

Mathematics scope and sequence chart: Grades 5 to 9

	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
REASONING AND PROBLEM SOLVING					
To be applied in other strands	<ul style="list-style-type: none"> Routine/non-routine problems in number, algebra, geometry, measures, data handling Representing and interpreting problems Explaining methods and reasoning Deciding when to use a calculator and interpreting display Giving examples to match a general statement 	<ul style="list-style-type: none"> Routine/non-routine problems in number, algebra, geometry, measures, data handling Representing and interpreting problems; changing from one representation to another Explaining methods and reasoning Checking results for reasonableness Searching for all possibilities Identifying simple patterns and explaining them in words 	<ul style="list-style-type: none"> Routine/non-routine problems in number, algebra, geometry, measures, data handling Representing and interpreting problems; changing from one representation to another Explaining methods and reasoning, including reasoning to establish truth of a statement Presenting and explaining solution in context of problem Making generalised statements using words and symbols 	<ul style="list-style-type: none"> Routine/non-routine problems in number, algebra, geometry, measures, data handling Representing and interpreting problems in different ways Choosing techniques Explaining methods and reasoning, including reasoning to establish truth of a statement Using step-by-step reasoning in geometry, or using symbols, and finding counter-examples Finding alternative solutions 	<ul style="list-style-type: none"> Routine/non-routine problems in number, algebra, geometry, measures, data handling Representing and interpreting problems Breaking problems into parts Choosing techniques Explaining methods and reasoning, developing simple proofs and identifying exceptional cases Recognising degree of accuracy Finding alternative solutions
NUMBER					
Whole numbers and decimals up to 3 places	<ul style="list-style-type: none"> Place value to 3 decimal places; comparing, ordering, rounding Mental addition of several 1-digit numbers Multiplication/division of whole numbers and decimals by 10, 100, 1000, and their multiples Mental multiplication/division of whole numbers using factors Quotient as fraction or decimal Written methods for: <ul style="list-style-type: none"> multiplication/division (ThHTU × U, ThHTU ÷ U, HTU × TU, HTU ÷ TU) addition/subtraction of decimals with up to 3 places multiplication/division of decimals with up to 2 places by 1-digit whole number 	<ul style="list-style-type: none"> Notation for recurring decimals Multiplying and dividing dividend and divisor by the same number Order of operations (not brackets) Mental multiplication/division of simple decimals and whole numbers Written methods for multiplication/division of: <ul style="list-style-type: none"> whole numbers with up to 4 digits by a 2-digit whole number decimals with up to 2 places by 2-digit whole number 	<ul style="list-style-type: none"> Ordering and symbols: <, ≤, >, ≥, =, ≠ Rounding; ≈ symbol Order of operations; brackets Multiplication/division of whole numbers and decimals by 0.1, 0.01, 0.001 Mental addition, subtraction, multiplication and division of simple decimals Written methods for: <ul style="list-style-type: none"> multiplication/division of decimals with up to 2 places by decimal with up to 2 places 	<ul style="list-style-type: none"> Understanding principles of commutative, associative and distributive laws and their use in mental and written calculations Mental, and written calculations in appropriate cases 	<ul style="list-style-type: none"> Significant figures Rounding, including measures, to a given degree of accuracy

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Calculator	<ul style="list-style-type: none"> Using a basic calculator Calculator methods, including inverse operations Real-life word problems involving numbers or measures Estimating/checking answers 	<ul style="list-style-type: none"> Further use of basic calculator Calculator methods, including inverse operations Real-life word problems involving numbers or measures Estimating, checking and rounding answers, including interpreting display in context of problem 	<ul style="list-style-type: none"> Using a scientific calculator Calculator methods, including inverse operations, combined operations, using the memory Real-life word problems involving numbers or measures Estimating, checking and rounding answers 	<ul style="list-style-type: none"> Further use of scientific calculator, including function keys Real-life word problems involving numbers or measures Estimating, checking and rounding answers 	<ul style="list-style-type: none"> Further use of scientific calculator, including function keys Real-life word problems involving numbers or measures Estimating, checking and rounding answers
Properties of numbers and integers, powers and roots	<ul style="list-style-type: none"> Squares of numbers 1 to 12, corresponding square roots Properties of numbers less than 100: multiple, factor, prime 	<ul style="list-style-type: none"> Prime numbers, factors, prime factors, multiples, HCF, LCM Divisibility by 2, 3, 4, 5, 6 and 10 	<ul style="list-style-type: none"> Representing and ordering directed numbers (words, models, number line) Four operations with directed numbers Positive integer powers of whole numbers; +ve and -ve square roots of squares to 144; $\sqrt{\quad}$ sign Use of scientific calculator to calculate positive integer powers and square roots 	<ul style="list-style-type: none"> Positive integer powers of whole numbers and decimals; cube roots of perfect cubes to ± 216; $\sqrt[3]{\quad}$ sign Use of scientific calculator to evaluate powers and roots Use of calculator or spreadsheet to find approximate values of square roots of whole numbers to 100 	<ul style="list-style-type: none"> Use of laws of indices for multiplication and division of small integer powers, including positive and negative integer powers of 10 Standard form, including interpreting a calculator display Use of calculator or spreadsheet to find approximate values of roots
Fractions	<ul style="list-style-type: none"> Equivalent fractions Expressing a fraction in its simplest form Comparing and ordering related and unrelated fractions using diagrams (denominators up to 12) Finding fractions of quantities Adding and subtracting simple fractions 	<ul style="list-style-type: none"> Finding equivalent fractions, including simplest form Converting fractions to decimals and vice versa Comparing and ordering unrelated fractions by using division to convert to a decimal (with/without a calculator) Addition and subtraction of proper fractions, different denominators Multiplication of a proper fraction by a fraction Division of a proper fraction by a whole number Simple mental calculations 	<ul style="list-style-type: none"> Converting fractions to decimals and vice versa, recognising any terminating decimal as a fraction Comparing and ordering unrelated fractions by: <ul style="list-style-type: none"> converting to decimals (with/without calculator) forming common denominator Relating operations to models Calculating mentally with proper fractions in simple cases Addition and subtraction of mixed numbers, including combined operations Multiplication and division of one mixed number by another Using fraction key on calculator 	<ul style="list-style-type: none"> Four operations for fractions, including combined operations and brackets Calculating mentally with fractions in appropriate cases Using a scientific calculator to calculate with fractions 	

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Percentages	<ul style="list-style-type: none"> • Concept of percentage; simple equivalent fractions, decimals, percentages • Calculating a given percentage of a quantity (simple cases) 	<ul style="list-style-type: none"> • Converting fractions and decimals to percentages and vice versa • Calculating a given percentage of a quantity • Finding the whole, given a percentage part (simple cases) • Expressing one quantity as a percentage of another • Simple mental calculations 	<ul style="list-style-type: none"> • Estimating and calculating a given percentage of a quantity • Expressing one quantity as a percentage of another • Finding the whole, given a percentage part • Calculating percentage increases or decreases • Calculating mentally with percentages in simple cases 	<ul style="list-style-type: none"> • Using a scientific calculator to calculate with percentages • Calculating mentally with percentages in appropriate cases 	<ul style="list-style-type: none"> • Simple interest
Ratio and proportion		<ul style="list-style-type: none"> • Ratio of two quantities (simple cases); dividing a quantity in a given ratio • Equivalent ratios, including lowest terms • Direct proportion, including simple currency conversions 	<ul style="list-style-type: none"> • Relating ratios to fractions • Ratio of two or more quantities: equivalent ratios, including lowest terms • Comparing ratios • Direct proportion, unitary method 	<ul style="list-style-type: none"> • Using a scientific calculator to calculate with ratios and proportions • Ratio problems involving similar triangles (see Geometry) • Scale drawings (see Geometry) 	
ALGEBRA					
Sequences, functions and graphs	<ul style="list-style-type: none"> • Simple rules to generate sequences and ordered pairs, and to find missing terms • Coordinates in first quadrant 	<ul style="list-style-type: none"> • Term-to-term and position-to-term rules to generate sequences and find missing terms • Graphs of simple linear functions (first quadrant) 	<ul style="list-style-type: none"> • Numeric or geometric sequences (term-to-term or position-to-term rules); formulating nth term in words or symbols • Coordinates in all four quadrants • Graphs of $y = mx + c$, on paper and using ICT (all quadrants) • Use of graphics calculator to generate sequences and to plot graphs 	<ul style="list-style-type: none"> • Formulating nth term of sequence using symbols • Definition of a function • Representing functions; identifying intercepts and intervals where function increases or decreases • Graphs of proportional/linear functions from practical situations, including conversion and distance–time graphs • Use of graphics calculator to generate sequences and to plot graphs 	<ul style="list-style-type: none"> • Gradients of lines given by $y = mx + c$, and of lines parallel and perpendicular to $y = mx + c$ • Simultaneous linear equations, graphical methods, on paper and using ICT • Graphs of simple quadratic and cubic functions, on paper and using ICT; approximate solution of quadratic equations by graphical methods • Graphs arising from practical situations, including non-linear functions • Use of graphics calculator to generate sequences and to plot graphs

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Expressions, equations and formulae	<ul style="list-style-type: none"> Simple formulae using words, including unit conversions 	<ul style="list-style-type: none"> Using letters to represent numbers Algebraic expressions in one variable: <ul style="list-style-type: none"> simplification, excluding brackets evaluation by substituting integers Construction and evaluation of simple formulae using letters 	<ul style="list-style-type: none"> Algebraic expressions and formulae: <ul style="list-style-type: none"> simplification, collection of like terms, removal of brackets evaluation by substituting integers formulation of simple algebraic expressions or equations to model a situation Linear equations or inequalities (integer coefficients, unknown on one or both sides, brackets) 	<ul style="list-style-type: none"> Algebraic expressions and formulae: <ul style="list-style-type: none"> simplification of sum, difference, product and quotient of expressions evaluation by substituting integers formulation of linear expressions or equations to model a situation factorisation by removing common factors addition and subtraction of simple algebraic fractions with integer denominators Linear equations or inequalities (coefficients as decimals or fractions with integer denominators) 	<ul style="list-style-type: none"> Algebraic expressions: <ul style="list-style-type: none"> evaluation by substituting integers of polynomials such as $3x^2 + 4$ and $2x^3$ expansion of $(x + b)(x + d)$, where b and d are integers squaring a linear expression; factorisation of corresponding quadratic expression factorisation by removing common factors of: <ul style="list-style-type: none"> $ax + ay$ $ax + bx + ay + by$ identities such as <ul style="list-style-type: none"> $a^2 - b^2 = (a + b)(a - b)$ $(a + b)^2 = a^2 + 2ab + b^2$ addition, subtraction, multiplication and division of simple algebraic fractions Changing the subject of a simple formula Fractional linear equations (numerical and linear algebraic denominators, brackets), simple cases Simultaneous linear equations, two unknowns, by elimination and by substitution Quadratic equations of the form <ul style="list-style-type: none"> $a^2x^2 - b^2y^2 = 0$ $x^2 \pm 2ax + a^2 = 0$ by recognising the factors Approximate solutions using ICT of equations such as $x^3 + x = 20$

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GEOMETRY					
Geometry	<ul style="list-style-type: none"> • Rotation symmetry • Labelling conventions for angles • Relating angles in degrees to whole, half and quarter turns • Ordering angles • Simple cases of finding unknown angles involving: <ul style="list-style-type: none"> – angles in a straight line and at a point – angle sum of triangle – angle properties of equilateral, isosceles and right-angled triangles, and rectangles and squares • Nets of cube and cuboid 	<ul style="list-style-type: none"> • Simple reflections and rotations • Labelling conventions for geometric figures • Angle sum of quadrilateral • Finding unknown angles in involving: <ul style="list-style-type: none"> – angles in a straight line and at a point – vertically opposite angles – angle sum of triangle – angle and side properties of equilateral, isosceles and right-angled triangles, rectangles, squares and parallelograms (excluding properties related to diagonals) 	<ul style="list-style-type: none"> • Identification of properties of 2-D shapes, including angle, side, diagonal and symmetry properties of quadrilaterals • Identification of properties of 3-D shapes; planes of symmetry; nets of cubes, cuboids, prisms, pyramids, cones • Finding unknown angles involving: <ul style="list-style-type: none"> – angles in a straight line and at a point – vertically opposite angles – corresponding, alternate and supplementary angles – angle sum and exterior angle of triangle – angle and side properties of triangles – angle, side and diagonal properties of squares, rectangles, parallelograms, rhombuses – angle bisectors and perpendicular bisectors 	<ul style="list-style-type: none"> • Recognising similar triangles • Sum of interior angles and sum of exterior angles of a polygon; calculation of unknown angles of a polygon • Reflection and rotation symmetry of 2-D shapes, on paper and using ICT; symmetrical properties of triangles, quadrilaterals and regular polygons • Deducing properties in a given plane figure using known properties of angles and shapes • Transformations: using coordinates in all four quadrants, on paper and using ICT, to identify and draw in relation to a simple 2-D shape: <ul style="list-style-type: none"> – a reflection in lines parallel to or at 45° to the axes – a rotation about the origin, or a vertex of the shape, or a mid-point of a side, through multiples of 90° – a translation parallel to one of the axes – an enlargement (whole-number scale factor) – the combination of two simple transformations • Visualising and describing 3-D shapes 	<ul style="list-style-type: none"> • Congruent triangles and similar triangles: <ul style="list-style-type: none"> – establishing congruence or similarity – finding unknown sides and angles of similar or congruent figures • Deducing properties in a given plane figure using known properties of angles and shapes • Using Pythagoras' theorem and its converse to solve 2-D problems (see Trigonometry) • Given the coordinates of A and B, finding: <ul style="list-style-type: none"> – the mid-point of line segment AB – the length of line segment AB – the point that divides line segment AB in a given ratio • Transformations: <ul style="list-style-type: none"> – identifying line of reflection, centre and angle of rotation, centre of enlargement and scale factor in simple cases – enlargement of a simple 2-D shape (positive fractional scale factor)

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Constructions	<ul style="list-style-type: none"> Coordinates in first quadrant (see Sequences, functions and graphs) Using ruler, set square and protractor to: <ul style="list-style-type: none"> measure and draw line segments and angles in degrees (acute) construct 2-D shapes on grids 	<ul style="list-style-type: none"> Using ruler, set square and protractor to: <ul style="list-style-type: none"> measure and draw angles (acute, obtuse, reflex) draw perpendicular and parallel lines construct rectangles and squares construct triangles, given SAS or ASA 	<ul style="list-style-type: none"> Using ruler, set square, protractor and compasses to: <ul style="list-style-type: none"> draw parallel and perpendicular lines draw circles and arcs, including Islamic patterns construct angle bisectors and perpendicular bisectors construct simple plane shapes from given data Using ICT to explore constructions 	<ul style="list-style-type: none"> Using ruler, protractor and compasses to construct geometrical figures, including scale drawings Using ICT to explore constructions 	<ul style="list-style-type: none"> Plans and elevations
MEASURES					
Measurement	<ul style="list-style-type: none"> Conversions between: km, m, cm and mm, kg and g, l and ml, using decimal notation Converting units of time 24-hour clock; calculating time intervals in hours and minutes Reading timetables Using rulers, weighing scales, measuring cylinders, stopwatches Reading numbers from scales and dials 		<ul style="list-style-type: none"> Choosing units to estimate measurements Compound measures: rate and speed 	<ul style="list-style-type: none"> Appreciation of precision of measurement – upper and lower bounds Conversions of measures, including area and volume, and units of speed (e.g. km/h to m/s) Further problems involving speed Using calculator for time or speed calculations Compound measures: density 	
Mensuration	<ul style="list-style-type: none"> Perimeter and area of: <ul style="list-style-type: none"> squares and rectangles shapes formed from two squares or rectangles, e.g. L-shape, T-shape Finding side of square given area or perimeter, and similar problems with rectangles Volume of cube, cuboid (cm^3, m^3) 	<ul style="list-style-type: none"> Perimeter and area of triangles and parallelograms Surface area of cuboid Finding edge of cube given volume or surface area, and similar problems with cuboids Equivalence of 1000 cm^3 and 1 litre, or 1 cm^3 and 1 ml, and volume of liquid in cuboid container 	<ul style="list-style-type: none"> Perimeter and area of triangles, rectangles, parallelograms, trapeziums and related shapes Parts of a circle: circumference and area of circle 	<ul style="list-style-type: none"> Volume and surface area of cubes and cuboids and related solids Recall equivalence of 1 litre and 1000 cm^3 	<ul style="list-style-type: none"> Volume and surface area of right prisms and cylinders Area of plane shapes related to circles

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Trigonometry					<ul style="list-style-type: none"> Sine, cosine, tangent (right-angled triangle) Pythagoras' theorem (excluding proof)
DATA HANDLING					
Statistics	<ul style="list-style-type: none"> Collecting and organising discrete data, grouping as appropriate Construction and interpretation of: <ul style="list-style-type: none"> frequency diagrams for grouped discrete data line graphs Venn diagrams 	<ul style="list-style-type: none"> Collecting and tabulating data Using ICT to generate graphs, charts and tables, including pie charts Interpretation of graphs and charts, including pie charts Mean, median, mode and range to describe a simple distribution 	<ul style="list-style-type: none"> Collecting, classifying and tabulating data Construction (on paper and using ICT) and interpretation of: <ul style="list-style-type: none"> tables pictograms bar charts line graphs pie charts (no calculation of angles) Different representations of same data set Mean, median, mode, range 	<ul style="list-style-type: none"> Sources of error in data collection Designing data collection sheet Collecting data from secondary sources Construction (on paper and using ICT) and interpretation of: <ul style="list-style-type: none"> frequency tables and diagrams (grouped continuous data, equal intervals) pie charts Comparison of two distributions 	<ul style="list-style-type: none"> Identifying questions that can be answered by statistical methods Construction (on paper and using ICT) and interpretation of: <ul style="list-style-type: none"> scatter diagrams lines of best fit; basic understanding of correlation frequency diagrams, choosing appropriate equal class intervals Calculating mean, median, range of small sets of discrete or continuous data Finding modal class and estimating mean, median and range for grouped data
Probability			<ul style="list-style-type: none"> Informal language of probability Probability scale Equally likely outcomes for single events Total probability of all mutually exclusive outcomes is 1 	<ul style="list-style-type: none"> Estimating probabilities from experimental data, understanding that different outcomes may result from repeated experiments Calculating theoretical probabilities Systematic listing of all possible outcomes Comparing experimental and theoretical probabilities in simple cases 	<ul style="list-style-type: none"> Relative frequency as an estimate of probability, including grouped data $P(A) + P(B)$ (A and B mutually exclusive) Further comparison of experimental and theoretical probability in different contexts

