Key Stage 3

The purpose of our KS3 Maths curriculum is to inspire pupils, secure strong academic outcomes and to drive learners to think and work independently and with a powerful sense of curiosity. Pupils develop mathematical fluency and confidence because they are supported by a challenging curriculum that gives abundant opportunities to master their knowledge and understanding so that they can analyse, evaluate, make judgements and justify their reasoning.

Throughout Key Stage 3 pupils explore and extend their understanding of:

- our number system, and parts of wholes;

- number operations and calculation methods;

- relationships between sets of numbers, using algebra and graphs;

- the properties and measurements of 2-D and 3-D shapes;

- using and analysing data to inform us about our world.

Key Stage 4

During Key Stage 4 pupils extend the knowledge, skills and understanding developed in earlier Key Stages. A fundamental aim is to enable pupils to apply their knowledge logically and creatively. They see more challenging questions related to a wide variety of contexts and mature in their ability to reason mathematically, make deductions and inferences and draw conclusions. They are also taught to check and evaluate their methods and answers, assessing whether they are reasonable and make sense.

Key Stage 5

Studying Mathematics at KS5 invites pupils to enhance 7TQ TET(ct)-4(7TQ TET(ctꞁue00012546 0 841w)-3(h)11i0.e,a9)a(re8ho)-5( )ae knowl confido wd Qd3 pu 841.9c0.00(thi)3(n)(4)

KS3	Topics	Skills	Understanding	Assessment
Year 7	Analysing & displaying data	Tables & pictograms, bar charts, grouped data, mode & modal class, Range & median, Mean	Pupils will create or use a variety of frequency diagrams and measures of average to analyse simple data sets	

KS3	Topics	Skills	Understanding	Assessment
	Fractions	comparing & simplifying fractions, 4 operations with fractions, mixed numbers	Pupils will be able to order and simplify fractions, add/subtract fractions with	

KS3	Topics	Skills	Understanding	Assessment
	Expressions and equations	simplifying expressions, solving simple equations, factorising and expanding,		

KS3	Topics	Skills	Understanding	Assessment
	Probability	language, probability scale, calculating probability, experimental probability, mutual exclusivity, tree diagrams	Pupils will use the language associated with probability and be able to relate these words to locations on the probability scale. They will describe the probability of single events and compare theoretical and experimental probabilities. They will be able to display the probability of two events using a table or tree diagram.	KPI 8 Calculating with Fractions: Using appropriate methods when calculating with fractions.

KPI 9 Linear Graphs: Understanding the relationship between two quantities in direct proportion and its associated graph. Understanding the properties of linear graphs.

KPI 10 Percentages, decimals and Fractions: Understanding the equivalence of fractions, decimals and percentages and their uses to represent proportions of a whole.

KPI 11 Probability: Understanding and comparing probabilities. Calculating theoretical probabilities and experimental probability.

KPI 12 |

KS3	Topics	Skills	Understanding	Assessment
			diagram that satisfy criteria involving Loci, Scale and inequalities.	
	Transformations	Reflection, rotation, translation, enlargement, combinations, 2D&3D applications	Pupils will recognise, describe and draw all four transformations in isolation and in combination.	
Year 9	Number Calculations	directed numbers, laws of indices, prime factor decomposition, powers of 10, estimation, bounds	Pupils will perform calculations with positive & negative numbers, work with indices, express numbers as a product of prime factors, consider place value/ order of magnitude when making calculations round numbers in order to estimate calculations and consider bounds.	Each KPI is assessed either through an end of topic assessment

KPI 1 Indices and Standard Form: Understanding indices; manipulation and associated conventional notation.

KPI 2 Expressions and Formulae: Manipulating algebraic identities and solving algebraic equations.

KPI 3 Dealing with Data: Performing all assessed |

KS3	Topics	Skills	Understanding	Assessment
			decimals & percentages and will round to a given number of decimal places or significant figures.	KPI 5 Constructions: Constructing accurate scale diagrams of a variety of 2D Shapes.
	Geometry in 2D Shapes and 3D solids	Angles & constructions, Pythagoras' theorem, geometric formulae, compound shapes/circles, congruency, loci	Pupils will be able to use geometry equipment to construct angles, shapes and loci. They will use Pythagoras' theorem in 2D & 3D. They will calculate angles in polygons, areas and perimeters of compound shapes. They will present arguments for congruency.	KPI 6 Sequences, inequalities, Equations and proportion: Understanding nth term of linear and non-linear sequences. Understanding differences and similarities between solving equations and inequalities.
	Multiplicative reasoning	direct proportion, rates of change, scales & ratio, similarity, non-linear proportion, arcs & sectors of circles	Pupils will use algebra to find a constant of proportionality, hence using algebra to solve problems involving proportion. They will work with compound measures such as speed, density and pressure. They will calculate missing sides on similar shapes and will find arc lengths and sector areas.	KPI 7 Circles, Pythagoras and Prisms: Calculating lengths and areas of triangles and circles using the associated formulas involving Pythagoras and Pi.
	Algebraic and geometric formulae	using & finding nth term, changing the subject, substitution,	Pupils will find the nth term of arithmetic linear and quadratic sequences. They will describe the progression of geometric sequences. Pupils will rearrange simple formulae and substitute into formulae.	KPI 8 Graphs: Drawing and interpreting linear graphs presented in a variety of ways.
	Probability	language, probability scale, calculating probability, experimental probability, mutual exclusivity, tree diagrams, sample space, 2-way tables, independent events	Pupils will describe the probability of single and combined events and compare theoretical and experimental probabilities. They will be able to display the probability of two events using a table or tree diagram, taking into account mutual exclusivity and independence.	KPI 9 Probability: Identifying mutually exclusive events and using the associated notation. Using a variety of diagrams to visualise and solve probability problems. KPI 10 Comparing Shapes: Understanding congruency and

KS3	Topics	Skills	Understanding

KS4	Topics

KS4	Topics	Skills	Understanding	Assessment
			Pupils will be able to use graphs to solve Simultaneous Equations.	
	Sequences	linear Sequences, Quadratic Sequences and Geometric Sequences. Fibonacci Sequence and Substitution.	Pupils will be able to generate a Linear or Quadratic sequence. Pupils will be able to find the nth term of a Linear or Quadratic sequence and use the nth term to solve a problem. Pupils will be able to understand the difference between a GP and an AP.	
	Percentages	Percentage Amounts, Percentage		

KS4	Topics	Skills	Understanding	Assessment
	Pythagoras and Trigonometry	Pythagoras, Trigonometry in right and triangles, Sine Rule and Cosine Rule.	Pupils will be able to identify the appropriate skill to use when solving a problem that uses Pythagoras and Trigonometry and then apply it to the problem.	
	Perimeter, Area and Volume, Bounds	Area of Squares, Rectangles, Triangles, Trapezium and Circles. Volume of Prisms, Cylinders and Cones and Spheres. Perimeter and Area of Sectors. Upper and Lower bounds.	Pupils will be able to use areas and volumes to work out questions in a range of contexts. Pupils will be able analyse critically the validity of their results.	
	Probability	Sample Space Diagrams, Venn Diagrams, Frequency Trees, Two Way Tables and Tree Diagrams. AND Rule and the OR Rule to work out Probability.	Pupils will be able to calculate the probability of an Event happening by using Tree Diagrams, AND/OR Rule and Two-Way Tables. Pupils will able to analyse the reliability of their results and justify the probability of events happening or not happening. Pupils will understand the importance of working systematically to find all outcomes.	
	Direct and inverse proportion	Direct and Inverse Proportion, Graphically and Algebraically.	Pupils will recognize when values are in Direct Proportion Algebraically and Graphically. Pupils will be able to set up and use equations to solve problems on Proportion.	
	Averages and Range	Pupils will be able to interpret a scatter graphs considering outliers and one the line of best fit to interpolate results. Pupils will understand the difference between causation and correlation. Compare and interpret box plots and understand the advantages of	Pupils will be able interpret, compare and comment on different distributions and consider outliers. They will recognize the advantages and disadvantages of different measures of Averages.	

KS4	Topics	Skills	Understanding	Assessment
		interquartile range over range. Pupils will be able to interpret Histograms.		
	Representing and Interpreting Data and Scatter Graphs	Scatter graphs, time-series graphs histograms and cumulative frequency graphs.	Pupils will be able to interpret a scatter graphs considering outliers and one the line of best fit to interpolate results. Pupils will understand the difference between causation and correlation. Compare and interpret box plots and understand the advantages of interquartile range over range. Pupils will be able to interpret Histograms.	
	Sampling and Questionnaires	Questionnaires, Sampling Techniques and Stratified Sampling.	Pupils will be able to construct and critically analyse a Questionnaire/Survey. They will understand the limitations of their data and be able to comment how a sample size and collection method will lead to possible bias.	
	Circle Theorems	Circle Theorems, parts of a Circle.	Pupils will be able to apply Circle Theorems to Geometric Problems.	
	Transformations	Rotation, Reflection, Enlargement and Transformation.	Pupils will be able to use a variety of Scale Factors including Negative and Fractional. They will be able to describe fully a Transformation using correct subject specific language. Pupils will be able to apply a Combination of Transformations.	

KS4

KS5	Topics	Skills	Understanding	Assessments
	The binomial expansion	Pascal's triangle, factorial notation, the binomial expansion, solving binomial problems, binomial estimation.	Pupils will use Pascal's triangle to identify binomial coefficients and use them to expand simple binomial expressions, use combinations and factorial notation, use the binomial expansion to expand brackets, find individual coefficients in a binomial expansion, make approximations using the binomial expansion.	
	Trigonometric ratios	The cosine rule, the sine rule, area of triangles, solving triangle problems, graphs of sine cosine and tangent, transforming trigonometric graphs.	Pupils will use the cosine rule to find a missing side or angle, use the sine rule to find a missing side or angle, find the area of a triangle using an appropriate formula. Solve problems involving triangles, sketch the graphs of the sine, cosine, tangent functions and simple transformations of these functions.	
	Trigonometric identities and equations	Angles in all four quadrants, exact values of trigonometric ratios, trigonometric identities, simple trigonometric equations, harder trigonometric equations, equations and identities.	Pupils will calculate the sine, cosine and tangent of any angle, know the exact trigonometric ratios for 30,45 and 60 degrees, know and use the relationships between tan=sin/cos and sin^2+cos^2=1, solve simple trigonometric equations, solve more complicated trigonometric equations, some of which produce quadratics.	
	Vectors	Vectors, representing vectors, magnitude and direction, position vectors, solving geometric problems, modelling with vectors.	Pupils will use vectors in two dimensions, use column vectors and carry out arithmetic operations on vectors, calculate the magnitude and direction of a vector,	

KS5	Topics	Skills	Understanding	Assessments
			vectors in speed and distance calculations, use vectors to solve problems in context.	
	Differentiation	Gradients of curves, finding the derivative, differentiating simple, differentiating quadratics, differentiation functions with two or more terms, gradients tangents and normal, increasing and decreasing functions, second order derivatives, stationary points, sketching gradient functions, modelling with differentiation.	Pupils will find the derivative of simple functions, solve problems involving gradients, tangents, and normals, identify increasing and decreasing functions, find second order derivatives or simple functions, find stationary points of functions and determine their nature, sketch the gradient function of a given function, model real-life situations with differentiation.	
	Integration	Simple integration, indefinite integrals, finding functions, definite integrals, areas under curves, areas under the x-axis, areas between curves and lines.	Pupils will find y given dy/dx, integrate polynomials, find f(x) given f'(x) and a point on the curve, evaluate definite integrals, find	

KS5	Topics	Skills	Understanding	Assessments
			estimate the values of constants in non-linear models.	
Year 12 Statistics	Data collection	Populations and samples, sampling, non-random sampling, types of data, the large data set.	Pupils will understand 'population', 'sample' and 'census' and comment on the advantages and disadvantages of each, understand the pros and cons of simple random sampling, systematic sampling, stratified sampling, quota sampling, and opportunity sampling, define qualitative quantitative, discrete and continuous data and understand grouped data, understand the large data set and how to collect data from it, identify types of data and calculate simple statistics.	
	Measures of location and spread	Measures of central tendency, other measures of location, measures of spread, variance and standard deviation, coding.	Pupils will calculate measures of central tendency such as the mean, median and mode, calculate measures of location such as percentiles and deciles, calculate measures of spread such as range, interquartile range and interpercentile range, calculate variance and standard deviation, understand and use coding.	
	Representations of data	Outliers, box plots, cumulative frequency, histograms, comparing data.	Pupils will identify outliers in data sets, draw and interpret box plots, draw and interpret cumulative frequency diagrams and histograms, compare two data sets.	

KS5	Topics	Skills	Understanding	Assessments
	Correlation	Correlation, linear regression.	Pupils will draw and interpret scatter diagrams for bivariate data, interpret correlation and understand that it does not imply causation, interpret the coefficients of a regression line equation for bivariate data, understand when you can use a regression line to make predictions.	
	Probability	Calculating probabilities, Venn diagrams, mutually exclusive and independent events, tree diagrams.	Pupils will calculate probabilities for single events, draw and interpret Venn diagrams, understand mutually exclusive and independent events, and determine whether two events are independent, use and understand tree diagrams.	
	Statistical distributions	Probability distributions, the binomial distribution, cumulative probabilities.	Pupils will understand and use simple discrete probability distributions including the discrete uniform distribution, understand the binomial distribution as a model and comment on appropriateness, calculate individual probabilities for the binomial distribution, calculate cumulative probabilities for the binomial distribution.	
	Hypothesis testing	Hypothesis testing, finding critical values, one-tailed tests, two-tailed tests.	Pupils will understand the language and concept of hypothesis testing, understand that a sample used to make an inference about a population, find critical values of a binomial distribution using tables, carry out one and two-tailed tests for the proportion of the binomial distribution and interpret the results.	

KS5	Topics	Skills	Understanding	Assessments
Year 12 Mechanics	Modelling in mechanics	Constructing a model, modelling assumptions, quantities and units, working with vectors.	Pupils will understand how the concept of a mathematical model applies to mechanics, understand and be able to apply some of the common assumptions used in mechanical models, know SI units for quantities and derived quantities used in mechanics, know the difference between scalar and vector quantities.	
	Constant acceleration	Displacement-time graphs, velocity-time graphs, constant acceleration formulae 1, constant acceleration formulae 2, vertical motion under gravity.	Pupils will understand and interpret displacement-time and velocity-time graphs, derive the constant acceleration formulae and use them to solve problems, use the constant acceleration formulae to solve problems involving vertical motion under gravity.	
	Forces and motion	Force diagrams, forces as vectors, forces and acceleration, motion in 2 dimensions, connected particles, pulleys.	Pupils will draw force diagrams and calculate resultant forces by adding vectors, understand and use Newton's first law, understand and use Newton's second law F=ma, apply Newton's second law to vector forces and acceleration, understand and use Newton's third law, solve problems involving connected particles.	

KS5	Topics	Skills	Understanding	Assessments
			calculus to derive constant acceleration formulae.	
Year 13 Core	Algebraic methods	Proof by contradiction, algebraic fractions, partial fractions, repeated factors, algebraic division.	Pupils will use proof by contradiction to prove true statements, multiply and divide two or more algebraic fractions, add or subtract two or more algebraic fractions, convert an expression with linear factors int eh denominator into partial fractions, convert an expression with repeated linear factors in the denominator into partial fractions, divide algebraic expressions, convert an improper fraction into partial fraction form.	
	Functions and graphs	The modulus function, functions and mappings, composite functions, inverse functions, y=f(x) and y=f(|x|), combining transformations, solving modulus problems.	Pupils will understand and use the modulus

KS5	Topics	Skills	Understanding	Assessments
	Trigonometric functions			

KS5	Topics	Skills	Understanding	Assessments
			model real-life situations with differential equations.	
	Vectors	3D coordinates, vectors in 3D, solving geometric problems, application to mechanics.	Pupils will understand 3D Cartesian coordinates, use vectors in three dimensions, use vectors to solve geometric problems, model 3D motion in mechanics with vectors.	
Year 13 Statistics	Regression, correlation and hypothesis testing.	Exponential models, measuring correlation, hypothesis testing for zero correlation.	Pupils will understand exponential models in bivariate data, use a change of variable to estimate coeffic	

KS5	Topics	Skills	Understanding	Assessments
		distribution, finding mu and sigma, approximating a binomial distribution, hypothesis testing with the normal distribution.	points on a standard normal curve, find unknown mans and/or standard deviations for a normal distribution, approximate a binomial distribution using a normal distribution, select appropriate distributions and solve real-life problems in context, carry out a hypothesis test for the mean of a normal distribution.	
Year 13 Mechanics	Moments	Moments, resultant moments,		

KS5	Topics	Skills	Understanding	Assessments

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KS5	Topics	Skills	Understanding	Assessments
Year 13 Futher Core	Complex numbers	Exponential form of complex numbers, multiplying and dividing complex numbers, De Moivre's theorem, trigonometric identities, sums of series, nth roots of a complex number, solving geometric problems.	Pupils will express a complex number in exponential form, multiply and divide complex numbers in exponential form, understand de Moivre's theorem, use de Moivre's theorem to derive trigonometric identities and to find sums of series, know how to solve completely equations of the form $Z^n-a-ib=0$, use complex roots of unity to solve geometric problems.	
	Series	The method of differences, higher derivatives, Maclaurin series, series expansions of compound functions.	Pupils will understand and use the method of differences to sum finite series, find and use higher derivatives of functions, know how to express functions as an infinite series in ascending powers using Maclaurin series expansion, be able to find the series expansions of compound functions.	
	Methods in calculus	Improper integrals, the mean value of a function, differentiating inverse trigonometric functions, integrating with inverse trigonometric functions, integrating using partial fractions.	Pupils will evaluate improper integrals, understand and evaluate the mean value of a function, integrate rational functions using trigonometric substitutions, integrate using partial fractions.	
	Volumes of revolution	Volumes of revolution around the x-axis, Volumes of revolution around the y-axis, volumes of revolution of parametrically defined curves, modelling with volumes of revolution.	Pupils will find the volume of revolution around the x and y-axis, for curves defined parametrically and model real-life applications of volumes of revolution.	
	Polar coordinates	Polar coordinates and equations, sketching curves, area enclosed by a polar curve, tangents to polar curves.	Pupils will understand and use polar coordinates, convert between polar and Cartesian coordinates, sketch curves with r given as a function of theta, find the area	

KS5	Topics	Skills	Understanding	Assessments
			enclosed by a polar curve, find tangents parallel to, or at right angles to, the initial line.	
	Hyperbolic functions	Introduction to hyperbolic functions, inverse hyperbolic functions, identities and equations, differentiating hyperbolic functions, integrating hyperbolic functions.	Pupils will understand the definitions of hyperbolic functions, sketch the graphs of hyperbolic functions, understand and use the inverse hyperbolic functions, prove identities and solve equations using hyperbolic functions, differentiate and integrate	

KS5	Topics	Skills	Understanding	Assessments
Further Statistics	Discrete random variables	Expected value of a discrete random variables, variables of a discrete random variable, expected value and variance of a function of X, solving problems involving random variables.		

KS5	Topics	Skills	Understanding	Assessments
	Central Limit Theorem	The central limit theorem, applying the central limit theorem to other distributions.	Pupils will understand and apply the central limit theorem to approximate the sample mean of a random variable, apply the central limit theorem to other distributions.	
	Chi-squared tests	Goodness of fit, degrees of freedom and the chi-squared family of distributions, testing a hypothesis, testing the goodness of fit with discrete data, using contingency tables, apply goodness-of-fit tests to geometric distributions.	Pupils will form hypotheses about how well a distribution fits as a model for an observed frequency distribution and measure goodness of fit of a model to observed data, understand degrees of freedom and use the chi-squared family of distributions, be able to test a hypothesis, apply goodness-of-fit tests to discrete data and geometric distributions, use contingency tables.	
	Probability generating functions	Probability generating functions, probability generating functions of standard distributions, mean and variance of a distribution, sums of independent random variables.	Pupils will understand the use of probability generating functions, use them for standard deviation, mean and variance and know the probability generating function of the sum of independent random variables.	
	Quality of tests	Type 1 and type 2 errors, finding type 1 and type 2 errors using the normal distribution, calculate the size and power of a test, the power function.	Pupils will know about type 1 and type 2 errors, find type 1 and type 2 using the normal distribution, calculate the size and power of a test, draw a graph of the power	

KS5	Topics	Skills	Understanding	Assessments

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	The travelling salesman problem	The classical and practical travelling salesman problems, using a minimum spanning tree method to find an upper bound, using a minimum spanning tree method to find a lower bound, using the nearest neighbour algorithm to find an upper bound.	Pupils will explain the differences between the classical and practical problems, use minimum spanning tree method to find an upper and lower bound, use the nearest neighbour algorithm to find an upper bound.	
	Linear programming	Linear programming problems, graphical methods, locating the optimal point, solutions with integer values.	Pupils will formulate a problem as a linear programming problem, illustrate two-variable linear programming problems graphically, locate the optimal point in a feasible region using the objective line method, use the vertex testing method to locate the optimal point, determine solutions that need integer values.	