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## Mathematics | Rationale/Aims

### Rationale

Learning mathematics enriches the lives of, and creates opportunities for, all Australians. The Australian mathematics curriculum provides students with essential mathematical skills and knowledge in number and algebra, measurement and geometry, and statistics and probability. It develops the numeracy capabilities that all students need in their personal, work and civic life, and provides the fundamentals required of mathematical specialists and professional users of mathematics.

Mathematics has its own value and beauty and it is intended that students will appreciate the elegance and power in mathematical reasoning. Mathematical ideas have evolved over centuries and across all cultures and they continue to expand. Digital technologies are contributing to this expansion of ideas and provide access to new tools for continuing mathematical exploration and invention. The Australian mathematics curriculum focuses on developing increasingly sophisticated and refined mathematical understanding, fluency, logical reasoning, analytical thought processes and problem-solving skills to enable students to respond to familiar and unfamiliar situations by employing mathematical strategies to make informed decisions and solve problems efficiently.

The Australian mathematics curriculum ensures that the links between the various components of mathematics, and to other disciplines, are made clear. Mathematics is composed of multiple but interrelated and interdependent concepts and systems which students apply in other disciplines. In science, for example, understanding sources of error and their impact on the confidence of conclusions is vital, as is the use of mathematical models; in geography, interpretation of data underpins the study of human populations and their physical environments; in history, students need to be able to imagine timelines and time frames to reconcile relativities of related events; and in English, deriving quantitative and spatial information is an important aspect of making meaning of texts.

The curriculum is written with the expectation that schools will ensure that all students benefit from access to the power of mathematical reasoning and be able to apply their mathematical understanding creatively and efficiently. The mathematics curriculum provides students with carefully paced, in-depth study of critical skills and concepts. It encourages teachers to facilitate students to become self-motivated, confident learners through inquiry and active participation in challenging and engaging experiences.

### Aims

The Australian mathematics curriculum aims to ensure that students are confident, creative users and communicators of mathematics, able to investigate, represent and interpret situations in their personal and work lives and as active citizens.

It aims to ensure students develop increasingly sophisticated understanding of mathematical concepts and fluency with processes, able to pose and solve problems and reason in number and algebra; measurement and geometry; and statistics and probability.

It aims to ensure students recognise connections between the areas of mathematics and other disciplines and appreciate mathematics as an accessible and enjoyable discipline to study.

Mathematics | Strands

**Kindergarten Content descriptions**

Number and Algebra	Statistics and Probability	Measurement and Geometry
<b>1. Counting</b> Say, understand and reason with number sequences, initially to and from 20, and then beyond, moving to any starting point	<b>1. Data representation</b> Collect, represent and interpret data from simple questions with objects and drawings where one object or drawing represents one data value	<b>1. Geometry</b> Sort, describe, name, and represent familiar two-dimensional shapes and three-dimensional objects in the environment
<b>2. Numeration</b> Understand numbers to 10, including matching number names, numerals and quantities, and work fluently with small numbers including subitising and partitioning	<b>2. Data investigation</b> Solve problems by collecting data and answering questions about obvious attributes of themselves and familiar objects and events	<b>2. Comparison</b> Use direct and indirect comparison to decide which is longer, heavier and holds more and explain reasoning in everyday language
<b>3. Comparing collections</b> Compare and order collections, initially to 20, and then beyond, and explain reasoning		<b>3. Time</b> Read time on the hour on digital and analogue clocks, and make connections between common sequences such as days of the week and other familiar events and actions
<b>4. Addition and subtraction</b> Model, represent and solve problems concerning additive and sharing situations involving combining, change and missing elements		<b>4. Location</b> Describe the position and movement of objects, including themselves
<b>5. Pattern</b> Sort and classify familiar objects, explain reasons for these classifications and copy, continue and create patterns with objects and drawings		

**Achievement standard (Kindergarten)**

By the end of Kindergarten, students are able to confidently recall the sequence of numbers to 20, matching names and numerals and find the total of small collections by counting. They subitise small quantities, partition numbers to 10 and use one-to-one relations to share and count out quantities. Students collect data from straightforward questions about themselves and familiar events and, with assistance, can organise this data. They readily use everyday language to describe measurements found by direct comparison and sort and classify familiar shapes.

## Year 1 Content descriptions

Number and Algebra	Statistics and Probability	Measurement and Geometry
<b>1. Counting</b> Say, understand and reason with number sequences to and from 100 by ones from any starting point, and say number sequences of twos, fives and tens starting from zero	<b>1. Data representation</b> Represent data using pictographs where one picture represents one data value	<b>1. Geometry</b> Recognise, visualise and classify familiar two-dimensional shapes and three-dimensional objects using obvious features such as number of corners or faces or length of sides
<b>2. Numeration</b> Recognise, model and represent numbers to 100, and read, write and order those numbers	<b>2. Data interpretation</b> Read and make connections between lists, tables and pictographs	<b>2. Length and capacity</b> Measure length and capacity using uniform informal units and compare measures explaining reasoning in everyday language
<b>3. Place value</b> Understand and work fluently with counting collections to 100 by grouping in tens, and counting the tens, and use place value to partition and regroup those numbers	<b>3. Chance</b> Identify outcomes arising from familiar chance events and describe using everyday language such as yes, no or maybe	<b>3. Time</b> Read analogue and digital clocks to the half hour and describe duration using months, weeks, days and hours
<b>4. Fractions</b> Understand one-half as one of two equal parts, and recognise and create halves of collections		<b>4. Money</b> Recognise, describe and order Australian coins
<b>5. Addition and subtraction</b> Model, represent and solve problems involving additive and sharing situations using efficient strategies including counting on		<b>5. Location</b> Give and follow directions to familiar locations
<b>6. Number patterns</b> Copy, continue, create and describe patterns with objects and numbers to 100		

## Achievement standard (Year 1)

By the end of Year 1, students are able to quantify collections to 20 and can count forwards and backwards to 100. They understand and are fluent with partitioning numbers to 10. They can read, write, order and model two-digit numbers and understand that these numbers are comprised of units of tens and ones. They are beginning to understand the relationship between addition and subtraction and use this knowledge to model and solve simple additive problems. Students collect data about themselves and their peers and represent these data in lists, tables and pictographs. They use everyday language to describe simple geometry and measurement ideas and use uniform informal units to measure and compare length and capacity and use hours and half-hours to describe time.

## Year 2 Content descriptions

Number and Algebra	Statistics and Probability	Measurement and Geometry
<b>1. Counting</b>	<b>1. Data representation</b>	<b>1. Geometry</b>
Say, understand and reason with number sequences increasing by twos, fives and tens from any starting point including using calculators	Record data using tallies and represent data using tables, pictographs and bar and column graphs	Describe features of two-dimensional shapes and three-dimensional objects, draw them and use materials to make models of these
<b>2. Numeration</b>	<b>2. Data interpretation</b>	<b>2. Metric units</b>
Recognise, model and represent numbers to 130, and read, write and order those numbers	Read and make connections between lists, tables and graphs showing data from familiar contexts, and explain interpretations	Measure and compare length and capacity using uniform informal and familiar metric units and measure mass using balance scales with familiar metric units
<b>3. Place value</b>	<b>3. Chance</b>	<b>3. Area</b>
Work fluently with counting increasingly larger collections up to 1000, grouping in hundreds and tens and counting the tens and hundreds and use place value to partition and regroup these numbers	Experiment with chance devices and describe outcomes as likely or unlikely and identify some events as certain or impossible	Compare the area of regular and irregular shapes directly
<b>4. Fractions</b>		<b>4. Time</b>
Recognise and interpret common uses of halves, quarters and thirds of everyday shapes, objects and collections		Read analogue and digital clocks to the quarter hour and to use a calendar to identify the date, and name and order months and seasons
<b>5. Addition and subtraction</b>		<b>5. Money</b>
Model, represent and make connections between simple additive situations, solving them using efficient written and calculator strategies and explaining the choice of strategy		Count and order small collections of Australian coins
<b>6. Multiplication and division</b>		<b>6. Transformations</b>
Model, represent and make connections between simple multiplicative situations such as groups of, arrays, sharing, solving them using efficient mental and written strategies and calculators and explaining their choice of strategy		Predict and draw the effect of 1-step sliding, flipping and turning of familiar shapes and objects including using digital technology and identify half and quarter turns from any starting point
<b>7. Number patterns</b>		<b>7. Location</b>
Copy, continue, create and describe patterns with numbers, especially place value patterns and identify missing elements		Interpret simple maps of familiar locations such as the classroom to identify the relative position of key features

## Achievement standard (Year 2)

By the end of Year 2, students are able to understand the sequence of numbers to 130, recognising patterns in units of 10 and 100. They apply this understanding to efficiently represent collections larger than 100 and to partition numbers into units of tens and ones. They describe and connect patterns of twos, fives and tens, solve multiplicative problems and model everyday simple functions. Students describe events produced by simple chance devices and understand different ways of representing data. Students compare lengths, capacities and masses using informal units and familiar metric units and areas by direct comparison. They identify and describe properties of familiar shapes and objects, can visualise and represent them, and can use simple maps.

## Year 3 Content descriptions

Number and Algebra	Statistics and Probability	Measurement and Geometry
<b>1. Counting</b>	<b>1. Data investigation</b>	<b>1. Symmetry</b>
Understand and reason with number sequences increasing and decreasing by twos, fives and tens from any starting point, moving to other sequences, emphasising patterns and explaining relationships	Investigate data-oriented questions about familiar situations, predict what the data might show, carry out the investigation and report the results	Use symmetry, identifying its occurrence in the environment to create symmetrical patterns, pictures and shapes
<b>2. Numeration</b>	<b>2. Data representation</b>	<b>2. Metric units</b>
Recognise, model, represent and visualise numbers initially to 1000 and then beyond, and read, write and order those numbers	Construct, read and make connections between tables, diagrams and graphs including dot plots with prepared baselines	Use direct and indirect comparison to order and compare objects by length and develop 'real life' benchmarks for familiar metric units of length, mass and capacity including centimetre, metre, kilogram and litre
<b>3. Place value</b>	<b>3. Chance</b>	<b>3. Area</b>
Justify various uses of the place value system to describe numbers to 1000, using the hundreds and tens as units, and to partition and regroup those numbers to assist calculation and solve problems	Conduct chance experiments and recognise that there will be variation in results as well as having expected outcomes	Measure and compare areas using uniform informal units, explaining reasoning in everyday language
<b>4. Addition and subtraction</b>		<b>4. Time</b>
Model, represent and solve problems involving additive situations using efficient mental and written strategies and calculators		Read analogue and digital clocks to the five minutes and compare and order events according to their duration
<b>5. Multiplication and division</b>		<b>5. Money</b>
Model, represent and solve problems involving multiplicative situations including 'for each' and 'times as many' using efficient mental and written strategies and calculators		Represent money values in multiple ways and count out the change of simple transactions
<b>6. Fractions</b>		<b>6. Angles</b>
Solve problems involving everyday uses of fractions as equal parts of regular shapes or collections and as numbers, building connections between the number of parts and the size of the fraction		Create angles and recognise that equivalence in angles such as two quarter turns is the same as a straight angle
<b>7. Calculation</b>		<b>7. Location</b>
Understand and become fluent with addition and related subtraction facts to 10 plus 10 and multiplication facts of 1, 2, 5 and 10		Create and interpret simple maps to show position and pathways between objects
<b>8. Number patterns</b>		
Copy, continue, create, describe and identify missing elements in patterns with numbers including patterns resulting from performing one operation and place value patterns		

## Achievement standard (Year 3)

By the end of Year 3, students are able to understand place value to 1000 and connect this to comparing and ordering length, mass and capacity. They apply this understanding to choose efficient strategies (mental, written and calculator) to solve problems in everyday situations. They understand the relationship between the number of parts and the size of fractions, and use this understanding to solve everyday problems including describing quarter and half turns. They use number patterns including those found in the multiples of 2, 5 and 10 and apply these in contexts such as reading clocks to five minutes and using money. Students collect, represent and interpret data in tables, graphs and diagrams and conduct simple chance events. Students estimate and order length, mass and capacity using personal benchmarks. They use symmetry in designs and can represent positions and direction using simple maps.

## Year 4 Content descriptions

Number and Algebra	Statistics and Probability	Measurement and Geometry
<p><b>1. Factors and multiples</b></p> <p>Work and reason with number sequences increasing and decreasing from any starting point, and to recognise multiples of 2, 5, 10 and factors of those numbers</p>	<p><b>1. Data investigation</b></p> <p>Plan and undertake surveys, such as with the whole class, to answer questions posed, represent the data and report the results, including using ICT</p>	<p><b>1. Geometry</b></p> <p>Generalise about the two-dimensional shapes that form the surfaces of common three-dimensional objects and make connections with the nets of these objects justifying reasoning</p>
<p><b>2. Numeration</b></p> <p>Recognise, represent, visualise and work fluently with reading, writing and ordering numbers to 1 million</p>	<p><b>2. Data representation</b></p> <p>Construct, read, interpret and make connections between tables and simple graphs with many-to-one correspondence between data and symbols, including using ICT</p>	<p><b>2. Metric units</b></p> <p>Use metric units to estimate, measure and compare the length, mass and capacity of familiar objects reading scales to the nearest graduation</p>
<p><b>3. Place value</b></p> <p>Justify various uses of the place value system to describe large numbers, and to partition and regroup those numbers to assist calculation and solve problems</p>	<p><b>3. Chance</b></p> <p>Predict the outcomes of chance experiments involving equally likely events, and compare and contrast the predictability of outcomes of experiments with small numbers of trials to those with large numbers including using ICT to generate the trials</p>	<p><b>3. Area and volume</b></p> <p>Measure and compare area using familiar metric units and compare volumes using uniform informal units</p>
<p><b>4. Fractions</b></p> <p>Compare and contrast everyday uses of halves, thirds, quarters, fifths, eighths and tenths, work fluently with renaming to find equivalent fractions and solve problems involving fractions as operators</p>	<p><b>4. Unequal outcomes</b></p> <p>Justify representations of simple situations with unequal outcomes such as constructing spinners using technology</p>	<p><b>4. Time</b></p> <p>Read analogue and digital clocks to the minute, understand equivalent representations of 12-hour time, and sequence daily and weekly events</p>
<p><b>5. Counting – fractions</b></p> <p>Understand fractions as rational numbers, including working fluently with counting by quarters, and halves including with mixed numbers, and representing these numbers on a number line</p>		<p><b>5. Angle</b></p> <p>Describe the connection between turns and angles and create and classify angles as equal to, greater than or less than a right angle</p>
<p><b>6. Multiplication and division</b></p> <p>Understand and become fluent with multiplication facts and related division facts of 2, 3, 5 and 10 extending to 4, 6, 8 and 9</p>		<p><b>6. Location</b></p> <p>Create, interpret and use basic maps using simple scales and legends and directions such as left, right, forward and backward</p>
<p><b>7. Calculation</b></p> <p>Select, explain, justify and apply mental, written strategies and use calculators to solve problems involving addition, subtraction and multiplication with one- and two-digit numbers and division by one digit numbers without remainders</p>		<p><b>7. Visualising</b></p> <p>Visualise the result of combining and splitting shapes and to represent all possible combinations of small numbers of triangles and squares</p>
<p><b>8. Number patterns</b></p> <p>Copy, continue, create, describe and identify missing elements in patterns with numbers including large numbers as well as patterns resulting from performing two operations</p>		

**Achievement standard (Year 4)**

By the end of Year 4, students are fluent with and evaluate the efficiency of mental and written strategies with one- and two-digit numbers and use these to solve problems. They identify and describe number patterns involving one or two operations and can find missing numbers in these patterns. Students pose questions that can be answered by data and plan and undertake data investigations, including the analysis of secondary data sets. They report their results using tables and graphs using one to one relationships between the data and the representation and evaluate their investigation. They can describe likelihood of familiar chance events using everyday language. They fluently choose appropriate tools and metric units to measure and compare the length, mass and capacity of objects and compare volumes using informal units. They can read scales to the nearest graduation. Their understanding of time extends to reading clocks to five minute intervals and to sequencing daily and weekly events, interpreting calendars and estimating duration. They confidently classify angles as equal to, greater than or less than a right angle and use these classifications to solve problems. They can identify obvious features of shapes and objects and visualise results of combining small numbers of squares and triangles.

## Year 5 Content descriptions

Number and Algebra	Statistics and Probability	Measurement and Geometry
<b>1. Decimals</b>	<b>1. Data investigation</b>	<b>1. Geometry</b>
Recognise and represent numbers involving tenths and hundredths; read, write and order those numbers and connect them to fractions	Solve problems involving the collection of data over time, carry out the investigation and report the results, including using ICT, and justify conclusions about the relationship between the variables	Make connections between different types of triangles and quadrilaterals using their features, including symmetry and explain reasoning
<b>2. Place value</b>	<b>2. Summary statistics</b>	<b>2. Time</b>
Justify various uses of the place value system to describe decimal numbers, and to partition and regroup those numbers to assist calculations and solve problems	Identify the mode and median in lists and on dot plots	Solve realistic problems involving time duration including using 12- and 24-hour time
<b>3. Fractions and decimals</b>	<b>3. Data representations</b>	<b>3. Scales</b>
Solve problems involving making comparisons using equivalent fractions and decimals and everyday uses of percentages, relating them to parts of 100 and hundredths	Use and compare the effectiveness of a range of data representations including for specific situations	Read and interpret scales using whole numbers of metric units for length, capacity, mass and temperature
<b>4. Multiplication and division</b>	<b>4. Chance</b>	<b>4. Perimeter, area, volume</b>
Solve realistic problems involving multiplicative situations with large numbers including division by one-digit numbers	Quantify chance with fractions, and apply this to investigate complementary events	Explore different ways of calculating perimeter and area of rectangles and volume of rectangular prisms using metric units
<b>5. Fractions</b>		<b>5. Transformations</b>
Understand and become fluent with and solve realistic additive problems involving addition and subtraction of fractions with the same or related denominators and fractions as operators		Visualise, demonstrate and describe the effects of translations, reflections, and rotations of two-dimensional shapes and describe line and simple rotational symmetry, including using ICT
<b>6. Estimation</b>		<b>6. Location</b>
Use estimation and rounding to check the reasonableness of answers		Describe locations and routes using a coordinate system such as road maps, the four main compass directions and the language of direction and distance
<b>7. Algebraic thinking</b>		
Copy, continue, create and describe patterns with numbers and use graphs, tables and rules to describe those patterns		
<b>8. Factors and multiples</b>		
Identify and describe properties of numbers including factors, multiples and composites and solve problems involving those properties		

## Achievement standard (Year 5)

By the end of Year 5 students are able to describe the place value system for whole numbers and can extend its use to two decimal places. Students choose efficient mental and written strategies for calculations with whole numbers, solve additive problems with fractions and relate fractions to decimals and percentages. Students choose appropriate graphs for single variable data, and begin to represent change in data over time. They use representation of single variable data to describe distributions including the use of median, mode and range. They use measurements effectively including time and can devise and use efficient ways of calculating perimeter, area and volume. They can describe locations and routes and describe and demonstrate the effects of transformations.

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## Year 6 Content descriptions

Number and Algebra	Statistics and Probability	Measurement and Geometry
<b>1. Integers</b>	<b>1. Data representation</b>	<b>1. Geometry</b>
Read, represent, write, interpret and order positive and negative integers	Construct, read and interpret tables and graphs including ordered stem and leaf plots, and construct pie charts and other simple data displays including using technology	Visualise and solve problems relating to packing and stacking
<b>2. Decimals</b>	<b>2. Data interpretation</b>	<b>2. Measurement</b>
Recognise and represent numbers involving thousandths, read, write and order those numbers, and connect them to fractions	Interpret secondary data presented in the media and elsewhere, identifying misleading representations and distinguishing between samples and populations	Solve problems involving comparison of length, area, volume and other attributes using appropriate tools, scales and metric units
<b>3. Place value</b>	<b>3. Variation</b>	<b>3. Metric System</b>
Justify uses of the place value system to describe decimal numbers, and to partition and regroup those numbers to assist calculation and solve problems	Explore concepts of variation and error by collecting repeated measurements	Work fluently with the metric system to convert between metric units of length, capacity and mass, using whole numbers and commonly used decimals
<b>4. Multiplication and division</b>	<b>4. Chance</b>	<b>4. Angles</b>
Apply multiplication and related division facts to solve realistic problems efficiently using mental and written strategies and calculators justifying the reasonableness of answers and explaining reasoning	List all outcomes for chance events and quantify probabilities using simple fractions, decimals and percentages	Estimate, compare and measure angles
<b>5. Ratio and rate</b>		<b>5. Time</b>
Recognise and solve problems involving unit ratio and everyday rates and check for reasonableness of answers		Create, interpret and use timetables and timelines including calculating elapsed time
<b>6. Decimals</b>		<b>6. Measurement formulas</b>
Understand and work fluently with decimal numbers to thousandths, and multiply and divide numbers including decimals by whole numbers to solve additive problems, including using technology		Understand and use the formulas for calculating perimeters and areas of rectangles, and volumes of rectangular prisms
<b>7. Fractions</b>		<b>7. Transformation and symmetry</b>
Understand and work fluently with and solve additive problems involving fractions with unrelated denominators, compare and contrast fractions using equivalence		Describe patterns in terms of reflection and rotational symmetry, and translations including identifying equivalent transformations using ICT
<b>8. Estimation</b>		<b>8. Location</b>
Estimate the outcomes of calculations involving decimal numbers and justify the reasonableness of answers		Describe and interpret locations and give and follow directions, using scales, legends, compass points, including directions such as NE and SW, distances, and grid references
<b>9. Number properties</b>		
Identify and describe properties of numbers including prime, composite and square numbers		

**Achievement standard (Year 6)**

By the end of Year 6, students are able to work with numbers including fractions and decimals to thousandths and apply their place value understanding to establish equivalences. They confidently solve realistic problems including those involving rate and ratio choosing appropriately written and mental strategies or calculators. They use estimation strategies to predict and check reasonableness of calculations. Students represent data choosing appropriate displays including stem and leaf plots and distinguish between sample and population data. They are beginning to quantify probability. Students can visualise and connect two- and three-dimensional shapes and objects. Their facility with maps extends to the use and interpretation of scales and legends. They are beginning to connect algebra and measurement, understanding the basis for formulas for perimeter, area and volume of simple polygons and rectangular prisms.

## Year 7 Content descriptions

Number and Algebra	Statistics and Probability	Measurement and Geometry
<b>1. Indices</b>	<b>1. Data measures</b>	<b>1. Geometry</b>
Understand and work fluently with index notation and represent whole numbers as a product of powers of prime numbers	Determine mean, median, and range and use these measures to compare data sets explaining reasoning including using ICT	Describe the properties of parallel and perpendicular lines, triangles and quadrilaterals to classify them and make geometric constructions including angle bisectors and perpendicular bisectors
<b>2. Integers</b>	<b>2. Data investigation</b>	<b>2. Measurement formulas</b>
Order, add and subtract integers fluently and identify patterns for multiplication and division including using ICT	Investigate questions involving the collection of univariate and simple bivariate data, including the use of back-to-back stem plots and scatter plots	Relate the formula for calculating the area of triangles to the formula for rectangles and parallelograms, to develop the formula for the volume of rectangular prisms, and use these to solve problems
<b>3. Calculation</b>	<b>3. Sample space</b>	<b>3. Transformations</b>
Understand and become fluent with written, mental and calculator strategies for all four operations with fractions, decimals and percentages	Construct sample spaces for single-step experiments with equally likely outcomes and use them to assign probabilities	Visualise, demonstrate and describe translations, reflections, rotations and symmetry in the plane, including using coordinates and ICT
<b>4. Variables</b>	<b>4. Relative frequency</b>	<b>4. Time</b>
Apply the associative, commutative and distributive laws and the order of operations to mental and written computation and generalise these processes using variables	Calculate relative frequencies, and recognise variation between results of chance experiments	Calculate duration using 12- and 24-hour time, explain and use time zones
<b>5. Linear equations</b>		<b>5. Location</b>
Use symbols to represent linear relationships and solve problems involving linear relationships where there is only one occurrence of a variable		Interpret and create maps and plans, including using legends and scales, describe relative position, and plan journeys
<b>6. Coordinates</b>		
Plot points on the Cartesian plane using all four quadrants		

## Achievement standard (Year 7)

By the end of Year 7, students work fluently with index notation. They are able to use the operations to calculate accurately with integers, fractions and decimals, choosing appropriate operations when solving problems, and correctly applying the order of operations. They extend this understanding to algebraic representations, selecting and applying formulas for area and volume and begin to generalise arithmetic patterns, including linear functions, representing them algebraically and graphically. Students conduct systematic data-based enquiry using univariate and bivariate data, choosing appropriate graphs, calculating measures of spread and centre and drawing conclusions. They identify equally likely outcomes and calculate probabilities and relative frequencies from data. Students have a sound understanding of the geometric properties of angles, triangles and quadrilaterals and two-dimensional views of three-dimensional objects. They are beginning to construct logical geometric arguments about properties of triangles and quadrilaterals.

## Year 8 Content descriptions

Number and Algebra	Statistics and Probability	Measurement and Geometry
<b>1. Ratio and rate</b>	<b>1. Statistical measures</b>	<b>1. Congruence</b>
Solve problems involving use of percentages, rates and ratios, including percentage increase and decrease and the unitary method and judge reasonableness of results	Use a mean or median from a sample to estimate the mean or median of a population and to recognise the limitations of samples	Identify properties and conditions for congruence of plane figures, and use coordinates to describe transformations
<b>2. Index laws</b>	<b>2. Data investigation</b>	<b>2. Measurement formulas</b>
Understand, describe and use generalisations of the index laws with positive integral indices	Collect samples and construct tables and graphs including frequency column graphs with and without technology for grouped data, and to select and justify the choice of measure of centre and spread used	Generalise from the formulas for perimeter and area of triangles and rectangles to investigate relationships between the perimeter and area of special quadrilaterals and volumes of triangular prisms and use these to solve problems
<b>3. Calculation</b>	<b>3. Probability</b>	<b>3. Circles</b>
Solve problems involving fractions, decimals and percentages, including those requiring converting and comparing, and judge the reasonableness of results using techniques such as rounding	Identify complementary events and use the facts that probabilities range between 0 and 1 and sum to 1 over the sample space to check probabilities	Investigate the relationship between features of circles such as circumference, area, radius and diameter and generalise these to solve problems involving circumference and area
<b>4. Algebra</b>	<b>4. Representing probability</b>	<b>4. Congruence</b>
Generalise the distributive law to expansion and factorisation of simple algebraic expressions and use the four operations with algebraic expressions	Use Venn diagrams or two-way tables to illustrate 'and', 'or', 'given' and 'not' criteria, and to calculate simple probabilities	Explain properties for congruence of triangles and apply these to investigate properties of quadrilaterals
<b>5. Linear equations</b>		<b>5. Location</b>
Create, solve and interpret linear equations, including those using realistic contexts using algebraic and graphical techniques		Solve problems involving interpreting and creating maps and plans using scales
<b>6. Coordinates</b>		<b>6. Visualisation</b>
Plot graphs of linear functions and use these to find solutions of equations including using ICT		Create, interpret and use two-dimensional representations of three-dimensional objects, including projections, isometric views and plans
		<b>7. Pythagoras</b>
		Use Pythagoras theorem to solve simple problems involving right-angled triangles

## Achievement standard (Year 8)

By the end of Year 8, students are able to use number, algebraic conventions and formulas and apply this understanding to problem solving with ratios and scale, percentage increase and decrease, perimeters and areas of triangles, quadrilaterals and circles and volumes of triangular prisms. Students readily connect tabular, graphical and algebraic representations of linear functions, and choose appropriate models for solving real life problems. They use numerical and graphical summaries of data, interpret these to draw conclusions and calculate probabilities. They apply mathematical reasoning including congruence and transformations to solve geometric problems and generalise formulas for the perimeter for triangles and rectangles to other quadrilaterals and develop understanding of the volumes of simple prisms. They are able to visualise three-dimensional objects from two-dimensional representations including isometric drawing and plans.

## Year 9 Content descriptions

Number and Algebra	Statistics and Probability	Measurement and Geometry
<b>1. Financial maths</b> Solve problems in financial mathematics including applications of simple and compound interest including using ICT and judge reasonableness of results	<b>1. Data investigation</b> Investigate problems requiring data-based inquiry, collecting univariate and bivariate data, including from secondary sources, and justify conclusions	<b>1. Geometry</b> Investigate properties of polygons and circles, including lines and angles, forming generalisations, explaining reasoning and solving problems
<b>2. Index laws</b> Work fluently with index laws, in both numeric and algebraic expressions and use scientific notation, significant figures and approximations in practical situations	<b>2. Sample space</b> Calculate probabilities for two- and three-step experiments with equally likely outcomes which involve 'with replacement' and 'without replacement'	<b>2. Pythagoras</b> Solve problems involving right angled triangles using Pythagoras' theorem and trigonometric ratios and justify reasoning
<b>3. Linear and quadratic functions</b> Understand simplification techniques for linear and quadratic functions including collecting like terms, common factors, the expansion of binomial products and simple binomial factorisation	<b>3. Probability</b> Compare theoretical and experimental probabilities for two- and three-step experiments	<b>3. Similarity</b> Apply transformations to triangles to explain similarity and congruence, to establish geometric properties
<b>4. Linear equations</b> Solve problems involving linear equations and inequalities and substitution into, and rearrangement of formulas	<b>4. Sampling</b> Evaluate non-random and random sampling techniques	<b>4. Circles</b> Solve problems involving circumference and area of circles and part circles, and the surface area and volume of cylinders and composite solids
<b>5. Simultaneous equations</b> Solve problems involving linear simultaneous equations, using algebraic and graphical techniques including using ICT		<b>5. Location</b> Interpret and create maps and plans, including relative location, directions and bearings, and optimal paths
		<b>6. Visualisation</b> Construct and identify elevations and cross-sections of three-dimensional objects, and explain reasoning

## Achievement standard (Year 9)

By the end of Year 9, students are able to skilfully use number and algebra in problem-solving situations involving finance, right-angle triangle geometry and the calculation of area and volume. They have a sound understanding of linear functions and index laws, and are developing fluency with quadratic and simple non-linear functions. Students choose appropriate techniques, including sampling, in data-based inquiry and confidently represent sample spaces and use these to determine theoretical probabilities. They are confident users of maps and plans, and are developing the use of formal proofs in geometric contexts. They apply Pythagoras' theorem to the solution of right-angled triangles and have a basic understanding of trigonometric ratios.

## Year 10 Content descriptions

Number and Algebra	Statistics and Probability	Measurement and Geometry
<b>1. Financial maths</b>	<b>1. Data representation</b>	<b>1. Geometry</b>
Solve problems in financial mathematics including ones using recursive techniques, and extend these techniques to investigate growth and decay including using ICT	Construct and interpret box plots and compare data sets represented by parallel box plots	Use formal mathematical language to classify shapes and objects including congruence and similarity
<b>2. Proportion</b>	<b>2. Data investigation</b>	<b>2. Trigonometry</b>
Solve problems involving direct and inverse proportion	Pose data-orientated questions, plan sampling, data collection and representation, make and justify conclusions, report the investigation and evaluate choices	Work fluently with trigonometric ratios and solve problems requiring their use in right-angled triangles including direction and angles of elevation and depressions using the three trigonometric ratios
<b>3. Coordinate geometry</b>	<b>3. Chance</b>	<b>3. Surface area and volume</b>
Understand and use graphical and analytical methods of finding distance, midpoint and gradient of an interval on a number plane	Identify, whether two events of the sample space are independent or not, or mutually exclusive, for one- and two-step experiments with equally likely outcomes	Solve problems involving surface area and volume of pyramids, cones and spheres
<b>4. Quadratic expressions</b>	<b>4. Data interpretation</b>	<b>4. Latitude and longitude</b>
Understand how to expand and factorise quadratic expressions using a variety of strategies	Evaluate statistical reports in the media and other places by linking claims to displays, statistics and sampling	Solve problems involving latitude, longitude, and distances on the Earth's surface, using great circles
<b>5. Functions</b>		
Connect algebraic and graphical representations of functions and relations such as parabolas, circles and exponentials		
<b>6. Equations</b>		
Solve non-linear equations algebraically and graphically and using technology		

## Achievement standard (Year 10)

By the end of Year 10, students are able to skilfully use number and algebra in problem-solving situations involving finance, proportion, trigonometry and the calculation of area, volume and distances on the Earth's surface. They readily interpret and connect algebraic and graphical representations of functions and use these to analyse and solve equations. Students choose appropriate numerical, technological and graphical techniques to interpret and compare data sets presented to them and confidently determine theoretical probabilities for one- and two-step experiments and understand the concept of independence. They readily interpret and construct geometric proofs involving the application of congruence and similarity. They routinely communicate solutions in appropriate formats and can judge the reasonableness of results and evaluate the strategies and techniques used.

## Year 10A Content descriptions

Number and Algebra	Statistics and Probability	Measurement and Geometry
<b>1. Surds</b> Work fluently with operations with surds and fractional indices and solve simple exponential equations	<b>1. Bivariate data</b> Model linear relations in bivariate numerical data sets using the least squares line of best fit and interpret the result including using ICT	<b>1. Trigonometry</b> Use the unit circle to graph trigonometric functions and solve simple trigonometric equations
<b>2. Recursion</b> Apply recursive techniques to arithmetic integer sequences, generalise the $n$ th term and solve related problems		<b>2. Sine and cosine rule</b> Understand the sine and cosine rules and apply these to solve problems involving non-right-angled triangles
<b>3. Functions and relations</b> Solve a wide range of quadratic equations and construct graphs of parabolas and circles		

## Achievement standard (Year 10A)

In addition to the Year 10 achievement standard, by the end of 10A students are able to reason mathematically in a wide range of contexts. Their understanding of the real number system is extended to irrational numbers including surds. They can use algebraic, including recursive, techniques to solve equations including quadratics and simple exponential equations. They can model linear relationships in bivariate data and are able to solve trigonometric equations and use trigonometric relationships to solve problems involving non-right-angled triangles.