MATHEMATICS

Year 11

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.
- 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.

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.

Term	Topics	Knowledge and key terms	Skills developed	Assessment
Summer 2	• Number • Indices, Surds • Algebra (Consolidating Year 10 Algebra) • Complex Quadratic equations	**Students will be able to:** • Know and use the laws of indices. Computer gaming, Finance • **Simplify surd expressions involving squares including expanding brackets and rationalise denominators. Engineers needing precise calculations** • Simplify and manipulate algebraic expressions involving **algebraic fractions** • Simplifying, expanding and factorising single brackets, substitution, solving linear equation and inequalities. • Review basics, solving equations, rearranging and solving equations and Inequalities. Linear simultaneous equations, Simplifying and expanding quadratic brackets. • Simplify and manipulate algebraic expressions **(including those involving surds and algebraic fractions)** by expanding products of two or more binomials. • **Find roots of an equation by completing the square and using the quadratic formula.** • **Solve two simultaneous equations in two variables where one is quadratic algebraically**	• Evaluate simple fractional and negative indices in the form • Understand what a surd is and simplify basic surds. • Solve equations with algebra and indices mixed. • Consolidate their numerical and mathematical capability from key stage 3 • Select and use appropriate calculation strategies to solve increasingly complex problems • Extend fluency with expressions and equations from key stage 3, to include quadratic equations, simultaneous equations and inequalities • Use mathematical language and properties precisely • Recognise and use the equation of a circle, centre the origin • Derive and use the key facts for circle geometry. • **Review the equation of a circle –Finding the point of intersection of a circle and a line.**	• Pixi Maths RAG • Maths Takeaway • Mathswatch homework • **AO1: Use and apply standard techniques** • **AO2: Reason, interpret and communicate mathematically** • **AO3: Solve problems within mathematics and in other contexts**

		Engineers, Mathematicians, Physicists and Astronomers, Sports, Construction.		Group work Class discussions Targeted Questioning
	• Iteration	• **find approximate solutions to equations numerically using iteration.** #Software developer, Graphic designer #Trial and Error until we get the desired result.		
	• Quadratic Inequalities	• Express solutions to inequalities using set notation • Construction, Designing roller coasters.	• **Solve quadratic inequalities in one variable and identifying the regions by sketching graphs of Quadratic functions**	
	• Circle Theorems	• Identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment • Apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results Aerospace Engineer, Navigator, Astronomer		
	• Probability Sample spaces. The probability scale Most able: Conditional probability	• 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. Actuarial Analysis, Data Scientist, Financial Risk Analyst #Pros and Cons of Gambling	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 enumerate sets and combinations of sets systematically, using tables, grids, Venn diagrams and tree diagrams calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions **calculate and interpret conditional probabilities through representation using expected frequencies**	

			with two-way tables, tree diagrams and Venn diagrams.	
Autumn 1	• Direct and Inverse Proportion	**Students will be able to:** • Interpret mathematical relationships both algebraically and graphically e.g. direct and inverse proportion and real-life graphs.	• Develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems. • Make and use connections between different parts of mathematics to solve problems. • Model situations mathematically and express the results using a range of formal mathematical representations, reflecting on how their solutions may have been affected by any modelling assumptions. • Select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems; interpret their solution in the context of the given problem. • Apply Pythagoras' theorem to problems in three dimensions, including repeated use of the theorem e.g. in finding the length of the diagonal of a cuboid • Identify right-angled triangles in three-dimensional shapes and use trigonometry to find missing sides and angles.	• Pixi Maths RAG • Maths Takeaway • Mathswatch homework • **AO1: Use and apply standard techniques** • **AO2: Reason, interpret and communicate mathematically** • **AO3: Solve problems within mathematics and in other contexts**
	• Graphs of cubic, quadratic- identify turning points • Linear Inequality, solving and Regions • Pythagoras and Trigonometry	• **Sketch quadratic and cubic functions. Know where a graph will cross the x-axis** • **Understand maximum and minimum points.** Engineers, Physicist, Astronomy • Express solutions to inequalities using set notation • Solve several inequalities in two variables, representing the solution set on a graph • Understand, recall and use Pythagoras theorem in 2D and **3D shapes.** **Speed limits, number of persons in the elevators, grade boundaries, who can take a given medication, age limit –travel for free, eat a hotel free, TV license free for > 80 years old etc** • Understand, use and recall the trigonometric ratios sine, cosine and tan and apply them to find angles and lengths. • **Know the exact values of Sin, Cos and tan 0, 30, 45, 60 and 90.** • **Know and apply the sine rule and cosine rule to find unknown lengths and angles and trigonometric area to calculate the sides and angles of any triangle given the areas.** Construction, Aviation, Engineering and Product Design		
	• Area and Arc length of sectors.	• Calculate arc lengths, angles and areas of sectors of circles Space Scientist, Aeronautical Engineers **Averages including Histograms, Tree diagrams and Venn diagrams to find probability.**	• A sector is a fraction of 360° of the entire circle. • Understand and use standard mathematical formulae; rearrange formulae to change the subject ,	Group work Class discussions Targeted Questioning

	• Revisit Handling data and Probability	• To be able to find the measures of location and measures of spread including CF graphs, Boxplots, Scatter graphs and to use tree diagrams to solve Probability questions including Capture-Recapture method. Data Analyst		
Autumn 2	• Functions and transformation of functions • Transformations	**Students will be able to:** • **Develop an understanding of functions.** Use function notation and find composite function **and inverses.** • **Interpret and analyse transformations of graphs of cubic, quadratic and trigonometric functions and write the functions algebraically** • Understanding the notation for transformation of functions is critical to accessing this topic. ○ f(x) ±a = Vertical Translation ○ f(x ± a) = Horizontal Translation ○ af(x) = Horizontal stretch ○ f(ax) = Vertical stretch Animator, Construction worker, Scientists	• Understand and use function notation • Find the inverse of a function • Interpret the succession of two functions as a composite function • Identify and sketch the graphs of translations and reflections of a given graph • Identify and sketch the graphs of translations and reflections of the graph of a given equation • Use quadratic graphs to find the approximate solution to quadratic equations • Identify intercepts, and using symmetry, the turning points of graphs of quadratic functions	• Pixi Maths RAG • Maths Takeaway • Mathswatch homework
	• Compound Measures	• Use and apply compound units such as density and pressure and Speed/distance/time • Know and apply: • Speed = Distance ÷ Time • Density = Mass ÷ Volume • Pressure = Force ÷ Area Engineers, Chemists and Scientists		• **AO1: Use and apply standard techniques** • **AO3: Solve problems within mathematics and in other contexts**
	• Similar Shapes	To be able to find missing length, Area and volume of similar shapes using Linear scale factor, **Area scale factor and Volume scale factors.** **Animator, Fashion designer, Engineers**	• Apply the concepts of congruence and similarity, including the relationships between lengths, areas and volumes in similar figures • Compare lengths, areas and volumes using ratio notation; make links to similarity and scale factors	Group work Class discussions Targeted Questioning

	**Revise additional topics as per needs of class Percentages including Simple and Compound interest, Growth and Decay	• Express one quantity as a percentage of another • Compare two quantities using percentages • Work with percentages greater than 100%; • Solve problems involving percentage change • Solve problems involving percentage increase/decrease • Solve problems involving original value problems • Solve problems involving simple interest including in financial mathematics • Set up, solve and interpret the answers in growth and decay problems, including compound interest and work with general iterative processes Banking, Business, Medicine, Scientists	• Students to have a secure understanding of the difference between simple and compound interest. Profit and Loss Mortgages Payday loans Savings Best Value for Money	
Spring 1	• Vectors and geometric proof • Graphs	**Students will be able to:** • Add and subtract vectors algebraically and use column vectors. • **Solve geometric problems involving vectors and produce proofs.** Scientists, Astronauts, Pilots, Navigators • Plot and interpret graphs (**including exponential graphs, reciprocal Graphs and trigonometric function**) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration.	• Understand and use vector notation. • Work out the magnitude of a vector. • Calculate using vectors and represent the solutions graphically. • Calculate the resultant of two vectors. • Solve problems using vectors. • Use the resultant of two vectors to solve vector problems. • Express points as position vectors. • Prove lines are parallel. • Prove points are collinear. • Solve geometric problems in two dimensions using vector methods. • Apply vector methods for simple geometric proofs. Use tables of values to plot polynomial graphs **Use tables of values to plot reciprocal graphs** **Reinforce their knowledge of the shapes of graphs covered earlier in the course e.g. exponential, trigonometric.** ➢ Construct and interpret graphs of real-life contexts such as: ➢ Currency conversion	• Pixi Maths RAG • Maths Takeaway • Mathswatch homework • **AO1: Use and apply standard techniques** • **AO2: Reason, interpret and communicate mathematically** • **AO3: Solve problems within mathematics and in other contexts**

Spring 2	• Gradient of a curve at a point. • Acceleration • 3d Pythagoras and Trigonometry. • Product rule of counting Revision	• Review equation of straight lines-Parallel and Perpendicular. • Find the equation of the tangent to a circle. ➢ **Interpret the gradient at a point on a curve** ➢ Calculate or estimate gradients of graphs Architects, Market Analyst, Economist • Extend Pythagoras and Trigonometry to 3d to find missing sides and angles. • To work out the total number of ways of performing a series of task Architects, Engineers, Designers	➢ Temperature conversion ➢ Distance-time graphs ➢ Recognise and sketch graphs of $y = x^2$, $y = x^3$ and $y = 1/x$ ➢ Distance – **Time graphs can be extended to Speed-Time/Acceleration-Time graphs**. • **interpret the gradient at a point on a curve as the instantaneous rate of change; apply the concepts of average and instantaneous rate of change (gradients of chords and tangents) in numerical, algebraic and graphical contexts**	Group work Class discussions Targeted Questioning