m dividing by 2 and 6’)
- Applies commutative, associative and distributive properties when calculating
• Uses materials to explain the associative and commutative properties for multiplication and addition to their peers using specific examples, and then generalising to show that it works every time (e.g. uses a 3-by-5 array of blocks to show that 3 rows of 5 blocks will always be 15 blocks, and that 5 rows of 3 blocks will be the same) mentally (e.g. says ‘29 × 7 is the same as 20 × 7 plus 9 × 7, which is 140 + 63, which is 203’)

• Chooses a suitable level of accuracy for a calculation, depending on the context and reason for calculating (e.g. to order a load of mulch for a garden, they would use cubic metres not litres or metres)

Financial decisions can be made based on the analysis of short- and long-term benefits, and consequences of cash, credit and debit transactions (e.g. cost–benefit analysis of a variety of mobile phone plans)

Financial transactions for the provision of goods and services may incur additional costs determined by government and organisations (e.g. goods and services tax and transaction fees on everyday bank accounts)

- Knows how, and can explain why, supermarkets round total money amounts but not individual item amounts (e.g. if four people each buy an item for 21c, they will each pay 20c; if one person buys four items at 21c each, they will pay 85c total)
- Makes sound financial decisions based on income, expenses and personal need (e.g. a mobile phone plan)
- Knows that money used in business and finance is usually represented with four decimal places, and is truncated to the nearest cent depending on the context
- Explains their choice of a mobile phone plan using mathematical language
- Knows that purchases of goods and services incur government charges (e.g. tax on salary or GST)
### Knowledge and understandings — Algebra

**Variables, algebraic expressions and equations, relationships and functions can be described, represented and interpreted.**

**Variables and constants are represented using words and symbols when writing expressions and equations (e.g. \( V = \pi r^2 h \) where \( V \) is the volume of a cylinder in m\(^3\), \( r \) is the radius in metres and \( h \) is the height in metres)**

- Expands numbers and variables represented by index powers (e.g. \( 3^4 = 3 \times 3 \times 3 \times 3 \) and \( y^3 = y \times y \times y \))
- Understands concatenation (i.e. that ‘3x’ represents ‘3 lots of whatever number \( x \) represents’ since \( x \) is a variable quantity; if \( c \) represents the number of cats, then ‘4c’ does not represent four cats but ‘4 lots of the number of cats’) and can complete a table showing different representations
- Uses a diagram to show \( (a + 2) \times (a + 3) = a^2 + 5a + 6 \) and \( (2x)^2 = 4x^4 \) to show that \( x^3 \times x^2 = x^5 \) and \( x^5 \div x^2 = x^3 \)
- Uses words and symbols to represent variables and constants, and interprets algebraic expressions for relationships developed in context

### Algebraic relationships can be modelled, interpreted and evaluated using integer, decimal and fraction values of variables (e.g. explore the relationship between area, width and length of a rectangle where the area equals 100 cm\(^2\))

- Determines when numbers satisfy given inequalities (e.g. Which numbers in the set \( \{2, 3, 4, 5, 6\} \) satisfy the inequality \( 2x + 4.5 > 11? \))
- Generalises number patterns and describes what they have noticed as changing in the pattern in a general sense (e.g. on examining the pattern 2, 4, 8, 16…, can describe the pattern as ‘Each number in the pattern is doubled to get the next term’ for the sequence)
- Uses concatenation to expand \( 4(2x + 8) \) by reading this as ‘4 lots of, 2 lots of whatever number \( x \) represents plus 8’
- Understands inequalities (e.g. given \( 3 > x \), determines that the value of \( x \) can be any real number, not just integers, less than 3; given that a number is less than 0.4, can write this as \( c < 0.4 \) or \( 0.4 > c \))

- Interprets the variables involved in using some simple non-linear functions to model situations and makes related predictions (e.g. uses a constant ratio to generate a pattern for compound interest such as \( $10 \ 000, $10 \ 600, $11 \ 236… \) and the time taken to complete a 24-km bushwalk for various average speeds)
- Interprets the variables involved in using linear functions to model situations and makes related predictions (e.g. uses a linear model developed from Year 9 student data to predict the height of a Year 9 student from their forearm length)
- Graphs two linear equations and knows that the point where they intersect on the graph is an ordered pair that is a point on both graphs (e.g. graphs \( y = 2x + 1 \) and \( y = 1 - x \), and recognises that their point of intersection (0,1) is a point on \( y = 2x + 1 \) and \( y = 1 - x \))
- Explores and establishes linear equivalences [e.g. \( 2(4x + 8) = 4(2x + 4) = 8(x + 2) \)]
- determines whether a set of values satisfies an equation or inequality (e.g. ‘When \( a = 3 \) and \( b = 2 \), does \( 3a + 2b = 12? \)’, or ‘Does a square of side length 3.5 m have an area less than 10 m\(^2\)?’)
- Explores and establishes simple non-linear equivalences (e.g. generalises number patterns including...
27² = (20 + 7)² = 20² + 2 × 20 × 7 + 7² = 400 + 280 + 49 = 729

- Constructs expressions that involve the four arithmetic operations, simple reciprocals, whole-number powers and substitutes into, and evaluates these expressions with the assistance of technology as required
- Formulates linear functions to describe a situation involving constant rates of change given various data (e.g. given two values from the graph of a straight line and a constant gradient)

Inverse, associative, commutative and distributive properties can be used to manipulate and rearrange algebraic expressions that involve the four operations, reciprocals, whole-number powers and square roots (e.g. rearrange p = 3q – 2 to obtain q = (p + 2) ÷ 3)

- Solves simple linear equations of the form y = ax + b using a variety of methods, including algebra (e.g. solves 3x + 7 = 22; finds the cost of a taxi charge in dollars per kilometre if the flag fall is $2.80 and a 60-km trip costs $100)
- Uses a variety of methods to solve simple non-linear equations (e.g. finds the time taken to travel 300 km at an average speed of 85 km/h; finds the value of x for which 2x² + 3 = 53; determines the approximate dimensions of a rectangle with area 100 cm², width w and length 3 cm greater than its width)
- Rearranges linear and some simple non-linear algebraic expressions (e.g. p = 3q – 2 to obtain q = (p + 2) ÷ 3; given A = πr² and a specific value of A, finds the corresponding value of r and obtains the general case r = √A/π, noting that r must be positive in the related practical context)

Linear and some non-linear equations related to real-life problems can be represented and solved using a variety of methods (e.g. find the time taken to travel 300 km at an average speed of 85 km/h; determine the approximate dimensions of a rectangle with area 100 cm², width w and length 3 cm greater than its width)

- ‘Tells the story’ shown by a graph (e.g. a graph of someone’s emotions during the day or noise levels in a room during a party) by describing how one quantity varies from the other
- Identifies the variables in a situation based on a description of it or familiarity with it (e.g. for the statement ‘The amount of daylight in a typical day changes over the year’ can determine that the ‘amount of daylight’ and ‘time’ are the variables)
- Models, applies and interprets relationships, including simple inequalities, involving variables related to a given context (e.g. calculates a human body mass index (BMI) as weight w kg divided by height h m², or w ÷ h², and compares with the healthy BMI range of 20 to 25; the area of a rectangle with breadth b cm and length l cm is less than 100 cm²)
- Uses known formulae to develop, apply and interpret new relationships (e.g. a cube of side length h cm has a surface area of 6 × h² cm²; the volume of a cylinder height h m and radius r m has a circular base area × height = πr² × h m³)
Tables of values constructed for linear and simple non-linear functions can be graphed (e.g. tables of values for the relationship \( vt = 6 \), where \( v \) represents the average speed in kilometres per hour and \( t \) represents the time travelled in hours, are constructed and graphed)

- Generates a table of input–output values for a function rule, such as \( y = 2x + 1 \), and graphs the points on the coordinate plane (ordered pairs — four quadrants)
- Recognises where it doesn’t make sense to ‘join the points’ of a function graph
- Interprets the points on a coordinate grid in terms of the variables graphed (e.g. matches Australian cities with points plotted on a coordinate grid, with ‘Population’ on one axis and ‘Distance from Brisbane’ on the other)
- Recognises when a function is linear or non-linear (e.g. knows that when they graph \( 2x + 4 = y \) they will get a straight line but that \( 2x^2 + 4 = y \) will not be linear, and explores what the shape might be)
- Plots points for linear functions (e.g. the temperature conversion between Celsius and Fahrenheit scales, \( F = 1.8C + 32 \), \( C = \frac{5}{9}(F – 32) \)) and simple non-linear functions of a discrete or continuous variable [e.g. the area of a circle in terms of its radius; number patterns generated by constant multiplication from a given starting value (1, 15, 225, …), (80, 40, 20, 10…)], and uses sketches done by hand, graphing aids and technology to generate graphs of these functions
- Sketches graphs and uses technology to explore the effect of varying the values of \( a \) and \( b \) in the rule of a linear function \( f(x) = ax + b \) on the corresponding graph, and describes these effects with reference to gradient and the \( y \) axis intercept (e.g. \( y = x \rightarrow y = 2x \), \( y = 3x \), \( y = -2x \), \( y = -3x \), \( y = -3x + 2 \), \( y = -3x + 4 \))
- Investigates rules for a set of four linear functions that create a shape between intersection points of their graphs (e.g. \( y = x \), \( y = -x \), \( y = 4 - x \), \( y = x - 4 \))
- Draws graphs of some simple non-linear functions interpreted in a practical context (e.g. graphs of \( vt = 6 \), \( vt = 12 \), \( vt = 24 \), \( vt = 48 \) where \( v \) is average speed in kilometres per hour and \( t \) is time of travel at a given average speed in hours) and describes the effect of changing constants used to specify the rule of the function on the corresponding graphs
Knowledge and understandings — Measurement

Units of measure, instruments, formulas and strategies can be used to estimate and calculate measurement, and consider reasonable error.

Instruments, technologies, strategies and formulas are used to estimate, compare and calculate measures and derived measures, including rate, area, duration and Australian time zone differences (e.g. average speed in kilometres per hour to determine time needed to complete a journey)

- Selects units that are sensible for the purpose for everyday descriptions and comparisons (e.g. compares two boxes by capacity if they want to store tennis balls but by length if they want to pack books)
- Uses a variety of instruments and technologies for indirect measures of quantities and time (e.g. stopwatch to measure elapsed time, data logger to measure temperature change)
- Distinguishes the need to find area rather than perimeter (and vice versa) in problem-solving situations (e.g. knows they need to find perimeter to calculate fencing costs for a property but area to calculate amount of seed needed)
- Explores the volume of pyramids and cones, and their relationship with the volume of the prism that would exactly encompass them
- Calculates the volume of a sphere and explores its relationship with the volume of the cube that would exactly encompass it
- Chooses and effectively uses an appropriate unit, and instrument or technology, to measure a required attribute or characteristic, and justifies their choice (e.g. says ‘I need some kitchen scales because bathroom scales are not accurate enough to measure recipe ingredients with’)
- Calculates simple rates and results that proceed from them (e.g. travelling 150 km at 30 km/h in a boat will take 5 hours; if they can walk 3 km in 30 min, then that is a rate of 6 km/h, assuming their rate remains constant)
- Knows how a century is named (e.g. that the 21st century is between 2001 and 2100)
- Determines the time in various capital cities in Australia (including during daylight saving months) using both 12- and 24-hour clocks
- Knows Australian time zones (AEST, ACST, AWST)
- Uses an electronic and/or manual personal timetable and diary effectively
- Understands duration of events and time

- Chooses and uses informal (e.g. pinch, span), metric or SI (International System) units (metre, kilogram) to measure with to suit the context (e.g. knows that their hand span will be good enough as a guide to see whether a wardrobe will fit into a space on the wall, but that if they are purchasing a wardrobe that will fit, they will need to be more accurate and measure with a metric ruler before they leave home)
- Knows when measuring when more than one attribute is needed (e.g. knows to measure height and width when placing a bookcase under a window in a hallway)
- Chooses and uses a variety of instruments for indirect measures of quantities and time (e.g. a stopwatch to measure elapsed time, data logger to measure temperature change) and justifies their choice (e.g. chooses a normal watch to measure time in a backyard race but explains that a stopwatch is needed to measure time in a race at school sport)
- Suitably dissects a composite shape into several rectangles (and other shapes as needed) in order to find the area of the shape, choosing and using appropriate formulae
- Suitably dissects composite shapes into several rectangular prisms (and other 3D shapes as needed) to determine volume of the shape, choosing and using appropriate formulae
- Uses everyday measuring instruments correctly and accurately in order to minimise error for a given context (e.g. places a measuring jug on a flat surface and reads graduations at eye level to measure as accurately as possible)
- Uses appropriate combinations of units and formulae to measure and calculate length, area and volume in a given context (e.g. designs and costs an automatic watering system for a garden)
- Calculates and applies rates in familiar contexts (e.g. cordial mixtures mL/L to obtain desired sweetness; average speed in kilometres per hour to determine time needed to complete a journey, saying ‘I need to get to Pete’s place 3 km away in 2 hours, so I will need to walk at a rate of 1.5 km/h’)
- Interprets and solves realistic problems related to Australian time zones
**Relationships exist between units of equivalent measure and are used to make conversions of units (e.g. use 4.5 ha instead of 45 000 m^2 to state the area of a parcel or block of land)**

- Knows of related historical units of area, including hectares to acres and perches
- Converts from one size unit to the next size unit (e.g. metres to centimetres, centimetres to millimetres) and can round upwards or downwards to the next unit, depending on the degree of accuracy required in context (e.g. converts 3200 mL to 3.2 L and says ‘That 3-L jug won’t hold this liquid because there’s too much of it’)
- Knows decimal representations of time (e.g. that 2:25 hours is not 2 1/4 hours and 3 1/2 hours is not 3:50 hours)
- Converts between different units of measure for the same attribute (e.g. expresses 4.5 ha in square metres, converts 35.67 t to kilograms, calculates the number of seconds in 3 h and 25 min, finds the metric equivalent in millimetres of a 1/8-in. drill bit)

**Lengths and angles that cannot be measured directly can be investigated using scale, similarity or trigonometry (e.g. finding the height of a building using the angle of elevation and the distance to the base of the building; calculating distances from maps)**

- Identifies unreasonable estimates of measurements by comparing with a known measurement (e.g. says ‘That room cannot be 8 m long because my stride is less than 1 m and the room is only 7 strides long’)
- Measures and makes angles to a specified size using a protractor or other drawing aid accurately to within 5°
- Demonstrates that shapes with different perimeters can have equal areas, and those with different areas can have equal perimeters (e.g. makes rectangles with 24 cm^2 areas but with different perimeters, and rectangles with 16 cm perimeters but with different areas)
- Understands that if a shape is scaled in all directions (e.g. length and width), all linear measurements will be changed by the same ratio (e.g. given a rectangle drawn on a grid and asked to triple the length and width, predicts the new length of a diagonal)
- Understands when two figures or objects are mathematically similar and can explain why in terms of lengths and angles
- Identifies the hypotenuse in a right triangle, and can determine which side is opposite and which is adjacent with respect to the two non-right angles
- Reads scales and makes reasonable estimates where measures fall between marked gradations (i.e. intermediate gradations not marked)
- Identifies the interval within which a measurement occurs (e.g. the speedometer of a car typically provides a value which is accurate to plus or minus 3 km/h)
- Estimates length, area, volume, mass, time of day and duration of time, angle and temperature by comparing with experience and with respect to known references (e.g. estimates the time of day by referring to the position of the sun)
- Makes judgments about acceptable variation in estimation of quantities based on experience (e.g. wants 250 g of olives from a deli but will accept a quantity within the range of 240–260 g)
- Applies scale and similarity, Pythagoras’ Theorem or trigonometry to find lengths and angles in situations where they cannot measure directly (e.g. uses similarity to find lengths of sides of polygons; uses sin, cos and tan ratios or the Pythagorean Theorem to find missing sides or angles in right triangles)
Judgments can be made about acceptable error of measurement, and error can be compounded by repetition and calculation (e.g. cutting three pieces of material to an accuracy of 3 mm from a single piece may give a total error of up to 9 mm; when measuring the sides of a pentagon to find its perimeter, if each measurement has a 1-mm error, the perimeter calculation may be incorrect by up to 5 mm)

- By measuring accurately, determines when an estimate or a measurement of mass has been made (e.g. determines whether the weight of a person indicated is really 150 kg or 154 kg by using an accurate scale with gradations marked at 150, 151, 152 ... 160 rather than just 150 and 160)
- Understands that the unit and instrument they choose to measure with (which determines the level of accuracy) is actually a decision about how much error is tolerable (e.g. says ‘If we use a trundle wheel to measure the 100-m sprint track at school, it will be accurate enough for us but wouldn’t be for the Olympic Games’)

- Observes how error can be accumulated when several related measurements are made (e.g. three lengths of cloth measured and cut to an accuracy of 3 mm from a single piece of cloth may have a total error of up to 9 mm)
- Knows that the calculated length of the hypotenuse of a right triangle depends on the amount of rounding that occurs when calculating lengths of the other sides and finding the square root
### Knowledge and understandings — Chance and data

**Judgments can be based on theoretical or experimental probability. Data can be displayed in various ways, and analysed to make inferences and generalisations.**

Data can be gathered from samples and surveys, experiments and simulations, published data and databases, and used to estimate probabilities of events and respond to claims and questions (e.g. health statistics, such as the 1 in 10 chance of non-immunised people getting influenza in a given year, can be used to predict the number of people likely to suffer influenza in a year).

- Describes the difference between a random sample and a stratified random sample, and knows when it would be useful to undertake each (e.g. says ‘To survey the school about what school uniform we want, I need to make sure I survey the same number of boys as girls. Otherwise, if I survey more boys, it’s likely that we would get most people wanting grey socks, whereas girls might prefer white socks’)
- Presents short written or oral reports of their surveys, including what they wanted to find out, what questions they used, how they collected and organised their data, conclusions from their data and how they might do things differently next time
- Makes statements about proportions related to a population, based on estimates formed from a random sample (e.g. the proportion of people who think the leader of a political party is doing a poor, satisfactory or good job in relation to age group)

Sample spaces can be specified for single events and straightforward compound events using tables and tree diagrams, and probabilities can be determined using different methods, including counting, measuring and symmetry (e.g. a grid for the scores when two six-sided dice are rolled; a tree diagram for the combination of results obtained by spinning a six-coloured spinner and tossing a coin)

- Recognises equally likely outcomes from those that are not (e.g. knows that on the throw of a die, all six numbers are equally likely, and that it isn’t harder to roll a 6 than any other number, and can explain why
- Uses fractions to assign probabilities (e.g. if 8 boys’ names and 7 girls’ names are placed in a bowl, then the probability of drawing a boy’s name is \( \frac{8}{15} \))
- Compares experimental data from simple trials with theoretical probability (e.g. knows that, theoretically, they should get equal numbers of heads as tails when tossing a coin a number of times, but is not surprised when tossing a coin four times results in three heads) and can explain the difference (i.e. why they are not surprised)
- Understands the law of large numbers (i.e. as the number of trials increase, the closer the experimental probability gets to the theoretical probability)
- Knows the effect of replacement and non-replacement on probability
- Interprets colloquialisms, including ‘you’ve got Buckley’s’, ‘fifty-fifty’, ‘once in a blue moon’ and ‘fat chance’, in terms of likelihood of occurrence
- Estimates probabilities for a range of events, using materials and technology (e.g. gender sequences in families or school performance in a sports competition)
- Analyses situations involving random events and chance (e.g. when playing a game of snakes and ladders or cards, decides the level of likelihood of landing on a snake or drawing an ace)
- Explores the reasonableness of estimates of relative likelihood based on personal experience (e.g. explains why a student might claim that they are twice as likely to finish a 1500-m race ahead of their training partner than vice versa)
- Uses different representations to specify the sample space for straightforward compound events (e.g. a grid for the scores on a regular six-sided die and an octahedral die, a tree diagram for the combination of results obtained by spinning a six-coloured spinner and tossing a coin)
- Determines the probability for a straightforward compound event (e.g. the probability of having an alternating gender sequence (i.e. boy, girl, boy, or girl, boy, girl) in a family of three children)
- Understands that a compound event is an event made up of two simultaneous experiments (e.g. tossing a coin whilst simultaneously rolling a die)
- Knows what independence means (e.g. says ‘The results of tossing a coin twice in a row are independent because getting heads on the first one doesn’t affect what you get on the second one’)

**Data interpretation is simplified through the use of suitable representations and descriptive statistics (e.g. using two-way tables, histograms, stem and leaf plots, and measures of location)**

- Represents two-variable data in scatter plots (e.g. plots their arm length against their height)
- Uses a range of representations for discrete data, including bar and column graphs
- Recognises that line graphs might not be appropriate for discrete data because the lines joining the points don’t show information
- Enters data in databases with fields already defined (e.g. in preparation for a school healthy foods display, enters information on what foods each class member eats)
- Calculates the range of a set of scores, and knows that having a measure of location (mean, median or mode) and the range of the scores provides a good ‘picture’ of the scores, and their distribution; informally sketches freehand what a graph of the scores might look like, given the range and a measure of location.

**Simple measures of spread and centre, distribution of responses, and the effect of bias and outliers on the measures of location are used to make inferences (e.g. the proportion of people who think the leader of a political party is doing a poor, satisfactory or good job in relation to age group can be used to make inferences about the popularity of the political party)**

- Explores bias, and how bias can arise if random sampling is not used (e.g. if only children are sampled to explore the question ‘Are children better with technology than their parents?’), then it is likely that the answer will be biased in favour of children) and uses simple random sampling in surveys
- Uses averages and features of a set of data, including graphical representation, clusters, the middle 50% and outliers, to discuss the distribution of data in a sample and analyse related claims and questions (e.g. claims in the media about unemployment rates, questions about the fitness of a particular portion of the population)

- Uses a range of representations for continuous data, including stem and leaf plots and histograms, and decides which type of plot best suits the data and the purpose (intervals in which continuous data is grouped)
- Interprets data, and considers the impact of outliers on the mean, median and mode, and the usefulness of range as a measure of spread (e.g. house prices in a given location)
- Explores bias, and how bias can arise if random sampling is not used (e.g. if only children are sampled to explore the question ‘Are children better with technology than their parents?’), then it is likely that the answer will be biased in favour of children) and uses simple random sampling in surveys
- Identifies bias in the media and other forms of advertising, and suggests likely reasons
- Uses averages and features of a set of data, including graphical representation, clusters, the middle 50% and outliers, to discuss the distribution of data in a sample and analyse related claims and questions (e.g. claims in the media about unemployment rates, questions about the fitness of a particular portion of the population)
### Knowledge and understandings — Space

**Geometric conventions can be used to describe, represent, construct and manipulate a range of complex geometric shapes. Mapping conventions can be used to represent location, distance and orientation in maps and plans.**

Geometric conventions are used to describe a variety of 2D shapes and 3D objects, including curved surfaces, and compound and embedded shapes (e.g. using geometric terms, the diagonals of a rhombus bisect each other at right angles; using geometric symbols to indicate parallel, perpendicular and congruent lines)

- Describes features that distinguish one common class of shapes from another (e.g. says ‘Prisms have two parallel faces that are exactly the same but pyramids do not’)
- Applies the distinguishing features of common classes of quadrilaterals to determine ‘inclusive’ relationships between them (e.g. shows parallelograms, rectangles and squares in a Venn diagram and says ‘All squares are rhombuses but not all rhombuses are squares because their angles aren’t all 90°’)

2D shapes and 3D objects and their cross-sections can be represented as sketches, drawings or electronic images, using specifications and conventions to identify and show geometric properties (e.g. draw various cross-sections of product packaging)

- Draws isometric/front, side and top views of regular prisms, and distinguishes between these (e.g. says ‘That view is an isometric view because it has an edge closest to me’)
- Draws cross-sections of regular prisms, spheres, cylinders, and knows that the vertical cross-section will be represented by a different shape than a cross-section on an angle (e.g. says ‘The vertical cross-section of a cylinder is a circle, but if you cut it on an angle you get an ellipse’)
- Draws an object (such as a jug with a handle) and then imagines what it might look like from another direction; draws it from that direction, paying attention to specifics, including the placement of the handle

- Shows front, side and top (orthographic) views and cross-sections of 3D shapes and objects, including simple polyhedra, cylinders, spheres and cones, and composite shapes formed from these (e.g. a drink bottle)
- Draws 2D shapes to specification in terms of boundary, angle and scale (e.g. a symbol including a star in a circle is a five-pointed star inscribed in a circle of a given diameter)
- Represents 3D objects, including cylinders, cones and the platonic solids, and their cross-sections, as sketches, drawings or electronic images using geometric properties and conventions
- Represents 2D shapes as sketches, drawings or electronic images using specifications and conventions that refer to their geometric properties
- Visualises an object or scene in different orientations and draws possible ‘other views’ of an object from information contained in 2D drawings
### 3D objects can be constructed from plans, cross-sections, nets, and isometric and perspective diagrams (e.g. construct a soccer ball from a net of its stitching pattern, using a tessellation of pentagons and hexagons)

- Constructs a cube from its net; makes models of right prisms, given their isometric drawing
- Examines the drawing of a net of a shape and determines whether it will, in fact, fold up to make the shape based on their visualisation, and explains why or why not
- Uses drawing tools, including geometry software, models and materials, to represent and construct common 2D shapes and 3D shapes and objects, including composite shapes and objects
- Uses geometric shapes to construct accurate 2D representations of 3D objects (e.g. an isometric drawing, front-side, top view or a single-point perspective drawing of an hourglass; draws various cross-sections of a toothpaste tube; draws a suitable net for constructing a cone of a given slant-edge length with a lid from a sheet of paper), and discusses which properties are preserved by the representation and which are not (e.g. angle, side length, area)
- Constructs 3D objects from nets and makes models of 3D objects from isometric diagrams (e.g. a soccer ball from the net of its stitching pattern using a tessellation of pentagons and hexagons) and discusses their properties (e.g. says ‘What is the difference between two tetrahedrons joined at their bases and an octahedron, and which of these is a space-filling shape?)
- Visualises and plans essential details when constructing figures and objects (e.g. decides where to best place the tabs on a net to ensure that the made-up object holds together)

### Congruence, similarity, sequences of transformations and symmetry are used to analyse geometric properties (e.g. compare geometric properties of triangles to determine congruence or similarity)

- Uses an appropriate grid to produce a specified symmetrical shape (e.g. uses circular grid paper or computer graphics to rotate a given figure to make a design which has rotational symmetry, and which is rotated six times to get back to where it started
- Uses square grid paper or computer graphics to reflect a shape across a line of symmetry to create a shape that has four internal squares astride the line of symmetry
- Determines when two triangles are similar or congruent using the properties of similarity or congruency
- Uses transformations to modify tessellating shapes to produce other tessellating shapes, and informally explains why they do or do not work (e.g. a tessellation using squares can be modified to form an Escher-type design by outwardly

- Uses congruent and similar triangles to solve geometric problems involving patterns and design.
extending one side and inwardly extending the opposite side the same way (e.g. says ‘This shape won’t tessellate because if you translate this side onto the opposite side, it’s not exactly the same’)

**Deductions about geometric properties can be supported by proofs related to angle properties associated with parallel, perpendicular and transversal lines, and polygons (e.g. when two straight lines intersect, opposite angles are equal; the sum of the interior angles of a quadrilateral with four sides)**

- Determines the sum of the interior angles of a polygon with three, four or five sides
- Knows the angle properties related to parallel, perpendicular and transversal lines (i.e. co-interior, corresponding and alternate angles), and can use these terms appropriately in a sentence (e.g. says ‘The opposite angles formed by the intersection of the road and the creek are alternate angles’)
- Knows line segments and midpoints
- Makes deductions related to geometric properties of shapes (e.g. when two straight lines intersect, opposite angles are equal; the sum of the interior angles of a polygon with n sides is always $180° \times [n – 2]$)
- Explores demonstrations and informal proofs of general propositions (e.g. the sum of angles in a plane (flat surface) triangle is always $180°$. If corresponding angles are equal, then alternate angles are equal, or Pythagoras’ Theorem)
- Applies the angle properties related to parallel, perpendicular and transversal lines to find the size of unknown angles

**Maps and plans using scale, coordinates, distance, bearing, angles, keys and annotations can be constructed and used to specify location, and represent spatial relationships, as well as distance and orientation between locations (e.g. orienteering or bushwalking; shortest and alternative pathways around venues such as amusement parks)**

- Follows and gives directions for locations using coordinates (e.g. using a street directory, plans the shortest distance from a house at B4 to the beach at H12)
- Programs a computer to generate a specified shape based on coordinates (e.g. a rectangle), using the properties of the shape
- Understands that bearings are given in degrees clockwise from the north point (i.e. a bearing of $180°$ is south) and knows these equivalences for all major compass points
- Draws diagrams to represent familiar places or situations, paying close attention to arrangements rather than scale (e.g. draws a network-type diagram to represent the arrangement of the main buildings in their school or town, or draws a diagram to represent which teams play each other in the football finals)
- Provides directions from one location to another on a variety of maps and plans, with reference to key features, distance and orientation, and calculating approximate distance from scales (e.g. when planning a family holiday through central Australia says ‘The scale on the map in the atlas says 1 : 1000 so, to get to Alice Springs from here, we need to drive about 2000 km north, but we can also see Uluru if we take a left turn from the main highway about 600 kms south-west of Alice Springs’)
- Uses grids and coordinates, scale and true bearings to read, interpret and follow maps, such as on a bushwalk or orienteering (e.g. says ‘On the map it is 2 cm on a bearing of $270°$, so that means I need to walk 200 m in a westerly direction’)
- Interprets and constructs maps, diagrams and plans, and uses these to specify location and move from one location to another
- Draws and uses diagrams to represent and analyse relationships (e.g. the shortest path for a tour around a zoo, a draw for a knockout competition)