Scope and sequence

Mathematics

Year 7 to 10

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Mathematics: Scope and sequence year 7 to 10

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Context statement

The Mathematics curriculum is organised around the interaction of three content strands and four proficiency strands. The content strands are number and algebra, measurement and geometry and statistics and probability.

The Mathematics curriculum is taught through the proficiency strands of understanding, fluency, problem-solving and reasoning. They indicate the breadth of mathematical actions that teachers can emphasise. They describe how content is explored or developed.

Mathematics aims to instil in students an appreciation of the elegance and power of mathematical reasoning. Students are reasoning mathematically when they explain their thinking, when they deduce and justify strategies used and when they compare and contrast ideas and explain their choices.

Links between the various components of mathematics, are made clear and taught as interconnected skills.

Students need to be supported to build a robust knowledge of adaptable and transferable mathematical concepts. They need to make connections between related concepts and become confident, creative users and communicators of mathematics.

The South Australian Mathematics Scope and Sequence R-10:

- provides the achievement standards positioned with related strands; number and algebra, measurement and geometry statistics and probability
- makes the relationship between achievement standards and content explicit through listing the achievement standards alongside the relevant content descriptors
- emphasises the progression of skills by highlighting the verbs to emphasise the development of skills across the curriculum
- supports clarity by breaking achievement standards into dot points
- provides the sequence of content and sequence of achievement
- includes content descriptors listed with their associated elaborations.

Achievement standards

Strand: Number and algebra

Number and algebra are developed together, as each enriches the study of the other. Students apply number sense and strategies for counting and representing numbers. They explore the magnitude and properties of numbers. They apply a range of strategies for computation and understand the connections between operations. They recognise patterns and understand the concepts of variable and function. They build on their understanding of the number system to describe relationships and formulate generalisations. They recognise equivalence and solve equations and inequalities. They apply their number and algebra skills to conduct investigations, solve problems and communicate their reasoning.

Year 7	Year 8	Year 9	Year 10	Year 10A
By the end of year 7, students: • solve problems involving the order, addition and subtraction of integers • make the connections between whole numbers and index notation • make the connections between the relationship between perfect squares and square roots • solve problems involving all four operations with fractions, decimals, percentages and their equivalences, and express fractions in their simplest form • compare the cost of items to make financial decisions, with and without the use of digital technology • make simple estimates to judge the reasonableness of results • use variables to represent arbitrary numbers and connect the laws and properties of number to algebra • substitute numbers into algebraic expressions • assign ordered pairs to given points on the Cartesian plane • interpret and analyse graphs of relations from real data • develop simple linear models for situations, make predictions based on these models, solve related equations and check their solutions.	By the end of year 8, students: • use efficient mental and written strategies to make estimates • carry out the 4 operations with integers • apply the index laws to whole numbers • identify and describe rational and irrational numbers in context estimate answers • solve everyday problems involving profit and loss rates, ratios and percentages, with and without the use of digital technology • simplify a variety of algebraic expressions • connect expansion and factorisation of linear expressions • solve linear equations • graph linear relationships on the Cartesian plane.	By the end of year 9, students: • apply the index laws using integer indices to variables and numbers • express numbers in scientific notation • solve problems involving very small and very large numbers, and check the order of magnitude of calculations • solve problems involving simple interest • use the distributive law to expand algebraic expressions, including binomial expressions • simplify a range of algebraic expressions • find the distance between two points on the Cartesian plane • find the gradient and midpoint of a line segment using a range of strategies including the use of digital technology • sketch and draw linear and non-linear relations • solve simple related equations • explain the relationship between the graphical and symbolic forms, with and without the use of digital technology.	By the end of year 10, students: • recognise the connection between simple and compound interest • solve problems involving linear equations and inequalities • solve problems involving quadratic equations and related graphs, with and without the use of digital technology • solve problems involving pairs of simultaneous linear equations and related graphs, with and without the use of digital technology • substitute into formulas • find unknown values • manipulate linear algebraic expressions • expand binomial expressions • factorise monic and simple non-monic quadratic expressions, with and without the use of digital technology • represent linear, quadratic and exponential functions numerically, graphically and algebraically, and use them to model situations and solve practical problems.	

Scope and sequence

Sub-strand	Year 7	Year 8	Year 9	Year 10	Year 10A

Number and place value	Investigate index notation and represent whole numbers as products of powers of prime numbers:
	• **define** and compare prime and composite numbers and explain the difference between them
	• **apply** knowledge of factors to expressing whole numbers as products of powers of prime factors, such as repeated division by prime factors or **create** factor trees
	• **solve** problems involving lowest common multiples and highest common factors for pairs of whole numbers by comparing their prime factorisation.
		Use index notation with numbers to establish the index laws with positive integral indices and the zero index:
		• **evaluate** numbers expressed as powers of positive integers
		• **investigate** and establish the index laws:
		  • multiplication law
		  • division law
		  • power to power with the same base
		  • **apply** and simplify expressions using index laws
		  • **remove** brackets and simplify
		  • **express** in simplest form
		• **investigate** and establish the zero index law.			

	Investigate and use square roots of perfect square numbers: • **investigate** square numbers such as 25 and 36 and developing square-root notation • **investigate** between which two whole numbers a square root lies. Apply the associative, commutative and distributive laws to aid mental and written computation: • **understand** that arithmetic laws are powerful ways of describing and simplifying calculations and provide many opportunities to manipulate numbers. Compare, order, add and subtract integers: • the rule of BEDMAS • **explore** other rules such as more than one set of brackets and **evaluate** fractions.	Carry out the four operations with rational numbers and integers, using efficient mental and written strategies and appropriate digital technologies: • **recognise** rational numbers are the set of all numbers that can be expressed as fractions • **recognise** the decimal expansion of a rational number is either terminating or recurring • **use** the number line to develop strategies for adding and subtracting rational numbers • **use** patterns to assist in finding rules for the multiplication and division of integers • **evaluate** adding and subtracting fractions with lowest common denominator • **simplify** fractions and mixed numbers • multiply and divide fractions, cancel common factors and multiply numerators and then denominators together • divide by a fraction, then multiply the reciprocal of the fraction.			
Fractions and decimals					

Real numbers	Compare fractions using equivalence. Locate and represent positive and negative fractions and mixed numbers on a number line:
	
	• **explore** equivalent fractions by using a fraction wall or a number line (for example by using a fraction wall to show that 2/3 is the same as 4/6 and 6/9).
	
	Solve problems involving addition and subtraction of fractions, including those with unrelated denominators:
	
	• **explore** and **develop** strategies to solve additive problems involving fractions (for example by using fraction walls or rectangular arrays with dimensions equal to the denominators).
	
	Multiply and divide fractions and decimals using efficient written strategies and digital technologies:
	
	• **Investigat**e multiplication of fractions and decimals, using patterns and multiplication as repeated addition, with both concrete materials and digital technologies
	• **identify** the processes for division as the inverse of multiplication.
	
	Express one quantity as a fraction of another, with and without the use of digital technologies:
	
	• **explore** the quantities to be expressed and understand the reasons for the calculations.
		Investigate terminating and recurring decimals:
		
		• **recognise** terminating, recurring and non-terminating decimals and choosing their appropriate representations.
		
		Investigate the concept of irrational numbers, including π:
		
		• **understand** the real number system includes irrational numbers
		• **estimate** and calculate with whole numbers
		• **explore** the decimal representation of π as an irrational number neither terminating nor recurring.
		
		Solve problems involving the use of percentages, including percentage increases, percentage decreases and percentage error, with and without digital technologies:
		
		• **use** percentages to solve problems, including those involving markups, discounts, and GST
		• **use** percentages to calculate population increases and decreases
		• **explore** two methods:
		  ○ using two steps
		  ○ using a multiplier.
		
		Solve a range of problems involving rates and ratios, including distance-time problems for travel at a constant speed, with and without digital technologies:
		
		• **understand** that rate and ratio problems can be solved using fractions or percentages and choosing the most efficient form to solve a particular problem
		• **explore** and **interpret** population growth rates in Australia and Asia and explain their difference.
			Solve problems involving direct proportion:
			
			• **identify** direct proportion in real-life contexts.
			
			Explore the relationship between graphs and equations corresponding to simple rate problems.
			
			Apply index laws to numerical expressions with integer indices:
			
			• **simplify** and **evaluate** numerical expressions, using involving both positive and negative integer indices.
			
			Express numbers in scientific notation:
			
			• **represent** extremely large and small numbers in scientific notation
			• **represent** numbers expressed in scientific notation as whole numbers or decimals.
				Solve simple problems involving inverse proportion:
				
				• **explore** the case where doubling one variable halves the other.
					Define rational and irrational numbers and perform operations with surds and fractional indices:
					
					• **understand** the real number system includes irrational numbers
					• **extend** the index laws to rational number indices
					• perform the four operations with surds.
					
					Use the definition of a logarithm to establish and apply the laws of logarithms:
					
					• **investigate** the relationship between exponential and logarithmic expressions
					• **simplify** expressions using the logarithm laws.

	Round decimals to a specified number of decimal places: • **use** rounding to estimate the results of calculations with whole numbers and decimals • **recognise** the conventions for rounding • **recognise** the digits after the decimal point can be terminating or non-terminating • **recognise** a terminating decimal is a decimal that contains a finite number of digits				

	• **recognise** non-terminating decimals may be recurring, that is, contain a pattern of digits that repeats indefinitely after a certain number of places • **recognise** irrational numbers can only be approximated in the decimal number system.				
	Connect fractions, decimals and percentages and carry out simple conversions: • **describe** the choices of written, mental or calculator strategies for solving problems, including those involving large numbers • **understand** that quantities can be represented by different number types and calculated using various operations, and that choices need to be made about each • **calculate** the percentage of the total local municipal area set aside for parkland, manufacturing, retail and residential dwellings to compare land use. Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies: • **express** quantities as percentages of other amounts.				
	Recognise and solve problems involving simple ratios: • **understand** that rate and ratio problems can be solved using fractions or percentages • **determine** the most efficient form to solve a particular problem.				
Money and financial mathematics	Investigate and calculate 'best buys', with and without digital technologies: • **apply** the unitary method to identify 'best buys' situations • **use** measurement to estimate and measure with metric units, such as comparing the cost per 100g • **estimate** and calculate with whole numbers and apply this to the use of money.	Solve problems involving profit and loss, with and without digital technologies: • **express** profit and loss as a percentage of cost and selling price, comparing the difference • **represent** profit and loss as a percentage of the cost price • **investigate** the methods used in retail stores to express discounts • **explore** discount, selling price and GST.	Solve problems involving simple interest: • **understand** that financial decisions can be assisted by mathematical calculations • **explore** simple interest to establish the simple interest formula • **identify** areas where investments are over a period of months or days and interest rates are quoted as per annum.	Connect the compound interest formula to repeated applications of simple interest using appropriate digital technologies: • **explore** the comparison between compound interest and simple interest, and which grows more rapidly • **work** with authentic information, data and interest rates to calculate compound interest and solve related problems.	

Patterns and algebra	Introduce the concept of variables as a way of representing numbers using letters:
	
	• **recall** BEDMAS
	• **explore** the use of symbols to represent numbers
	• **use** the terminology variable or unknown
	• **understand** that arithmetic laws are powerful ways of describing and simplifying calculations and that using these laws leads to the generality of algebra
	• **establish** the arithmetic laws:
	  • commutative law such as:
	  3 + 4 = 4 + 3 and 3 x 4 = 4 x 3 and relate to everyday such as 'to school' and 'from school'
	  • associative law such as:
	  (2 + 3) + 4 = 2 +(3 + 4), the numbers do not move only the brackets, and
	  2 x (3 x 4) = (2 x 3) x 4
	  • distributive law such as:
	  3(2 + 5) is 3 x 7 = 21, and
	  3 x 2 + 3 x 5 is 6 + 15 = 21
	  That is
	  3(2 + 5)= 3 x 2 + 3 x 5.
		Extend and apply the distributive law to the expansion of algebraic expressions:
		
		• **apply** the distributive law to the expansion of algebraic expressions by revising the concept of perimeter to lead to the area model
		• **connect** the result of the distributive law is the expansion
		• **apply** collecting like terms and its meaning
		• **explore** the distributive law with negative coefficient
		• **explore** the distributive law with a variable.
			Extend and apply the index laws to variables, using positive integer indices and the zero index:
			
			• **develop** that index laws apply to variables as well as numbers. Consider some expressions, their factors and their simplification
			• **recall** Index laws with variables:
			  • multiply
			  • divide
			  • raising power to power
			  • power of a product
			  • power of a quotient
			  • power of zero
			• **investigate** negative index law with numbers
			• **connect** with the meaning of reciprocals
			• **apply** negative index law with variables.
				Factorise algebraic expressions by taking out a common algebraic factor:
				
				• **recall** process of factorisation, product of factors and highest common factor
				• **use** the distributive law and the index laws to factorise algebraic expressions
				• **understand** the relationship between factorisation and expansion
				• **factorise** the algebraic expression:
				  • common Factors
				  • difference of two squares
				  • perfect squares
				  • sum and product
				  • trial and error
				  • four terms by grouping in pairs.
					Investigate the concept of a polynomial and apply the factor and remainder theorems to solve problems:
					
					• **explore** the polynomials and name each polynomial
					• **describe** terms of a polynomial
					• **explore** function notation
					• **expand** and simplify polynomials
					• **explore** division of polynomials and establish terms, dividend, divisor, quotient and remainder
					• **investigate** the relationship between algebraic long division and the factor and remainder theorems
					• **explore** solving polynomial equations, graphing polynomial equations and applications.

	Create algebraic expressions and evaluate them by substituting a given value for each variable:
	
	• **write** algebraic expressions with one variable and then two variables
	• **establish** keywords: variable, numeral, expression, equation, terms, like terms, coefficient and constant term
	• **use** authentic formulas to perform substitutions and calculate the result
	• **perform** negative substitutions and calculate the result.
		Factorise algebraic expressions by identifying numerical factors:
		
		• **recognise** the relationship between factorising and expanding
		• **identify** the greatest common divisor (highest common factor) of numeric and algebraic expressions and using a range of strategies to factorise algebraic expressions.
			Apply the distributive law to the expansion of algebraic expressions, including binomials algebraic expressions, including binomials, and collect like terms where appropriate:
			
			• **understand** that the distributive law can be applied to algebraic expressions as well as numbers
			• **connect** the relationship between expansion and factorization
			• **identify** algebraic factors in algebraic expressions
			• **consider** the expansions:
			  • the product
			  • difference of two squares
			  • perfect squares
			  • binomial expansion
			  • consider $(a + b)(c + d + e)$.
				Simplify algebraic products and quotients using index laws:
				
				• **apply** knowledge of index laws to algebraic terms
				• **simplify** algebraic expressions using both positive and negative integral indices.	

Patterns and algebra	Extend and apply the laws and properties of arithmetic to algebraic terms and expressions: • **identify** order of operations in contextualised problems, preserving the order by inserting brackets in numerical expressions, then recognising how order is preserved by convention • **convert** between algebraic and word representations as descriptions of the same situation.	Simplify algebraic expressions involving the four operations: • **understand** that the laws used with numbers can also be used with algebra.		Apply the four operations to simple algebraic fractions with numerical denominators: • **express** the sum and difference of algebraic fractions with a common denominator • **develop** the four operations to algebraic fractions with variables in the denominator • **use** the index laws to simplify products and quotients of algebraic fractions.	
				Expand binomial products and factorise monic quadratic expressions using a variety of strategies: • **explore** the method of completing the square to factorise quadratic expressions and solve quadratic equations • **identify** and using common factors, including binomial expressions, to factorise algebraic expressions using the technique of grouping in pairs • **use** the identities for perfect squares and the difference of squares to factorise quadratic expressions.	
				Substitute values into formulas to determine an unknown: • **solve** simple equations arising from formulas • **solve** equations with repeated unknowns • **solve** equations with fractions • **apply** to linear equations and problem solving.	
Linear and non-linear relationships	Given coordinates, plot points on the Cartesian plane, and find coordinates for a given point: • **explore** map references • **describe** number grids, x-axis, y-axis, origin, x and y coordinates, ordered pairs and points on axes • **connect** the number line and number plane, leading to the four quadrants • **plot** points from a table of integer values and recognise simple patterns, such as points that lie on a straight line.	Plot linear relationships on the Cartesian plane with and without the use of digital technologies: • **recall** number grids, x-axis, y-axis, origin, x and y coordinates, ordered pairs, points on axes, number plane and the four quadrants • **complete** a table of values, plotting the resulting points and determining whether the relationship is linear • **plot** graphs of linear equations • **explore** the types of graphs such as steepness, sloping forward, sloping backwards, vertical lines and horizontal lines, using technology • **find** the rule for a linear relationship.	Find the distance between two points located on the Cartesian plane using a range of strategies, including graphing software: • **investigate** graphical and algebraic techniques for finding distance between two points • **use** Pythagoras' theorem to calculate the distance between two points and establish the distance formula.	Solve problems involving linear equations, including those derived from formulas: • **represent** word problems with simple linear equations and solving them to answer questions.	Describe, interpret and sketch parabolas, hyperbolas, circles and exponential functions and their transformations: • **recall** the connection between algebraic and graphical representations of relations such as parabolas, reciprocals, circles and exponentials • **apply** transformations, including translations, reflections in the axes and stretches to help graph parabolas, rectangular hyperbolas, circles and exponential functions.

	Solve simple linear equations: • **explore** solving equations by inspection, guess, check and improve, and introduce maintaining balance of an equation • **solve** equations using concrete materials, such as the balance model, and explain the need to do the same thing to each side of the equation • **use** substitution to check solutions • **investigate** strategies such as inverse operations and flowcharts to solve equations.	Solve linear equations using algebraic and graphical techniques. Verify solutions by substitution: • **solve** real life problems by using variables to represent unknowns.	Find the midpoint and gradient of a line segment (interval) on the Cartesian plane using a range of strategies, including graphing software: • **investigate** graphical and algebraic techniques for finding midpoint and gradient • **describe** the steepness and gradient of a line using vertical (y step) and horizontal (x step) steps, gradient formula and gradient of horizontal and vertical lines • **recognise** that the gradient of a line is the same as the gradient of any line segment on that line • **apply** gradient as the rate of change to problem solving • **investigate** gradients of parallel and perpendicular lines.	Solve linear inequalities and graph their solutions on a number line: • **recall** inequalities and number line representation • **investigate** four operations with inequalities and establish the rules • **solve** algebraic inequality equations and find the unknown • **represent** word problems with simple linear inequalities and solve them to answer questions.	Solve simple exponential equations: • **describe** exponential equations • **solve** exponential equations by equating indices when both sides have the same base • **use** technology to solve exponential equations if possible • **investigate** exponential equations derived from authentic mathematical models based on population growth • **solve** exponential equations using logarithm rules and applications.

	Investigate, interpret and analyse graphs from real life data, including consideration of domain and range:
	
	• **explore** properties of line graphs, such as dependent and independent variables
	• **explore** increasing and decreasing graphs
	• **estimate** from line graphs
	• **develop** the relationship between the time taken and distance travelled in line graphs
	• **use** travel graphs to investigate and compare the distance travelled to and from school
	• **interpret** features of travel graphs such as the slope of lines and the meaning of horizontal lines
	• **use** graphs of evaporation rates to explore water storage.
		Plot graphs of non-linear real-life data with and without the use of digital technologies, and interpret and analyse these graphs.	Sketch linear graphs using the coordinates of two points and solve linear equations:
			
			• **determine** linear rules from suitable diagrams, tables of values and graphs and describe them using both words and algebra.
				Solve linear simultaneous equations, using algebraic and graphical techniques, including using digital technology:
				
				• **investigate** graphical solution by graphing and using technology
				• **investigate** solution by substitution
				• **investigate** solution by elimination
				• **describe** the form of simultaneous equations and apply either substitution or elimination methods
				• **associate** the solution of simultaneous equations with the coordinates of the intersection of their corresponding graphs
				• **represent** word problems as simultaneous equations and solve them to answer questions.
					Apply understanding of polynomials to sketch a range of curves and describe the features of these curves from their equation:
					
					• **investigate** the features of graphs of polynomials such as cubics and quartics using technology to include:
					  • shape and the effect of leading coefficient
					  • axes intercepts
					  • the effect of repeated factors
					• **apply** the null factor law and remainder theorem to sketch the graph
					• **apply** this to higher degree polynomials
					• **explore** application problems.

			Graph simple non-linear relations with and without the use of digital technologies and solve simple related equations:
			
			• **investigate** the properties of parabolas (using technology), identifying turning point (vertex), axes intercepts, and the axis of symmetry
			• **graph** parabolas from:
			  • table of values,
			  • axes intercepts
			• **investigate** the connection with the number of *x*-axes intercepts and the x-axis
			• **explore** the equation of a circle using the distance formula, then graph the circle
			• **describe** the equation of a circle, in factored and general form
			• **connect** *x*-intercepts of a graph to a related equation.
				Solve problems involving gradients of parallel and perpendicular lines:
				
				• **solve** problems using the fact that parallel lines have the same gradient and conversely that if two lines have the same gradient then they are parallel
				• **solve** problems using the fact that the product of the gradients of perpendicular lines is $^{-}1$ and conversely that if the product of the gradients of two lines is $^{-}1$ then they are perpendicular
				• **use** the negative reciprocal to determine perpendicular lines.
					Factorise monic and non-monic quadratic expressions and solve a wide range of quadratic equations derived from a variety of contexts:
					
					• **recall the** process of factorization
					• **solve** monic quadratics, $a = 1$
					• **solve** non-monic quadratics, $a \neq 1$
					• **write** quadratic equations that represent practical problems.

				Explore the connection between algebraic and graphical representations of relations such as simple quadratics, reciprocals, circles and exponentials using digital technology as appropriate: • **recall** briefly sketching graphs of parabolas using a table • **use** technology to establish graphing quadratics using transformations • **discover** the properties of the parabola including axes intercepts • **establish** reciprocal functions and their properties using a table and technology • **recall** the equation of a circle • **use** technology if possible to establish graphing circles using transformations • **apply** translations, reflections and stretches to parabolas and circles • **establish** exponential functions and their properties using a table and technology • **sketch** the graphs of exponential functions using transformations • **explore** situations where quantities are increasing or decreasing exponentially to infer growth and decay situations • **apply** this to problem solving situations.	Use function notation to describe the relationship between dependent and independent variables in modelling contexts: • **connect** *y* and *f(x)* • **describe** *f(x)* as " *f* of *x*" • **explore** composite functions • **explore** inverse functions • **use** function notation in modelling context.

				Solve linear equations involving simple algebraic fractions: • **solve** a wide range of linear equations, including those involving one or two simple algebraic fractions, and checking solutions by substitution • **recall** problem solving method and steps • **represen**t word problems, including those involving fractions, as equations and solving them to answer the question.	Solve simultaneous equations using the systematic guess-check-and-refine method with digital technology: • **recall** solution using graphing, substitution and elimination • **use** technology to solve simultaneous equations • **apply** this to problem solving with simultaneous equations and check your solution.

				Solve simple quadratic equations using a range of strategies:
				
				• **recall** steps for solving equations
				• **use** a variety of techniques to solve quadratic equations:
				  • grouping
				  • completing the square and establish the properties
				  • the quadratic formula
				  • use the discriminant to identify a number of solutions
				  • choosing two integers with the required product and sum
				  • null factor law.
				
				Solve equations using the systematic guess-check-and-refine method with digital technology.	

Achievement standards

Strand: Measurement and geometry

Measurement and geometry are presented together to emphasise their relationship to each other, enhancing their practical relevance. Students develop an increasingly sophisticated understanding of size, shape, relative position and movement of two-dimensional figures in the plane and three-dimensional objects in space. They investigate properties and apply their understanding of them to define, compare and construct figures and objects. They learn to develop geometric arguments. They make meaningful measurements of quantities, choosing appropriate metric units of measurement. They build an understanding of the connections between units and calculate derived measures such as area, speed and density.

Year 7	Year 8	Year 9	Year 10	Year 10A
By the end of year 7, students: • use formulas for the area and perimeter of rectangles • classify triangles and quadrilaterals • represent transformations of these shapes on the Cartesian plane, with and without the use of digital technology • name the types of angles formed by transversals crossing parallel lines • solve simple numerical problems involving these lines and angles • describe different views of three-dimensional objects and use models, sketches and digital technology to represent these views • calculate volumes of rectangular prisms.	By the end of year 8, students: • convert between units of measurement for area and for volume • find the perimeter and area of parallelograms, rhombuses and kites • name the features of circles • calculate circumference and area • solve problems relating to the volume of prisms • make sense of time duration in real applications, including the use of 24-hour time • identify conditions for the congruence of triangles • deduce the properties of quadrilaterals • use tools, including digital technology, to construct congruent shapes.	By the end of year 9, students: • solve measurement problems involving perimeter and area of composite shapes • surface area and volume of rectangular prisms and cylinders, with and without the use of digital technology • relate three-dimensional objects to two-dimensional representations • explain similarity of triangles • interpret ratios and scale factors in similar figures • apply Pythagoras's theorem and trigonometry to solve problems involving angles and lengths in right-angled triangles.	By the end of year 10, students: • solve and explain surface area and volume problems relating to composite solids • use parallel and perpendicular lines, angle and triangle properties to solve practical problems • use similarity to solve practical problems • use trigonometry to solve practical problems • use congruence to solve practical problems • develop proofs involving lengths, angles and areas in plane shapes • use digital technology to construct and manipulate geometric shapes and objects • explore symmetry and pattern in two dimensions.	

Scope and sequence

Sub-strand	Year 7	Year 8	Year 9	Year 10	Year 10A
Units of measurement	Establish the formulas for areas of rectangles, triangles and parallelograms, and use these in problem-solving: • **build** on the understanding of the area of rectangles to develop formulas for the area of triangles • **establish** that the area of a triangle is half the area of an appropriate rectangle • **use** area formulas for rectangles and triangles to solve problems involving areas of surfaces.	Choose appropriate units of measurement for area and volume and convert from one unit to another: • **choose** units for area including mm^2, cm^2, m^2, hectares, km^2, and units for volume including mm^3, cm^3, m^3 • **recognise** that the conversion factors for area units are the squares of those for the corresponding linear units • **recognise** that the conversion factors for volume units are the cubes of those for the corresponding linear units.	Calculate areas of composite shapes: • **recall** area of squares, rectangles, triangles, parallelograms, trapeziums, rhombus, kites and circles • **establish area of** sectors • **understand** that partitioning composite shapes into rectangles and triangles is a strategy for solving problems involving area.		
	Calculate volumes of rectangular prisms: • **investigate** volumes of cubes and rectangular prisms, establish and use the formula $V = l \times b \times h$ • **recognise** and use cubic units when interpreting and finding volumes of cubes and rectangular prisms.	Find perimeters and areas of parallelograms, trapeziums, rhombuses and kites: • **establish** and **use** formulas for areas such as trapeziums, rhombuses and kites • **use** these formulas in problem-solving.	Calculate the surface area and volume of cylinders and solve related problems: • **analyse** nets of cylinders to establish formulas for surface area • **connect** the volume and capacity of a cylinder to solve authentic problems. **Solve** problems involving the surface area and volume of right prisms: • **recall** volume of rectangular and triangular prisms • **solve** practical problems involving surface area and volume of right prisms.	Solve problems involving surface area and volume for a range of prisms, cylinders and composite solids: • **recall** formulas of area, volume, and conversions • **investigate** and determining the volumes and surface areas of composite solids by considering the individual solids from which they are constructed.	Solve problems involving surface area and volume of right pyramids, right cones, spheres and related composite solids: • **use** formulas to solve problems • **use** authentic situations to apply knowledge and understanding of surface area and volume.
		Investigate the relationship between features of circles such as radius, diameter, circumference and area. **Recall** the irrational number π from the real number strand: • **investigate** the circumference and area of circles with materials or by measuring, to establish an understanding of formulas OR • **investigate** the area of circles using a square grid or by rearranging a circle divided into sectors. **Use** formulas to solve problems involving circumference and area in the same context.			

Sub-strand	Year 7	Year 8	Year 9	Year 10	Year 10A
		Develop formulas for volumes of rectangular and triangular prisms and prisms in general. **Use** formulas to solve problems involving volume and other prisms: • **investigate** the relationship between volumes of rectangular and triangular prisms (between units) • **explore** the volume of cylinders • **explore** capacity conversions and problem solving.			
		Solve problems involving duration, including using 12- and 24-hour time within a single time zone: • **identify** regions in Australia and countries in Asia that are in the same time zone.	Investigate very small and very large time scales and intervals • **investigate** the usefulness of scientific notation in representing very large and very small numbers		
Shape	Draw different views of prisms and solids formed from combinations of prisms: • **use** aerial views of buildings and other 3-D structures to visualise the structure of the building or prism.				
Location and transformation	Describe translations, reflections in an axis and rotations of multiples of 90° on the Cartesian plane using coordinates. Identify line and rotational symmetries: • **describe** patterns and investigate different ways to produce the same transformation such as using two successive reflections to provide the same result as a translation • **experiment** with creating and re-creating patterns using combinations of reflections and rotations, using digital technologies.				

Sub-strand	Year 7	Year 8	Year 9	Year 10	Year 10A
Geometric reasoning	Identify corresponding, alternate and co-interior angles when two straight lines are crossed by a transversal: • **define** and classifying pairs of angles as complementary, supplementary, adjacent and vertically opposite • **explore** the relationship of angles and parallel lines.	Define congruence of plane shapes using transformations and use transformations of congruent shapes to produce regular patterns in the plane including tessellations with and without the use of digital technology: • **recall** corresponding, alternate and co-interior angles, and complementary, supplementary, adjacent and vertically opposite angles • **understand** the properties that determine congruence of triangles and recognise which transformations create congruent figures • **establish** that two figures are congruent if one shape lies exactly on top of the other after one or more transformations (translation, reflection, rotation), and recognise that the matching sides and the matching angles are equal. Develop the conditions for congruence of triangles: • **investigate** the minimal conditions needed for the unique construction of triangles, leading to the establishment of the conditions for congruence (SSS, SAS, ASA and RHS) • **construct** triangles using the conditions for congruence • **solve** problems using the properties of congruent figures.	Use the enlargement transformation to explain similarity and develop the conditions for triangles to be similar: • **establish** the conditions for similarity of two triangles and compare this to the conditions for congruence • **use** the enlargement transformation to establish similarity, understanding that similarity and congruence help describe relationships between geometrical shapes and are important elements of reasoning and proof • **use** the properties of similarity and ratio, and correct mathematical notation and language, to solve problems involving enlargement (for example, scale diagrams). Solve problems using ratio and scale factors in similar figures: • **establish** the relationship between areas of similar figures and the ratio of corresponding sides (scale factor).	Apply logical reasoning, including the use of congruence and similarity, to proofs and numerical exercises involving plane shapes: • **distinguish** between a practical demonstration and a proof (for example demonstrating triangles are congruent by placing them on top of each other, as compared to using congruence tests to establish that triangles are congruent) • **perform** a sequence of steps to determine an unknown angle and side, giving a justification in moving from one step to the next • **communicate** a proof using a sequence of logically connected statements. Formulate proofs involving congruent triangles and angle properties: • **apply** an understanding of relationships to deduce properties of geometric figures (for example the base angles of an isosceles triangle are equal).	Prove and apply angle and chord properties of circles: • **establish** circle theorems • **perform** a sequence of steps to determine an unknown angle or length in a diagram involving a circle, or circles, giving a justification in moving from one step to the next • **communicate** a proof using a logical sequence of statements • **prove** results involving chords, segments, angles and tangents of circles.
	Investigate conditions for two lines to be parallel and solve simple: numerical problems using reasoning: • **construct** parallel and perpendicular lines using their properties, a pair of compasses and a ruler, and dynamic geometry software • **define** and identifying the relationships between alternate, corresponding and co-interior angles for a pair of parallel lines cut by a transversal.				

Sub-strand	Year 7	Year 8	Year 9	Year 10	Year 10A
	Demonstrate that the angle sum of a triangle is 180° and use this to find the angle sum of a quadrilateral: • **use** concrete materials and digital technologies to investigate the angle sum of a triangle and quadrilateral.	Establish properties of quadrilaterals using congruent triangles and angle properties, and solve related numerical problems using reasoning: • **establish** the properties of squares, rectangles, parallelograms, rhombuses, trapeziums and kites • **identify** properties related to side lengths, parallel sides, angles, diagonals and symmetry.			
	Classify triangles according to their side and angle properties and describe quadrilaterals: • **identify** side and angle properties of scalene, isosceles, right-angled and obtuse-angled triangles • **describe** squares, rectangles, rhombuses, parallelograms, kites and trapeziums.				
Pythagoras and trigonometry			Investigate Pythagoras' theorem and its application to solving simple problems involving right-angled triangles: • **investigate** Pythagoras' theorem using area of sides and establish the formula • **understand** that Pythagoras' theorem is a useful tool in determining unknown lengths in right-angled triangles and has widespread applications • **explore** the converse test of Pythagoras' theorem and Pythagorean triples • **recognise** that right-angled triangle calculations may generate results that can be integers, fractions or irrational numbers • **solve** problems using Pythagoras' theorem.	Solve right-angled triangle problems including those involving direction and angles of elevation and depression: • **recall** Pythagoras' theorem, its converse and Pythagorean triples • **solve** problems using Pythagoras' theorem, including triangles, quadrilaterals, circles, angles of elevation and depression and trigonometry • **apply** Pythagoras' theorem and trigonometry to problems in surveying and design.	Establish the sine, cosine and area rules for any triangle and solve related problems: • **explore** and establish the sine rule and cosine rule • **establish** the area of a non-right angled triangle • **solve** problems using the knowledge of sine, cosine and area rules • **apply** knowledge of sine, cosine and area rules to authentic problems such as those involving surveying and design.
			Use similarity to investigate the constancy of the sine, cosine and tangent ratios for a given angle in right-angled triangles: • **develop** the understanding of the relationship between the corresponding sides of similar right-angled triangles and the angle.		Use the unit circle to define trigonometric functions, and graph them with and without the use of digital technologies: • **explore** the circle with centre the origin and radius 1 unit • **establish** the unit circle equation with centre the origin and radius 1 unit, and its properties • **establish** the symmetrical properties of trigonometric functions, such as the relationship between sine and cosine • **investigate** angles of any magnitude • **recognise** that trigonometric functions are periodic, and that this can be used to describe motion.

Sub-strand	Year 7	Year 8	Year 9	Year 10	Year 10A
			Apply trigonometry to solve right-angled triangle problems: • **understand** the terms 'adjacent' and 'opposite' sides in a right-angled triangle • **select** and accurately use the correct trigonometric ratio to find unknown sides (adjacent, opposite and hypotenuse) and angles in right-angled triangles • **solve** problems using trigonometric ratios.		Solve simple trigonometric equations: • **use** periodicity and symmetry to solve equations with and without technology.
					Apply Pythagoras' theorem and trigonometry to solving three-dimensional problems in right-angled triangles: • **investigate** the applications of Pythagoras' theorem in authentic problems.

Achievement standards

Strand: Statistics and probability

Statistics and probability initially develop in parallel and the curriculum then progressively builds the links between them. Students recognise and analyse data and draw inferences. They represent, summarise and interpret data and undertake purposeful investigations involving the collection and interpretation of data. They assess likelihood and assign probabilities using experimental and theoretical approaches. They develop an increasingly sophisticated ability to critically evaluate chance and data concepts and make reasoned judgements and decisions, as well as building skills to critically evaluate statistical information and develop intuitions about data.

Year 7	Year 8	Year 9	Year 10	Year 10A
By the end of year 7, students: • identify issues involving the collection of discrete and continuous data from primary and secondary sources • construct stem-and-leaf plots • construct dot-plots • identify or calculate mean, mode, median and range for data sets, using digital technology for larger data sets • describe the relationship between the median and mean in data displays • determine the sample space for simple experiments with equally likely outcomes, and assign probabilities outcomes.	By the end of year 8, students: • explain issues related to the collection of sample data • discuss the effect of outliers on means and medians of the data • use various approaches, including the use of digital technology, to generate simple random samples from a population • model situations with Venn diagrams and explain the use of 'not', 'and' and 'or' • model situations with two-way tables and explain the use of 'not', 'and' and 'or' • choose appropriate language to describe events and experiments • determine complementary events • calculate the sum of probabilities.	By the end of year 9, students: • compare techniques for collecting data from primary and secondary sources • identify questions and issues involving different data types • construct histograms and back-to-back stem-and-leaf plots with and without the use of digital technology • identify mean and median in skewed, symmetric and bi-modal displays and use these to describe and interpret the distribution of the data • calculate relative frequencies to estimate probabilities • list outcomes for two-step experiments and assign probabilities for those outcomes and related events.	By the end of year 10, students: • compare univariate data sets by referring to summary statistics and the shape of their displays • describe bivariate data where the independent variable is time • use scatter-plots generated by digital technology to investigate relationships between two continuous variables • evaluate the use of statistics in the media • list outcomes for multi-step chance experiments involving independent and dependent events, and assign probabilities for these experiments.	

Scope and sequence

Sub-strand	Year 7	Year 8	Year 9	Year 10	Year 10A
Chance	Construct sample spaces for single-step experiments with equally likely outcomes: • **explore** the meaning of probability terminology (for example probability, sample space, favourable outcomes, trial, events and experiments) • **distinguish** between equally likely outcomes and outcomes that are not equally likely.	Identify complementary events and use the sum of probabilities to solve problems: • **recall the** concept of probabilities, outcomes, sample spaces and events • **identify** the complement of familiar events • **understand** that probabilities range between 0 to 1 • **calculate** the probability of an event allows the probability of its complement to be found.	List all outcomes for two-step chance experiments, both with and without replacement using tree diagrams or arrays. Assign probabilities to outcomes and determine probabilities for events: • **conduct** two-step chance experiments • **use** systematic methods to list outcomes of experiments and to list outcomes favorable to an event • **compare** experiments which differ only by being undertaken with replacement or without replacement.	Describe the results of two- and three-step chance experiments, both with and without replacements, assign probabilities to outcomes and determine probabilities of events. Investigate the concept of independence: • **recognise** that an event can be dependent on another event and that this will affect the way its probability is calculated.	Investigate reports of studies in digital media and elsewhere for information on their planning and implementation: • **evaluate** the appropriateness of sampling methods in reports where statements about a population are based on a sample • **evaluate** whether graphs in a report could mislead, and whether graphs and numerical information support the claims.
	Assign probabilities to the outcomes of events and determine probabilities for events: • **express** probabilities as decimals, fractions and percentages.	Describe events using language of 'at least', exclusive 'or' (A or B but not both), inclusive 'or' (A or B or both) and 'and': • **pose** 'and', 'or' and 'not' probability questions about objects or people.	Calculate relative frequencies from given or collected data to estimate probabilities of events involving 'and' or 'or': • **use** Venn diagrams or two-way tables to calculate relative frequencies of events involving 'and', 'or' questions • **use** relative frequencies to find an estimate of probabilities of 'and', 'or' events.	Use the language of 'if ... then', 'given', 'of', 'knowing that' to investigate conditional statements and identify common mistakes in interpreting such language: • **use** two-way tables and Venn diagrams to understand conditional statements • **use** arrays and tree diagrams to determine probabilities.	
		Represent events in two-way tables and Venn diagrams and solve related problems: • **use** Venn diagrams and two-way tables to calculate probabilities for events, satisfying 'and', 'or' and 'not' conditions • **understand** that representing data in Venn diagrams or two-way tables facilitates the calculation of probabilities • **collect** data to answer the questions using Venn diagrams or two-way tables.	Investigate reports of surveys in digital media and elsewhere for information on how data were obtained to estimate population means and medians: • **investigate** a range of data and its sources, for example the age of residents in Australia, Cambodia and Tonga; the number of subjects studied at school in a year by 14-year-old students in Australia, Japan and Timor-Leste.		
Data representation and interpretation	Identify and investigate issues involving numerical data collected from primary and secondary sources: • **obtain** secondary data from newspapers, the Internet and the Australian Bureau of Statistics • **investigate** secondary data relating to the distribution and use of non-renewable resources around the world.	Distinguish between a population and a sample and Investigate techniques for collecting data, including census, sampling and observation: • **identify** situations where data can be collected by census and those where a sample is appropriate.	Identify everyday questions and issues involving at least one numerical and at least one categorical variable, and collect data directly and from secondary sources: • **compare** the annual rainfall in various parts of Australia, Pakistan, New Guinea and Malaysia.	Determine quartiles and interquartile range and investigate the effect of individual data values, including outliers, on the interquartile range: • **find** the five-number summary (minimum and maximum values, median and upper and lower quartiles) and using its graphical representation, the box plot, as tools for both numerically and visually comparing the centre and spread of data sets, with and without technology.	Calculate and interpret the mean and standard deviation of data and use these to compare data sets: • **use** the standard deviation to describe the spread of a set of data • **use** the mean and standard deviation to compare numerical data sets.
	Construct and compare a range of data displays including stem-and-leaf plots and dot plots:	Explore the practicalities and implications of obtaining data through sampling using a variety of investigative processes:	Construct back-to-back stem-and-leaf plots and histograms and describe data, using terms including 'skewed', 'symmetric' and 'bi modal':	Construct and interpret box plots and use them to compare data sets:	Use information technologies to investigate bivariate numerical data sets.

Sub-strand	Year 7	Year 8	Year 9	Year 10	Year 10A
	• **recognise** that some data representations are more appropriate than others for particular data sets, and answering questions about those data sets • **use** ordered stem-and-leaf plots to record and display numerical data collected in a class investigation, such as constructing a class plot of height in centimetres on a shared stem-and-leaf plot for which the stems 12, 13, 14, 15, 16 and 17 have been produced.	• **investigate** the uses of random sampling to collect data • **explore** the categorical and numerical types of data • **recall** mean, median, mode and range.	• **use** stem-and-leaf plots to compare two like sets of data such as the heights of girls and the heights of boys in a class • **describe** the shape of the distribution of data using terms such as 'positive skew', 'negative skew' 'symmetric' and 'bi-modal'.	• **understand** that box plots are an efficient and common way of representing and summarising data and can facilitate comparisons between data sets • **use** parallel box plots to compare data about the age distribution of Aboriginal and Torres Strait Islander people with that of the Australian population as a whole.	Where appropriate use a straight line to describe the relationship allowing for variation: • **investigate** different techniques for finding a 'line of best fit', such as 'by inspection' or using linear regression, (use technology) • **explore** interpolation and extrapolation and the trend of being reliable or not reliable.
	Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data: • **recognise** that summarising data by calculating measures of centre and spread can help make sense of the data.	Explore the variation of means and proportions of random samples drawn from the same population: • **use** sample properties to predict characteristics of the population.	Compare data displays using mean, median and range to describe and interpret numerical data sets in terms of location (centre) and spread: • **compare** means, medians and ranges of two sets of numerical data which have been displayed using histograms, dot plots, or stem and leaf plots • **explore** the appropriate measure of central tendency to draw conclusions • **explore** measures of spread such as range, interquartile range to accurately describe a data set and draw conclusions.	Compare shapes of box plots to corresponding histograms and dot plots and discuss the distribution of data: • **investigate** data in different ways to make comparisons and draw conclusions.	
	Describe and interpret data displays using median, mean and range: • **use** mean and median to compare data sets and explain how outliers may affect the comparison • **locate** mean, median and range on graphs and connect them to real life.	Investigate the effect of individual data values, including outliers, on the mean and median: • **use** displays of data to explore and investigate effects.		Use scatter plots to investigate and comment on relationships between two numerical variables: • **use** authentic data to construct scatter plots, make comparisons and draw conclusions • **explore** the measures of centre, mean, median, range and interquartile range between two numerical variables and draw conclusions.	
				Investigate and describe bivariate numerical data where the independent variable is time: • **investigate** biodiversity changes in Australia since European occupation • **construct** and interpreting data displays that represent bivariate data over time.	
				Evaluate statistical reports in the media and other places by linking claims to displays, statistics and representative data: • **investigate** the use of statistics in reports regarding the growth of Australia's trade with other countries of the Asia region • **evaluate** statistical reports comparing the life expectancy of Aboriginal and Torres Strait Islander people with that of the Australian population as a whole.	