Mathematics

Year 10

What are the aims and intentions of this curriculum?

The aim of our Key Stage 4 Curriculum is to enable students to:

- Develop fluent knowledge, skills and understanding of mathematical methods and concepts
- To make the connection with the KS3 curriculum
- Acquire, select and apply mathematical techniques to solve problems
- Reason mathematically, make deductions and inferences and draw conclusions
- Comprehend, interpret and communicate mathematical information in a variety of forms appropriate to the information and context.

Throughout KS4: Students will need to keep working on key skills as they occur within other topics, as well as when the skills are being explicitly addressed. These include: Addition, subtraction, multiplication and division; order of operations; fractions, decimals and percentages; rounding and estimation; and algebraic notation. 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* ➢ Indices, Powers and roots ➢ **Fractional Indices ➢ **Surds, Operations with surds**	**Students will be able to:** • **Build on the knowledge gained on Indices seen in KS3** • Basic Laws of Indices. **Understanding Surds and their operations.** • Recognise and calculate with square numbers and cube numbers, knowing square and cube roots as appropriate • Recognise and calculate with square numbers and cube numbers, knowing square and cube roots as appropriate • Understand the meaning of roots and how to find these, including through approximation • Efficiently use a calculator, when appropriate #Accounting, Finance, Scientists • Understand the meaning of higher powers and know how to find these. • Understand, derive and use the rules of indices with integer values.	• **Make and use connections**, which may not be immediately obvious, between different parts of mathematics • **Perform routine** single and multi-step procedures effectively • **Accurately recall** facts, terminology and definitions • **Accurately carry out** complex procedures or set tasks requiring multi-step solutions • **Generate strategies** to solve complex mathematical and non-mathematical problems by translating them into a series of mathematical processes • recognise and use relationships between operations, including inverse operations (e.g. cancellation to simplify calculations and expressions); use conventional notation for priority of operations, including brackets, powers, roots and reciprocals • 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**.	• Pixi Maths RAG • Maths Takeaway • Maths watch homework • **AO1: Use and apply standard techniques** • **AO3: Solve problems within mathematics and in other contexts** Targeted Questioning Group work Class discussions Presentations researching a topic

		#Insurance Risk Assessors, Biologists, Computer Programmers • Identify the missing multiple which practices the skills of searching for a perfect square factor. • Understand the difference between rational and irrational numbers. • Simplify a surd. • Rationalise a denominator.		
	➢ *Algebra* **Equations and inequalities** • Solving quadratic equations • Completing the square • Solving simultaneous equations • Solving linear and quadratic simultaneous equations • Solving linear inequalities ➢ Simplifying and Factorizing Algebraic expressions ➢ Solving Equations	• Understand and use the concepts and vocabulary of expressions, equations, formulae, terms and factors • Use with great fluency: Basic Algebra facts • Employ and build on KS3 knowledge in • Collecting Like terms, multiplying brackets and factorizing linear and quadratic expressions • Substitute into, solve and rearrange linear equations. • Recognise the equation of a circle. • Factorise quadratic expressions of the form $x^2 + bx + c$ • Factorise- difference of two squares • **Factorise quadratic expressions of the form $ax^2 + bx + c$, when $a > 1$** • simplify and manipulate algebraic expressions (**including those involving surds {and algebraic fractions})** • Find the roots of quadratic functions. • Rearrange and solve simple quadratic equations. • Solve more complex quadratic equations. • Use the quadratic formula to solve a quadratic equation. • Complete the square for a quadratic expression. • Understand the ≥ and ≤ symbols. • Interpret inequalities. • Solve quadratic equations by completing the square. • Solve simple simultaneous equations.	• 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** • solve linear equations in one unknown algebraically (including those with the unknown on both sides of the equation); find approximate solutions using a graph • 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 • solve two simultaneous equations in two variables (linear/linear **or linear/quadratic)** algebraically; find approximate solutions using a graph • translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution • solve linear inequalities in one **or two** variable**(s), and quadratic**	

	➢ Changing the subject of the formula	• Solve simultaneous equations for real-life situations. • Use simultaneous equations to find the equation of a straight line. • Solve linear simultaneous equations where both equations are multiplied. • Interpret real-life situations involving two unknowns and solve them. • Solve simultaneous equations with one quadratic equation. • Use real-life situations to construct quadratic and linear equations and solve them. • Solve inequalities and show the solution on a number line and using set notation. • rearrange formula to change the subject #Engineers, Physicists, Astronomers, Agriculture	**inequalities in one variable;** represent the solution set on a number line • identify and interpret roots, intercepts, turning points of quadratic functions graphically; deduce roots algebraically **and turning points by completing the square**	
Autumn 1	➢ Fractions ➢ Percentages • **Probability** ➢ Experimental probability ➢ Independent events and tree diagrams ➢ Conditional probability	**Students will be able to:** • Build on KS3 knowledge in working with Fraction operations, **which include algebraic fractions.** • Simplify fractions. • Multiply whole numbers by decimals. • Add and multiply fractions and decimals. • To find percentage of an amount, Percentage Increase and decrease. # Banking, Interpreting Profit and loss in any Business, Science # Profit and loss, Mortgages, Savings #Pay day loans • List all outcomes for a single event systematically. • List all outcomes for two events systematically.	• **Perform routine** single and multi-step procedures effectively • Identify and work with fractions in ratio problems • **Accurately carry out** complex procedures or set tasks requiring multi-step solutions • Use the product rule for finding the number of outcomes for two or more events. • List all the possible outcomes of two events in a sample space diagram.	• Pixi Maths RAG • Maths Takeaway • Maths watch homework • **AO1: Use and apply standard techniques** • **AO3: Solve problems within mathematics and in other contexts**

	➢ Venn diagrams and set notation	• Know that the probability of something not happening is 1 minus the probability of the event happening. • Draw and use probability tree diagrams. • Use Venn diagrams. #different ways of ordering from a menu **# Gambling and Cons of it**	• Identify mutually exclusive outcomes and events. • Find the probabilities of mutually exclusive outcomes and events. • Find the probability of an event not happening. • Work out the expected results for experimental and theoretical probabilities. • Compare real results with theoretical expected values to see if a game is fair. • Draw and use frequency trees. • Calculate probabilities of repeated events. • Draw and use probability tree diagrams. • Decide if two events are independent. • Draw and use tree diagrams to calculate conditional probability. • Draw and use tree diagrams without replacement. • Use two-way tables to calculate conditional probability. • Use Venn diagrams to calculate conditional probability. • Use set notation.	• Targeted Questioning • Group work • Class discussions Presentations researching a topic
	• **SSM** ➢ Pythagoras and basic Trigonometry • Calculating areas and the sine rule • The cosine rule sine rule and 2D trigonometric problems	• Find missing angles and lengths of right-angled triangles of right angles triangles using Pythagoras and Trigonometry. • **Use sine rule and cosine rule to find missing side and angle for non-right angled triangles.** • **Area of triangles using Trigonometry** **#Engineering, Construction**	• Use Pythagoras' theorem to find missing sides in right-angled triangles • Put in use, the knowledge developed on their understanding of the trigonometric ratios • Solve associated problems in other shapes where right-angled triangles exist. • Put in use, the knowledge gained in to problem solve problems using trigonometric ratios in right-angled triangles • Deduce whether a triangle is right-angled by considering its sides	
	➢ Upper and lower bounds	• **Find the upper and lower bounds of a calculation using numbers that have been rounded to a given degree of accuracy** • Understand the difference between the bounds of discrete and continuous quantities # Structural Engineering # To know the limits in day today life	• Apply and interpret limits of accuracy when rounding or truncating, {including upper and lower bounds}.	

Autumn 2	• **SSM** • Congruence • Geometric proof and congruence • Similarity • More similarity • Similarity in 3D solids	**Students will be able to:** • Show that two triangles are congruent. • Know the conditions of congruence. • Prove shapes are congruent. • Solve problems involving congruence. • Use the ratio of corresponding sides to work out scale factors. • Find missing lengths on similar shapes. • Use similar triangles to work out lengths in real life. • Use the link between linear scale factor and area scale factor to solve problems. • Use the link between scale factors for length, area and volume to solve problems. # Engineers, Surveyors. • **Direct and Inverse Proportion** • **Compare lengths, areas and volumes using ratio notation and/or scale factors.** • **Make links to similarity**	• use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS) • 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 • 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 • apply the concepts of congruence and similarity, including the relationships between lengths, **areas and volumes** in similar figures • Understand that X is inversely proportional to Y is equivalent to X is proportional to 1/ Y • Construct and interpret equations that describe direct and inverse proportion	• Pixi Maths RAG • Maths Takeaway • Maths watch homework • **AO1: Use and apply standard techniques** • **AO2: Reason, interpret and communicate mathematically** • **AO3: Solve problems within mathematics and in other contexts** • Targeted Questioning • Group work • Class discussions • Presentations researching a topic

	➢ Proportion ➢ SSM ➢ Recurring decimals	• **Understand and use the relationship between lengths, areas and volumes of similar shapes building also on investigation work in KS3, students will discover what happens to the areas/volumes of enlarged 2D/3D shapes when the lengths are enlarged and deduce the corresponding relationships**. **#Making Connections and links** **#Managing time** • Angle properties • Angles between parallel lines • Interior and Exterior angles of polygons • Apply algebra to prove recurring decimals	• To be able to find interior and Exterior angles of a regular polygon • Understand and use Corresponding and Alternate angles between parallel lines. • Use the known properties of triangles and quadrilaterals to follow and to derive simple proofs in rectilinear figures, including key angle and area facts Building on students' experience in Year 9, and where necessary Consolidation of prior units. • Use angle facts to justify results in simple and **complicated** proofs	
Spring 1	➢ Transformation Algebra ➢ Quadratic sequences	• Review the concepts on: Rotation, Reflection, Enlargement and Translation. • Describe and transform a given shape by reflection, rotation, translation and enlargement (fractional and negative scale) **Student will be able to:** • Review Linear sequences • **Find the formula for the nth term of a quadratic sequence**	• compare lengths, areas and volumes using ratio notation; make links to similarity (including trigonometric ratios) and scale factors • **Perform routine** single and multi-step procedures effectively • **Generate strategies** to solve complex mathematical and non-mathematical problems by translating them into a series of mathematical processes • **Generate strategies** to solve complex mathematical and non-mathematical problems by translating them into a series of mathematical processes • Generate terms of sequences from either term to term or position to term rule	• Pixi Maths RAG • Maths Takeaway • Maths watch homework

	• SSM ➢ Loci and Construction	• **Find missing terms in, and find the formula for the nth term of geometric sequences with ratios that are surds** • **Investigate the development and structure of quadratic sequences, including the method of second differences to find a rule for the general term.** • **Geometric sequences will be extended to explicitly include surds**. **#Medicine** • Perpendicular and Angle bisectors • Construct triangles, bisect angles and construct the perpendicular bisector of a line. • Apply the 4 concepts of Loci to problem solve. • Draw and use scales on maps and scale drawings. #Engineering, Construction	• 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**	
Spring 2	➢ Bearings ➢ Algebraic Proofs Graphs ➢ Linear Graph	• Solve problems involving bearings • Consider right-angled triangles formed in bearing problems, as well as the general meaning and use of bearings. • Apply ruler and compass constructions to construct figures • Understand the term equidistant • Identify the loci of points and use these to solve real-world problems • **Use algebra to construct proofs of arguments.** • **recognise, sketch and interpret graphs of linear functions, quadratic functions, simple**	• Solve problems involving bearings. • Understand Perpendicular distance is the shortest distance. • Develop their skills of reasoning and justification to include proofs involving more angle facts. • Extend their understanding of algebraic proof to include proofs such as the sum of three consecutive integers is always a multiple of 3.	• **AO1: Use and apply standard techniques** • Targeted Questioning • Group work • Class discussions Presentations researching a topic • **AO3: Solve problems within mathematics and in other contexts**

	➢ Quadratic Graph ➢ Cubic Graph ➢ Reciprocal Graph ➢ Trigonometry graphs • Straight lines • Equations of parallel and perpendicular lines • Further Inequalities	**cubic functions, the reciprocal function y = 1 /x with x ≠ 0, exponential functions, and the trigonometric functions.** **#Physicists, Engineers.** • 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 linear inequalities in one or two variable(s)	• identify and interpret gradients and intercepts of linear functions graphically and algebraically • Solve simultaneous equations graphically. • Represent inequalities on graphs. • Interpret graphs of inequalities. • Recognise and draw quadratic functions. • Find approximate solutions to quadratic equations graphically. • Solve quadratic equations using an iterative process. • Find the roots of cubic equations. • Sketch graphs of cubic functions. • Solve cubic equations using an iterative process. • Solve several inequalities in two variables, representing the solution set on a graph. • Identify regions involving simultaneous inequalities.	
Summer 1	• Handling Data (Review) Sampling Cumulative frequency Box plots Drawing histograms Interpreting histograms Comparing and describing populations	• Averages, charts and diagrams • Understand how to take a simple random sample. • Understand how to take a stratified sample. • Draw and interpret cumulative frequency tables and diagrams. • Work out the median, quartiles and interquartile range from a cumulative frequency diagram. • Find the quartiles and the interquartile range from stem-and-leaf diagrams. • Draw and interpret box plots. • Understand frequency density. • Draw histograms. • Interpret histograms. • Compare two sets of data. # Data Analysts, Statistician	• Averages from frequency tables, Construct and interpret diagrams including **Cumulative frequency curve, Box plots and Histograms.** • **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** interpret, analyse and compare the distributions of data sets from univariate empirical distributions through: ● appropriate graphical representation involving discrete, continuous and grouped data, **including box plots**	Pixi Maths RAG Maths Takeaway Maths Watch homework • **AO1: Use and apply standard technique** • **AO2: Reason, interpret and communicate mathematically** • **AO3: Solve problems within mathematics and in other contexts**

- **SSM**

➢ Surface area and volume of pyramids, cones and spheres (including exact answers)

- Probability

➢ Sample spaces

➢ The probability scale

Most able:

➢ Conditional probability

#Understanding relationships, Estimating outcomes

- 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.
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- Calculate volume and surface area of a cylinder and a sphere.
- Solve problems involving volumes and surface areas.
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- Calculate volume and surface area of pyramids and cones.
- Solve problems involving pyramids and cones.

#Engineering, Construction, Scientists, Chemists

Students will be able to:

- Use knowledge of Populations and samples (Capture and Recapture)
- Understand and use Sample spaces and listing
- Systematically list outcomes using a variety of representations

- Review and consolidate theoretical and experimental probability
- **Use Probability of combined events, including tree diagrams and use of Venn diagrams to problem solve.**

- appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers, **quartiles and inter-quartile range**)

- use standard units of mass, length, time, money and other measures (including standard compound measures) using decimal quantities where appropriate
- estimate answers; check calculations using approximation and estimation, including answers obtained using technology.
- 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; <u>surface area and volume of spheres, pyramids, cones and composite solids</u>

- **Make deductions and inferences** of complex information and draw conclusions
- **Interpret and communicate** complex information accurately
- **Assess the validity** of a complex argument and critically evaluate a given way of presenting information

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	• Algebra ➢ Further simultaneous equations ➢ Algebraic fractions	• **Understand what is meant by conditional probability** • **Calculate conditional probabilities** • **Establish whether two events are independent** • **Solve more complex problems involving tree diagrams** • Understand that different trials of an experiment may produce different outcomes. #Some of our actions can have consequences #Marketing, Data Analyst,Weather forecasters. • Solving simultaneous equations one linear and one quadratic • Simplify algebraic fractions and solve an algebraic fractional equation. • Manipulate algebraic fractions use mainly common denominators to add and subtract algebraic fractions • Use graphs to solve system of equations • Revisit Quadratic Inequalities.	• Branches on a probability tree have a sum of one as they are mutually exclusive. • Conditional probability is where the outcome of a future event is dependent on the outcome of a previous event. • Enumerate sets and combinations of sets systematically, using tables, grids, Venn diagrams and tree diagrams • argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments and proofs solve quadratic equations (including those that require rearrangement) algebraically by factorising, by completing the square and by using the quadratic formula	