Curriculum overview: Maths (higher tier)

Key Stage 2

Number and ratio

- To have a good understanding of place value and to be able to round whole numbers to appropriate degrees of accuracy.
- To have a good understanding of negative numbers.
- To use mental and written methods for all four operations.
- To solve multi-step problems in contexts, deciding which operations and methods to use and why.
- To use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.
- To use their knowledge of the order of operations to carry out calculations involving the four operations.
- To identify common factors, common multiples and prime numbers and to apply this knowledge to simplify fractions.
- To add and subtract fractions with different denominators and mixed numbers.
- To multiply simple pairs of proper fractions and to divide proper fractions by whole numbers.
- To compare and order fractions, including fractions > 1.
- To multiply and divide numbers by a power of 10.
- To multiply one-digit numbers with up to two decimal places by whole numbers.
- To recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.
- To describe positions on the full coordinate grid (all four quadrants).
- To draw and translate simple shapes on the coordinate plane, and reflect them in the axes.
- To solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts.
- To solve problems involving the calculation of percentages [for example, of measures, and such as 15% of 360] and the use of percentages for comparison.
- To solve problems involving similar shapes where the scale factor is known or can be found.
- To solve problems involving unequal sharing and grouping using knowledge of fractions and multiples.

Geometry

- To solve problems involving the calculation and conversion of units of measure.
- To use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to three decimal places.
- To convert between miles and kilometres.
- To recognise that shapes with the same areas can have different perimeters and vice versa.
- To calculate the area of parallelograms and triangles.
- To calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm^3) and cubic metres (m^3), and extending to other units [for example, mm^3 and km^3].
- To draw 2-D shapes using given dimensions and angles.
- To illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius.
- To recognise, describe and build simple 3-D shapes, including making nets.
- To compare and classify geometric shapes based on their properties and sizes.
- To find unknown angles in any triangles, quadrilaterals, and regular polygons.
- To recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles

Algebra

- Simplify expressions by collecting like terms
- Substitute into a simple expression
- Recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3})
- Use simple formulae in words, and express missing number problems algebraically.
- Generate and describe linear number sequences.
- Find possible values in missing number problems and equations involving 1 or 2 unknowns.

Statistics and probability

- To complete, read and interpret information in tables, including timetables
- To solve comparison, sum and difference problems using information presented in a line graph
- To interpret and construct pie charts and line graphs and use these to solve problems.
- To calculate and interpret the mean as an average.

Key skills/content requirements at GCSE

Number and ratio	Algebra	Statistics and probability	Geometry
- Fractions - Percentages - Ratio	- Linear and non-linear graphs - Expanding and simplifying - Factorisation	- Theoretical and experimental probability - Independent and dependent events - Conditional probability	- Transformations - Constructions - Pythagoras' theorem

▪ Proportion ▪ Fraction, decimal, percentage conversions ▪ Multiples, factors and prime factorisation ▪ Calculations involving currency ▪ Problem solving ▪ Standard Form ▪ Indices ▪ Surds	▪ Forming and solving equations ▪ Inequalities ▪ Rearranging formulae ▪ Simultaneous equations ▪ Quadratic expressions and equations ▪ Algebraic proof ▪ Algebraic fractions ▪ Direct and inverse proportionality ▪ Functions ▪ Linear and quadratic sequences	▪ Venn diagrams ▪ Sample space diagrams ▪ Scatter graphs ▪ Pie charts ▪ Tree diagrams ▪ Cumulative frequency graphs ▪ Box plots ▪ Histograms ▪ Averages from diagrams and tables ▪ Sampling	▪ Trigonometry ▪ Congruence and similarity ▪ Angle facts and geometrical reasoning ▪ Vectors ▪ Circle theorems ▪ Perimeter ▪ Area of triangles and quadrilaterals ▪ Circles, sectors and segments ▪ Estimating the area under a curve ▪ Volume and Surface area ▪ Trigonometric graphs ▪ Conversions ▪ Maps and scales

Curriculum Overview

	Year 7 (Including Year 6 objectives)	Year 8 (Including Year 7 objectives)	Year 9 (Including Year 8 objectives)	Year 10 (Including Year 9 objectives)	Year 11 (Including Year 10 objectives)
Number	▪ recognise and use relationships between operations, including inverse operations ▪ use conventional notation for priority of operations, including brackets ▪ apply the concepts of prime numbers, factors, multiples, highest common factors and lowest common factors ▪ use powers and roots for positive integers ▪ round numbers to significant figures	▪ to apply formal written methods to both positive and negative numbers ▪ use conventional notation for priority of operations, including brackets, powers, roots and reciprocals ▪ use the concept of, prime factorisation ▪ interpret standard form A x 10^n, where $1 \leq A < 10$ and n is an integer ▪ interchange between terminating decimals and fractions ▪ identify and work with fractions in ratio problems ▪ interpret fractions and percentages as operators	• apply the laws of indices • to simplify and use surds • to find the reciprocal of a number • make calculations with numbers in standard form • converting between mixed and improper fractions • converting recurring decimals to fractions • converting between fractions, decimals and percentages	▪ calculating upper and lower bounds ▪ performing calculations with surds	▪ Rationalise the denominator involving surds
Ratio and Proportion	▪ use ratio notation, including reduction to simplest form ▪ divide a given quantity into two parts in a given part:part or part:whole ratio ▪ interpret percentages and percentage changes ▪ express one quantity as a percentage of another ▪ compare two quantities using percentages ▪ solve problems involving percentage change, including percentage	▪ change freely between compound units (e.g. speed, rates of pay, prices) in numerical contexts ▪ use compound units such as speed, rates of pay, unit pricing) ▪ apply ratio to real contexts and problems ▪ use scale factors, scale diagrams and maps ▪ compare lengths, areas and volumes using ratio notation ▪ work with percentages greater	▪ Find the total value divided into a ratio from the value of one part ▪ Calculate the value of one part of a ratio when given the value of another ▪ Convert between currencies ▪ calculate compound interest and depreciation ▪ calculate percentage profit and loss ▪ calculate percentages using multipliers ▪ calculate reverse	▪ interpreting velocity-time & Distance-time graphs ▪ solve proportion problems using the unitary method ▪ calculate quantities using direct and inverse proportion ▪ using kinematics to calculate speed, acceleration etc ▪ calculating exponential growth and decay ▪ recognise values in direct proportion by reference to	

	increase/decrease	than 100% ▪ solve problems involving percentage change, including original value problems, and simple interest including in financial mathematics	percentages with and without calculators	graph form	
Algebra	▪ use and interpret algebraic notation ▪ substitution ▪ understand and use the concepts and vocabulary of expressions, equations, formulae and terms ▪ simplify expressions by collecting like terms and multiplying a single term over a bracket ▪ interpret functions with inputs and outputs ▪ understand and use lines parallel to the axes, y=x and y=-x ▪ solve linear equations ▪ generate sequences ▪ recognise and use special sequences	▪ factorising expressions by taking out common factors ▪ plot graphs of linear equations ▪ identify and interpret gradients and intercepts ▪ recognise, sketch and interpret graphs of linear functions and simple quadratic functions ▪ find approximate solutions to linear equations using a graph ▪ finding the nth term of linear sequences	▪ forming expressions and equations ▪ expanding double brackets. ▪ use concept of difference of 2 squares ▪ changing the subject of an equation ▪ solve equations using iterative methods ▪ answer simple proofs ▪ finding the nth term of quadratic sequences	▪ calculate the midpoint of a line ▪ calculate the length of a line segment ▪ finding the equation of a line ▪ sketching and plotting quadratic, cubic, reciprocal and circle graphs ▪ solving linear inequalities and representing solutions on a number line and using set notation ▪ solving quadratic equations by factorisation and completing the square ▪ To solve quadratics by using the quadratic formula ▪ solving linear simultaneous equations using elimination, substitution and graphs. ▪ solving quadratic simultaneous equations	• identifying roots, intercepts and identifying intersection points • expanding more than two brackets • solving simultaneous equations graphically • use iterative methods • simplifying algebraic fractions • multiply and divide algebraic fractions • solving quadratic equations arising from algebraic fraction equations • changing the subject of a formula • proof – consecutive integers, squares, even numbers, odd numbers • functions, inverse functions and composite functions • reciprocal and exponential graphs. • interpreting gradients of linear and non-linear functions • estimating area under graphs • rate of change • forming and solving direct and inverse proportion problems
Statistics and probability	▪ interpret and construct tables, charts and diagrams for categorical data, and for ungrouped discrete numerical data ▪ use the mean, median,	▪ to analyse the frequency of outcomes of probability experiments ▪ to calculate expected outcomes ▪ relate relative expected	▪ constructing and completing two way tables ▪ identify trends, patterns and outliers on scatter graphs ▪ understanding the relationship between	▪ use Venn diagrams to calculate probabilities ▪ draw and interpret tree diagrams to calculate probabilities ▪ understand independent	

	mode and range to compare and interpret data	- frequencies to theoretical probability, - construct theoretical possibility spaces - enumerate sets and combinations of sets systematically - use the mean, median, mode and range for grouped data - use and interpret scatter graphs	- correlation and causality - interpolate and extrapolate results using a line of best fit or its equation - draw and interpret frequency polygons	- and mutually exclusive events - calculate conditional probabilities - use and interpret cumulative frequency graphs - interpreting and constructing box plots - interpreting and construction histograms - perform stratified sampling calculations to find the sample size of a population	
Geometry	- use the standard conventions for labelling and referring to the sides and angles of triangles - properties of: special types of quadrilaterals and triangles - understand congruence through transformations - properties of 3D solids - calculate area of triangles, parallelograms, trapezia - calculate volume of cuboids - describe translations as 2D vectors	- angles on parallel lines - similar shapes - interpret plans and elevations of 3D shapes - interpreting maps and scale drawings and use of bearings - know the formulae: circumference of a circle = 2πr = πd, area of a circle = πr² - know and apply formulae to calculate volume of right prisms (including cylinders) - calculate surface area of cuboids	- plot lines in the form x=a and y=a - Identify and describe all transformations. - find missing lengths in right angled triangles using Pythagoras' theorem - use angle facts to solve angle problems - angles in polygons	- conversion graphs - trigonometry - area and arc length of a sector - volume and surface area of 3D shapes. - planes of symmetry. - enlarge a shape by a positive and negative scale factor. - constructions and loci - recognise, sketch and interpret trigonometric graphs - transform trigonometric graphs. - calculate the area of a triangle using the formula (1/2absin(C)) - using the sine and cosine to calculate lengths and angles - using Pythagoras' theorem and trigonometry to solve 3D problems - proving triangles are congruent - finding the scale factors between similar shapes - finding lengths, area and volumes of similar solids	- prove and use the circle theorems - find and give reasons for missing angles on diagrams using circle theorems; and facts involving radius and tangent properties - finding the equation of a tangent to a circle at a given point - recognise and construct the graph of a circle - vectors and geometric proof

GCSE External assessment:

All content is assessed at the end of Year 11. The written examinations are made up of 3 examination papers, two calculator and one non-calculator. Each paper is equally weighted. Each lasts 1 hour 30 minutes and is marked out of 80. Students are awarded grades based on the 9-1 grading system (with 9 being the best grade).

Each examination is available at two tiers. Teachers will use internal class assessments to decide which tier is most appropriate for each student.

Tier	Available Grades
Higher	9-4
Foundation	1-5

SMSC in the mathematics

Through various projects, mini investigations and activities built into lessons, SMSC (Spiritual, Moral, Social and Cultural) is being delivered in high quality lessons.
What we offer:
- A classroom environment which encourages problem solving, collaborative work and enjoyment of exploring real-life problems.
- Participation in extra-curricular activities such as the UK Schools Mathematics Challenges, Maths Enrichment Days, Mathematics Revision Sessions, and Maths Club for students who want to extend themselves and have fun in mathematics

Spiritual development in mathematics
We encourage pupils to see the awe and wonder that can be found within mathematics – from the symmetry of a snowflake or the number of seeds in a sunflower head to the design of galaxies and the coordinates of a newly discovered planet. Pupils are introduced to famous
mathematicians, some of whom are also well-known as philosophers. There is a sense of wonder in the exactness of mathematics and students are able to gain a sense of personal achievement in solving problems.

Moral development in mathematics
We look at the use and interpretation of data, particularly the use of statistics and how people manipulate them to promote their own (biased) opinions. Pupils are encouraged to discuss the use and misuse of data in all issues, including those supporting moral arguments, and consider the use of questionnaires to conduct opinion surveys.
Social development in mathematics
Pupils are regularly asked to work in pairs or small groups during experimental or investigative work where they are able to develop both their problem solving and teamwork skills. They are given many opportunities to discuss their ideas and are encouraged to develop their
mathematical reasoning through communication with others. Through the use of peer- assessment pupils are able to improve their use of language and better understand how to give constructive criticism.

Cultural development in mathematics
Students are able to explore the mathematics found and used in other cultures. They are introduced to symmetrical patterns, number systems and mathematical methods such as patterns found in Islamic art and Roman numerals. Students are introduced to the culturally and historically significant art of code-breaking and theorems devised by famous mathematicians.