The **Programme of Study for Maths** is derived from the National Curriculum for Maths in England, which provides a coherent and structured framework for the progression of mathematical knowledge and skills from the Early Years Foundation Stage (EYFS) through to Key Stage 4 (KS4). It outlines a carefully sequenced body of knowledge and key concepts, ensuring continuity and progression across all key stages. Many of these concepts are revisited and developed in greater depth throughout the primary and secondary phases, supporting cumulative learning and mastery over time.

	Mathematics – PROGRAMME OF STUDY – KS4					
Prior learning: KS3	**Number**	**Algebra**	**Ratio, Proportion and rates of change**	**Geometry and measures**	**Probability**	**Statistics**
	understand and use place value for decimals, measures and integers of any size order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols =, ≠, <, >, ≤, ≥ use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation,	use and interpret algebraic notation, including: ab in place of a × b 3y in place of y + y + y and 3 × y a2 in place of a × a, a3 in place of a × a × a; a2 b in place of a × a × b b a in place of a ÷ b coefficients written as fractions rather than as decimals brackets substitute numerical values into formulae and expressions, including scientific formulae understand and use the concepts and vocabulary of expressions,	change freely between related standard units [for example time, length, area, volume/capacity, mass] use scale factors, scale diagrams and maps □ express one quantity as a fraction of another, where the fraction is less than 1 and greater than 1 use ratio notation, including reduction to simplest form divide a given quantity into two parts in a given part:part or part:whole ratio; express the division	derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders) calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes draw and measure line segments and angles in geometric figures, including interpreting scale drawings	record, describe and analyse the frequency of outcomes of simple probability experiments involving randomness, fairness, equally and unequally likely outcomes, using appropriate language and the 0-1 probability scale understand that the probabilities of all possible outcomes sum to 1 enumerate sets and unions/intersections of sets systematically, using tables, grids and Venn diagrams	describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers) construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts, pie charts, and pictograms for

including using product notation and the unique factorisation property use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals recognise and use relationships between operations including inverse operations use integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 and distinguish between exact representations	equations, inequalities, terms and factors simplify and manipulate algebraic expressions to maintain equivalence by: collecting like terms multiplying a single term over a bracket taking out common factors expanding products of two or more binomials understand and use standard mathematical formulae; rearrange formulae to change the subject model situations or procedures by translating them into algebraic expressions or formulae and by using graphs use algebraic methods to solve	of a quantity into two parts as a ratio understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction relate the language of ratios and the associated calculations to the arithmetic of fractions and to linear functions solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics solve problems involving direct and inverse proportion, including graphical and algebraic representations ⬜ use compound units such as speed, unit pricing	derive and use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); recognise and use the perpendicular distance from a point to a line as the shortest distance to the line describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric use the standard conventions for labelling the sides	generate theoretical sample spaces for single and combined events with equally likely, mutually exclusive outcomes and use these to calculate theoretical probabilities.	categorical data, and vertical line (or bar) charts for ungrouped and grouped numerical data describe simple mathematical relationships between two variables (bivariate data) in observational and experimental contexts and illustrate using scatter graphs.

	of roots and their decimal approximations interpret and compare numbers in standard form A x 10n 1≤A<10, where n is a positive or negative integer or zero work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and 2 7 or 0.375 and 8 3) define percentage as 'number of parts per hundred', interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, express one quantity as a percentage of another, compare two quantities using percentages, and	linear equations in one variable (including all forms that require rearrangement) work with coordinates in all four quadrants recognise, sketch and produce graphs of linear and quadratic functions of one variable with appropriate scaling, using equations in x and y and the Cartesian plane interpret mathematical relationships both algebraically and graphically reduce a given linear equation in two variables to the standard form y = mx + c; calculate and interpret gradients and intercepts of graphs of such linear	and density to solve problems.	and angles of triangle ABC, and know and use the criteria for congruence of triangles derive and illustrate properties of triangles, quadrilaterals, circles, and other plane figures [for example, equal lengths and angles] using appropriate language and technologies identify properties of, and describe the results of, translations, rotations and reflections applied to given figures identify and construct congruent triangles, and construct similar shapes by enlargement, with and without coordinate grids apply the properties of angles at a point,		

	work with percentages greater than 100% interpret fractions and percentages as operators use standard units of mass, length, time, money and other measures, including with decimal quantities round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places or significant figures] use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation use a calculator and other technologies to	equations numerically, graphically and algebraically use linear and quadratic graphs to estimate values of y for given values of x and vice versa and to find approximate solutions of simultaneous linear equations find approximate solutions to contextual problems from given graphs of a variety of functions, including piece-wise linear, exponential and reciprocal graphs generate terms of a sequence from either a term-to-term or a position-to-term rule recognise arithmetic sequences and find the nth term		angles at a point on a straight line, vertically opposite angles understand and use the relationship between parallel lines and alternate and corresponding angles derive and use the sum of angles in a triangle and use it to deduce the angle sum in any polygon, and to derive properties of regular polygons apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides, including Pythagoras' Theorem, and use known results to obtain simple proofs		

	calculate results accurately and then interpret them appropriately appreciate the infinite nature of the sets of integers, real and rational numbers	recognise geometric sequences and appreciate other sequences that arise.		use Pythagoras' Theorem and trigonometric ratios in similar triangles to solve problems involving right-angled triangles use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D interpret mathematical relationships both algebraically and geometrically		
	Working mathematically: Develop fluency Reason mathematically Solve problems					
Taught content: Knowledge/ Skills KS4						
	Number	**Algebra**	**Ratio, Proportion and rates of change**	**Geometry and measures**	**Probability**	**Statistics**
	Structure and calculation: N1 order positive and negative integers, decimals and fractions.	**Notation, vocabulary and manipulation** A1 use and interpret algebraic manipulation	R1 Change freely between related standard units and compound units in	**Properties & constructions** G1 Use conventional terms and notations: points, lines, vertices, edges,	P1 Record, describe and analyse the frequency of outcomes of probability experiments using	S1 infer properties of populations or distributions from a sample, while knowing the

N2 apply the four operations, including formal written methods, to integers, decimals and simple fractions

N3 use inverse operations

N4 use the concepts and vocabulary of prime numbers, factors (divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple,

N5 apply systematic listing strategies

N6 use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5

N7 calculate with roots

N8 calculate exactly with fractions and multiples of π | A2 substitute numerical values into formulae and expressions

A3 understand and use the concepts and vocabulary of expressions, equations, formulae, inequalities, terms and factors

A4 simplify and manipulate algebraic expressions by: collecting like terms, multiplying a single term over a bracket, taking out common factors, expanding products of two binomials ,factorising quadratic expressions, including the difference of two squares; simplifying expressions involving sums, products and powers, including the laws of indices

A5 understand and use standard mathematical formulae; rearrange formulae to change the subject | numerical and algebraic contexts

R2 Use scale factors, scale diagrams and maps

R3 Express one quantity as a fraction of another,

R4 Use ratio notation, including reduction to simplest form

R5 Divide a given quantity into two parts in a given part:part or part:whole ratio; express the division of a quantity into two parts as a ratio; apply ratio to real contexts and problems

R6 Express a multiplicative relationship between two quantities as a ratio or a fraction

R7 Understand and use proportion as equality of ratios | planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries; use the standard conventions for labelling and referring to the sides and angles of triangles; draw diagrams from written description

G2 Use the standard ruler and compass constructions; use these to construct given figures and solve loci problems; know that the perpendicular distance from a point to a line is the shortest distance to the line

G3 Apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles; understand and use alternate and corresponding angles on parallel lines; derive and use the | tables and frequency trees

P2 Apply ideas of randomness, fairness and equally likely events to calculate expected outcomes of multiple future experiments

P3 Relate relative expected frequencies to theoretical probability, using appropriate language and the 0-1 probability scale

P4 Apply the property that the probabilities of an exhaustive set of outcomes sum to one; apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one

P5 Understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size

P6 Enumerate sets and combinations of sets systematically, | limitations of sampling

S2 interpret and construct tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data, tables and line graphs for time series data and know their appropriate use

S4 interpret, analyse and compare the distributions of data sets from univariate empirical distributions through:

● appropriate graphical representation involving discrete, continuous and grouped data

● appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including |

N9 calculate with and interpret standard form **Fractions, decimals and Percentages** N10 work interchangeably with terminating decimals and their corresponding fractions N11 identify and work with fractions in ratio problems N12 interpret fractions and percentages as operators **Measures and accuracy** N13 use standard units of mass, length, time, money and other measures (including standard compound measures) using decimal quantities where appropriate N14 estimate answers; check calculations using approximation and	A6 know the difference between an equation and an identity A7 where appropriate, interpret simple expressions as functions with inputs and outputs. **Graphs** A8 work with coordinates in all four quadrants A9 plot graphs of equations that correspond to straight-line graphs in the coordinate plane; use the form y = mx + c to identify parallel lines. A10 identify and interpret gradients and intercepts of linear functions graphically and algebraically A11 identify and interpret roots, intercepts, turning points of quadratic functions graphically; deduce roots algebraically	R8 Relate ratios to fractions and to linear functions R9 Define percentage as 'number of parts per 100'; interpret percentages and percentage changes as a fraction or a decimal; express one quantity as a percentage of another; work with percentages greater than 100%; solve problems involving percentage change, including percentage increase/decrease, and simple interest R10 Solve problems involving direct and inverse proportion, including graphical and algebraic R11 Use compound units such as speed, rates of pay, unit pricing, density and pressure R12 Compare lengths, areas and	sum of angles in a triangle G4 Derive and apply the properties and definitions of: special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus; and triangles and other plane figures using appropriate language G5 use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS) G6 Apply angle facts, triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides, including Pythagoras' theorem and the fact that the base angles of an isosceles triangle are equal, and use known results to obtain simple proofs	using tables, grids, Venn diagrams and tree diagrams P7 Construct theoretical possibility spaces for single and combined experiments with equally likely outcomes and use these to calculate theoretical probabilities P8 Calculate the probability of independent and dependent combined events, including using tree diagrams and other representations	consideration of outliers) S5 apply statistics to describe a population S6 use and interpret scatter graphs; recognise correlation and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends while knowing the dangers of so doing

	estimation, including answers obtained using technology N15 round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places or significant figures); use inequality notation to specify simple error intervals due to truncation or rounding N16 apply and interpret limits of accuracy	A12 recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function A14 plot and interpret graphs of non-standard functions in real contexts to find approximate solutions to distance, speed and acceleration **Solving equations and inequalities** A17 solve linear equations in one unknown algebraically ;find approximate solutions using a graph A18 solve quadratic equations algebraically by factorising; find approximate solutions using a graph A19 solve two simultaneous equations in two variables and find	volumes using ratio notation; make links to similarity and scale factors R13 Understand that X is inversely proportional to Y is equivalent to X is proportional to 1/Y ; R14 Interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion R16 Set up, solve and interpret the answers in growth and decay problems, including compound interest	G7identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement (including fractional **and negative** scale factors) G9 Identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment G11 Solve geometrical problems on coordinate axes G12 Identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres G13 Construct and interpret plans and elevations of 3D shapes		

		solutions using a graph A21 create algebraic expressions or formulae; A22 solve linear inequalities in one variable; represent the solution set on a number line **Sequences** A23 generate terms of a sequence from either a term-to-term or a position-toterm rule A24 recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions A25 calculate the nth term of linear sequences		**Measurement & calculation** G14 Use standard units of measure and related concepts G15 Measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings G16 Know and apply formulae to calculate: area of triangles, parallelograms, trapezia; volume of cuboids prisms G17 Know the formulae: circumference of a circle , area of a circle; calculate: perimeters of 2D shapes, including circles; areas of circles and composite shapes; surface area and volume of spheres, pyramids, cones and composite solids G18 Calculate arc lengths, angles and	

				areas of sectors of circles		
				G19 Apply the concepts of congruence/similarity, inc lengths, areas and volumes in similar figures		
				G20 Know the formulae for: Pythagoras' theorem and the trigonometric ratios,; apply them to find angles and lengths in right-angled triangles and, where possible, general triangles in two and three dimensional figures		
				G21 Know the exact values of sin θ and cos θ for θ = 0°, 30°, 45°, 60° and 90°; know the exact value of tan θ for θ = 0°, 30°, 45° and 60°		
				Vectors		
				G24 describe translations as 2D vectors		
				G25 apply addition and subtraction of vectors, multiplication of vectors by a scalar,		

				and diagrammatic and column representations of vectors		
	Working mathematically: Develop fluency Reason mathematically Solve problems					
Subsequent learning: Higher paper	**Structure and calculation** N1 use the symbols =, $\neq, <, >, \leq, \geq$ N2 apply using mixed numbers – all both positive and negative; understand and use place value N3 use conventional notation for order of operations, including brackets, powers, roots and reciprocals N4 Express a number as a product of its prime factors N5 Multiply the number of outcomes for each event to find the total number of combinations	**Notation, vocabulary and manipulation** A1 use and interpret algebraic conventions, including: • ab in place of a × b • 3y in place of y + y + y and 3 × y • a^2 in place of a × a,etc. A2 substitute into scientific formulae A4 simplify and manipulate algebraic expressions including surds and algebraic fractions. A6 use algebra to support and construct arguments and proofs A7 interpret the reverse process as	R15 Understand that the gradient at a point on a curve gives the instantaneous rate of change; apply the concepts of average and instantaneous rate of change in numerical, algebraic and graphical contexts R16 including iterative processes	**Properties & constructions** G8 Describe the changes and invariance achieved by combinations of rotations, reflections and translations G10 Apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results **Mensuration & calculation** G22 know and apply the sine rule: a/sin A = b/sin B = c/sin C ,	P9 Use expected frequencies with two-way tables, tree diagrams and Venn diagrams to calculate and interpret conditional probabilities	S3 Construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use

	N6 estimate powers and roots of any given positive number N7 calculate with fractional indices N8 calculate exactly with surds and simplify surd expressions involving squares (e.g. $\sqrt{12} = \sqrt{(4 \times 3)} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}$) and rationalise denominators N9 calculate with and interpret standard form $A \times 10n$, where $1 \leq A < 10$ and n is an integer **Fractions, Decimals and Percentages** N10 change recurring decimals into their corresponding fractions and vice versa **Measures and accuracy** N15 use inequality notation($>, \geq, <, \leq, \neq$) to specify simple	the 'inverse function'; interpret the succession of two functions as a 'composite function' **Graphs** A9 use the form y = mx + c to identify parallel and perpendicular lines A11 identify turning pointsof a quadratic graph by completing the square A12 recognise, sketch and interpret graphs of, exponential functions (y = kx) for positive values of k, and the trigonometric functions(y = sin x, y = cos x and y = tan x) for angles of any size A13 sketch translations and reflections of a given function		and cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$, to find unknown lengths and angles in non right-angled triangles G23 Know and apply the formula Area = ½ ab sinC to calculate the area, sides or angles of any triangle **Vectors** G25 use vectors to form arguments and proofsin relation to geometric problems		

	error intervals due to rounding N16 apply and interpret limits of accuracy, including upper and lower bounds	**Solving equations and inequalities** A17 solve linear equations with the unknown on both sides of the equation; find approximate solutions using a graph A18 solve quadratic equations (including those that require rearrangement) algebraically by factorising, by completing the square and by using the quadratic formula; find approximate solutions using a graph A19 solve two simultaneous equations with two unknown values (linear/linear or linear/quadratic) algebraically; find approximate solutions using a graph				

		A20 find approximate solutions to equations numerically using iteration				
		A22 solve linear inequalities with one or two unknown value(s)				
		Sequences				
		A24 recognise and use sequences of simple geometric progressions (rn where n is an integer, and r is a rational number > 0 or a surd) and other sequences				
		A25 write expressions to calculate the nth term of linear and quadratic sequences				
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