MATHEMATICS

Year 9

What are the aims and intentions of this curriculum?

The aim of our Key Stage 3 Curriculum is to consolidate the numerical and mathematical capability and skills learnt from key stage 2 and to extend students' understanding of the number system and place value to include decimals, fractions, powers and roots. The curriculum also seeks to equip students with the knowledge to be able to make generalisations about the number system that will help them to make the necessary connections between mathematical topics and voids re-teaching when developing concepts in isolation. It also seeks to develop fluent understanding of the axioms and structures of number that are fundamental to mathematics which underpins the understanding of algebraic notations developed in this year and in the subsequent years. The KS3 Curriculum also aims to equip Students to apply algebraic reasoning in new contexts such as Geometry, and to also make linkage to different interpretations of fractions and be introduced to ratio. To provide students with a holistic experience, prepare them for future success, help them aspire and value mathematics, Personal Social Health and Economic (PSHE) education and Careers Education (CE) are incorporated into the curriculum.

Term	Topics	Knowledge and key terms	Skills developed	Assessment
Summer 2	➢ Number • Order of Operation • Rounding, Approximation and estimation • Factors and Multiples (HCF and LCM, Venn Diagram) • Roots and Surds • Indices	**Students will be able to:** • Calculate accurately negative and positive numbers following BIDMAS • Round numbers and Estimation calculations • Work accurately with square, cubes and roots • Identify primes, factors and multiples • Complete prime factorisation **Factors: families – using the factor tree** **Multiples: extended families (number of family members living together** **Prime: Single parent – Mom and 1 child or Dad and 1 child** • Find HCF and LCM • Optimise resources and eliminate wastage. • Understand surd notation-Being Irrational • Understand and work with questions involving surds including rationalising the denominator. • Work with indices- Index laws Business, Race Tracks, Traffic Lights,	• Select and use appropriate calculation strategies to solve increasingly complex problems • Extend their understanding of the number system. • Use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals • Recognise and use relationships between operations including inverse operations • Appreciate the infinite nature of the sets of integers, real and rational numbers. • calculate exactly with fractions, **surds** and multiples of π; **simplify surd expressions involving squares (e.g. √12 = √(4 × 3) = √4 × √3 = 2√3) and rationalise denominators** • Use problem solving strategies to find solutions	• All pupils will be sitting an End of term assessment. • Pupils will be assessed additionally as best seen fit by their subject teacher. • Mathswatch Group work Class discussions Targeted Questioning

• Standard form and its applications	• Calculate with Standard form	• Calculate with and interpret standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer	
➢ Algebra • Algebraic indices • Expression, equations and Formulae • Algebraic simplification	• Distinguish between expressions, equations, formulae and identities.	• substitute numerical values into formulae and expressions, including scientific formulae • understand and use the concepts and vocabulary of expressions, equations, formulae, identities, inequalities, terms and factors	
• Algebraic Expansion and Factorisation	• Factorise expressions into a single bracket • Factorise Quadratic expressions when a=1 • Solve equations involving brackets and numerical fractions. • Use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement) • Expand products of one or two or **three** binomials • Substitute numbers into formulae. • Rearrange formulae. • Substitute values in expressions, rearrange and simplify expressions, and solve equations	• understand and use standard mathematical formulae; rearrange formulae to change the subject • know the difference between an equation and an identity; argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments **and proofs** • where appropriate, interpret simple expressions as functions with inputs and outputs; ; **interpret the reverse process as the 'inverse function'; interpret the succession of two functions as a 'composite function' (the use of formal function notation is expected)**	
• Linear sequences • Quadratic Sequences	• Find a general formula for the nth term of an arithmetic sequence. • Determine whether a particular number is a term of a given arithmetic sequence. • Solve problems using geometric sequences. • Work out terms in Fibonnaci-like sequences.	• generate terms of a sequence from either a term-to-term or a position-to-term rule • Make and test conjectures about patterns and relationships; look for proofs or counter-examples	
	Predicting	• recognise and use sequences of triangular, square and cube numbers,	

			simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions (r^n where n is an integer, and r is a rational number > 0 **or a surd**) **and other sequences** • deduce expressions to calculate the nth term of linear **and quadratic** sequences • Model situations or procedures by translating them into algebraic expressions • Solve problems involving linear sequences in a variety of contexts • Students begin to appreciate that writing with algebra applies the rules of arithmetic to unknown numbers which are represented as letters.	
Autumn 1	➢ Algebra • Equation of straight-line graphs • Solving equations	**Students will be able to:** • Work with Coordinates in all four Quadrants • Identify the equations of horizontal and vertical lines • Plot coordinates from a rule to generate a straight line • Finding the gradient and y intercept of a line and equations of straight line given the gradient and y intercept. • **Finding equations of parallel and perpendicular lines.** • Solving Simultaneous equations • Introduction to KS4 content: Solve simultaneous equations algebraically and graphically.	• Make connections between number relationships, and their algebraic and graphical representations • Identify key features of a linear graph • identify and interpret gradients and intercepts of linear functions graphically and algebraically • plot graphs of equations that correspond to straight-line graphs in the coordinate plane; use the form y = mx + c to identify parallel **and perpendicular** lines; find the equation of the line through two given points or through one point with a given gradient • solve two simultaneous equations in two variables (linear/linear **or linear/quadratic)** algebraically; find approximate solutions using a graph	• All pupils will be sitting an End of term assessment. • Pupils will be assessed additionally as best seen fit by their subject teacher. • Mathswatch • Mathswatch Group work Class discussions Targeted Questioning

	• Laws of Indices (More Complex)	• Understand, derive and use the rules of indices with integer values • Apply the laws of Indices with Algebra- **including fractional** and negative indices.		
Autumn 2	➢ Handling Data • Graphs, Charts for both Grouped and ungrouped data • Statistical Measures • Averages from tables and Graphs • Statistical diagrams 1 • Time series • Scatter graphs • Line of best fit • Averages and range • Statistical diagrams 2 ➢ Algebra • Solving harder equations • Inequalities	**Students will be able to:** • Construct and use back-to-back stem and leaf diagrams. • Construct and use frequency polygons and pie charts. • Plot and interpret time series graphs. • Use trends to predict what might happen in the future. • Plot and interpret scatter graphs. • Determine whether or not there is a linear relationship between two variables. • Draw a line of best fit on a scatter graph. • Use the line of best fit to predict values. • Decide which average is best for a set of data. • Estimate the mean and range from a grouped frequency table. • Find the modal class and the group containing the median. • Construct and use two-way tables. • Choose appropriate diagrams to display data. • Recognise misleading graphs. • Form and solve linear equations and inequalities in one unknown, including those where the unknown appears on both sides • Rearrange and solve linear equations and inequalities given in any form, including those involving fractions and brackets	• 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 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 this using scatter graphs. • Identify possible primary or secondary sources; determine the sample size and most appropriate degree of accuracy. • solve linear equations in one unknown algebraically (<u>including those with the unknown on both sides of the equation</u>); find approximate solutions using a graph • <u>solve linear inequalities in one</u> **<u>or two</u>** <u>variable</u>**<u>(s);</u>** <u>represent the solution set on a number line</u>	• At the end of each unit there will be a unit test. • There will be online assessments for each topic covered. • All pupils will be sitting an End of term assessment. • Pupils will be assessed additionally as best seen fit by their subject teacher. • Mathswatch Group work Class discussions Targeted Questioning

Spring 1	➢ Number • Fraction, Decimal and Percentages • Percentages • Ratio and Proportion ➢ SSM • Angles and trigonometry • Pythagoras' Theorem	**Students will be able to:** • Convert between fractions, decimals and percentages (review Year 7) • Use percentages greater than 100% • Express one quantity as a percentage of another • Increase and decrease a quantity by a given percentage • Find the original quantity using its final amount and percentage change • Solve problems involving percentage change and reverse percentage • Write, simplify and compare ratios **Pharmacist making a mixture (medication) for a given patient** • Convert between currencies and measures • Recognise and use direct proportion • Solve problems involving ratio and proportion. Healthy Living, NHS guidance for Balanced diet- Food Pyramid • Derive Pythagoras' theorem • Use Pythagoras' theorem to find missing sides in right-angled triangles	• Extend their understanding of the number system. • extend and formalise their knowledge of ratio and proportion in working with measures and geometry, and in formulating proportional relations algebraically • identify and work with fractions in ratio problems • interpret fractions and percentages as operators • 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 of a quantity into two parts as a ratio; apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations) • express a multiplicative relationship between two quantities as a ratio or a fraction • understand and use proportion as equality of ratios • relate ratios to fractions and to linear functions • define percentage as `number of parts per hundred¿; interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively; express one quantity as a percentage of another; compare two quantities using percentages; work with percentages greater than 100%; solve problems involving percentage change, including percentage increase/decrease and original value problems, and simple interest including in financial mathematics • know the formulae for: Pythagoras' theorem, $a^2 + b^2 = c^2$ • Use trigonometric ratios to calculate an angle in a right-angled triangle.	• All pupils will be sitting an End of term assessment. • Pupils will be assessed additionally as best seen fit by their subject teacher. • Mathswatch • Group work • Class discussions • Targeted Questioning

	• Angle properties in a polygon-Interior and Exterior angles in a polygon • Basic Trigonometry	• Solve associated problems in other shapes where right-angled triangles exist • Deduce whether a triangle is right-angled by considering its sides • Find the formula for sum of the angles of any polygon • Understand and use the sum of the exterior angles of a polygon • Solve problems involving the angles/number of sides in a regular polygon • Develop an understanding of the trigonometric ratios • Solve problems using trigonometric ratios in right-angled triangles • Pythagoras' theorem $a^2 + b^2 = c^2$, and the trigonometric ratios, sin θ = opposite/hypotenuse, cos θ = adjacent/hypotenuse and tan θ = opposite/adjacent apply them to find angles and lengths in right-angled triangles **and, where possible, general triangles** in two **and three** dimensional figures • 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°	• Find angles of elevation and angles of depression. • Use trigonometric ratios to solve problems. • Know the exact values of the sine, cosine and tangent of some angles. • Investigate how other polygons, starting with quadrilaterals, can be divided into triangles and so deduce the general formula. • Following on from investigating exterior angles, they will then solve a series of problems such as finding the number of sides given information about the angles of polygons. • Investigate the trigonometric ratios using similar triangles • Define and use the cosine, sine and tangent ratios	
Spring 2	➢ Algebra • Rate of Change and graphs • Quadratic Graphs	**Students will be able to:** • Use linear and quadratic graphs to estimate values of y for given values of x • Find acceleration and distance from velocity–time graphs. • Draw and interpret real-life linear graphs. • Find the coordinates of the midpoint of a line segment. • Find the gradient and length of a line segment. • Find the equations of lines parallel or perpendicular to a given line. • Draw quadratic graphs. • Solve quadratic equations using graphs. • Identify the line of symmetry of a quadratic graph.	• Identify variables and express relations between variables algebraically and graphically • Find approximate solutions to contextual problems from given graphs of a variety of functions including:(e.g. real-life linear graphs) • recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function $y = 1/x$ with $x \neq 0$ • plot and interpret graphs (including reciprocal graphs) and graphs of non-standard functions in real contexts to find approximate solutions to problems such as	• At the end of each unit there will be a unit test. • There will be online assessments for each topic covered. • All pupils will be sitting an End of term assessment. • Pupils will be assessed additionally as best seen fit by their subject teacher.

		• Interpret quadratic graphs relating to real-life situations. • Draw graphs of cubic functions. • Solve cubic equations using graphs. • Draw graphs of reciprocal functions. • Recognise a graph from its shape. • Interpret linear and non-linear real-life graphs. • Draw the graph of a circle.	simple kinematic problems involving distance, speed and acceleration	• Mathswatch • Group work • Class discussions • Targeted Questioning
Summer 1	➢ SSM • Area, Perimeter, Surface Area and Volume • Transformation (Review)	**Students will be able to:** • Recall and use the formula for the area of a trapezium. • Convert between metric units of area. • Calculate the maximum and minimum possible values of a measurement. • Convert between metric units of volume. • Calculate volumes and surface areas of prisms. • Calculate the area and circumference of a circle. • Calculate area and circumference in terms of π. • Calculate the perimeter and area of semicircles and quarter circles. • Calculate arc lengths, angles and areas of sectors of circles. • Calculate volume and surface area of a cylinder and a sphere. • Solve problems involving volumes and surface areas. • Calculate volume and surface area of pyramids and cones. • Solve problems involving pyramids and cones. • Reflect a shape in a line, including on coordinate axes • Rotate a shape about a center, including on coordinate axes • Describe reflections and rotations.	• identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment • know and apply formulae to calculate: area of triangles, parallelograms, trapezia; volume of cuboids and other right prisms (including cylinders) • know the formulae: circumference of a circle = $2\pi r = \pi d$, area of a circle = πr^2; calculate: perimeters of 2D shapes, including circles; areas of circles and composite shapes; surface area and volume of spheres, pyramids, cones and composite solids • calculate arc lengths, angles and areas of sectors of circles • Identify the type of transformation carried out by comparing an object and image • use scale factors, scale diagrams and maps	• All pupils will be sitting an End of term assessment. • Pupils will be assessed additionally as best seen fit by their subject teacher. • Mathswatch • Group work • Class discussions • Targeted Questioning

	• Constructions	• Enlarge shapes by fractional and negative scale factors about a centre of enlargement. • Translate a shape using a vector. • Carry out and describe combinations of transformations. • Draw and use scales on maps and scale drawings. • Solve problems involving bearings. • Construct triangles using a ruler and compasses. • Construct the perpendicular bisector of a line. • Construct the shortest distance from a point to a line using a ruler and compasses. • Bisect an angle using a ruler and compasses. • Construct angles using a ruler and compasses. • Construct shapes made from triangles using a ruler and compasses. • Draw a locus. • Use loci to solve problems.	• 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); 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	