

SUBJECT: Maths

Year	Powerful Knowledge	Rationale
Year 13	Pure Maths (I) – manipulate algebraic expressions, recognise and use the properties of functions, solve geometric problems using vectors in 3 dimensions. Prove both algebraic and geometric conjectures.	Students can split expressions into partial fractions so they can integrate them more efficiently and find the binomial expansions of them. Students can give a clear and elegant proof of a conjecture, demonstrating their understanding of how maths can be used to confirm a given hypothesis.
	Pure Maths (II) - be able to differentiate and integrate expressions of all types, solve and use trigonometric equations and expressions (in both radians and degrees), recognise and manipulate different sequences and series.	Calculus – to help find areas under curves and find equations of tangents and normals to given equations. Trigonometry – to recognise how trigonometric equations can be used to model events in the real world. Binomial expansions – to see the individual terms of the infinite series and how each term builds up the picture of the overall expression.
	Mechanics – Calculate the turning effect of a force (moments), resolve forces into components and solve problems using smooth or rough inclined planes, model motion under gravity for an object projected horizontally.	An understanding of Mechanics helps students to be able to see how things move under certain forces in the real world. Predictions can be made and can be refined to better model the real-life situation.
	Statistics – Regression, Correlation and Hypothesis Testing, Probability, the Normal Distribution and its properties.	Statistical distributions can give a meaning to how things occur in the real-world, such as predicting weather patterns or expected occurrences of certain events. An understanding of the normal distribution can help students estimate (for example) the number of humans in the population with a height above 160cm.
Year 12	Pure Maths (I) - manipulate algebraic expressions, recognise and use the properties of quadratic functions and their graphs and transformations, solve geometric problems using vectors in 2 dimensions.	So students have a deep understanding of quadratics and the graphs of both cubics and quartics. All of these topics are extended into year 13 and so good understanding at this level helps develop deeper understanding at A-Level.
	Pure Maths (II) - be able to differentiate and integrate expressions at AS level, solve and use trigonometric equations and expressions in degrees only. Use co-ordinate geometry to work with equations of straight lines, curves and circles.	So students begin to work with areas of calculus and recognise why these are important for finding gradients and areas under a curve. In co-ordinate geometry, a good understanding of relationships between x and y ordinates is essential in all curve types to progress to A-Level.
	Mechanics – learn how mechanics models can predict what might happen in the real-world. Begin looking at forces and motion using both constant and variable acceleration.	An understanding of Mechanics helps students to be able to see how things move under certain forces in the real world, both under constant and variable acceleration.
	Statistics – be familiar with different types of sampling methods, different measures of location and spread, different ways of representing data. Become familiar with probability distributions, particularly the binomial distribution and how to perform hypothesis tests.	An understanding of sampling can help students see how data can be collected in the real-world, they can then have a better appreciation of how the data can be analysed using measures of location and spread. Predictions can be improved upon using probability and expected outcomes.
Year 11	In year 11, Foundation pupils have covered all the content for this part of the course and will revise all of the elements of the syllabus throughout the school year. Higher students will study the following:	
	Number, Ratio and Proportion – Recognise irrational numbers that can be written in surd form and manipulate	Develops a good understanding the difference between rational and irrational numbers. A very good grounding of this topic will help at A-Level.

	expressions that involve them (rationalising the denominator).	
	Algebra – Use and understand the different methods to solve quadratic equations and inequalities, including solving simultaneous equations using quadratics. Introduction to functions and iteration and its uses.	A big chunk of the AS and A-Level course is based on the use of quadratics and functions. Pupils develop a good understanding of how to prove a conjecture mathematically.
	Geometry – Draw and interpret Trigonometric graphs, Use the Sine and Cosine Rules to find missing angles and sides in any triangle, Circle Theorems to find missing angles in circles. Area, Volume and Scale Factors, Proof.	Previous knowledge on angles can assist pupils develop further with circle theorems and trigonometry. This section deepens understanding. A good grounding will assist A-Level studies.
	Handling Data and Probability – Draw and interpret Histograms and understand how to use probability rules when one event is dependent on the other (conditional probability).	To develop an appreciation of how data can be displayed, interpreted and used in the real world and how probability can be used to predict future events.
Year 10	Number, Ratio and Proportion – Use compound interest and depreciation to find the result of a repeated percentage change. Further compound measures work to find the Density, Ratio and Algebra, Index Laws for Negative and Fractional Powers.	Gives a deeper understanding of percentage work and how percentages are calculated and used. At A-Level the idea of repeated percentage change needs to be understood when working with exponential growth and decay. Density work provides a further understanding of compound measures.
	Algebra – Know and understand the different methods to solve two equations simultaneously, Drawing and interpreting graphs to include Velocity/Time graphs, cubic, reciprocal and exponential graphs, further sequences.	Solving equations work is extended to include two equations with two unknowns. Pupils can then see the links between graphs and equations more clearly, recognising that the solution represents where lines meet. This is extended in future years and into A-Level to include curves as well as straight lines. An understanding of how graphs are created with links to coordinates can help develop a deeper understanding of the nature of different types of equations.
	Geometry – Find the Volume and Surface Area of more complex shapes such as spheres and cones. Use Trigonometry to find missing angles and side lengths in right-angled triangles. Loci.	3D shape work is developed further to include more complex shapes such as spheres. Pupils then develop a deep understanding of the links between side lengths and angles of a right-angled triangle, before all types of angles in Y11.
	Handling Data and Probability – Introduction to Set Theory, Venn Diagrams Tree Diagrams to help find probabilities, Sampling, Cumulative Frequency and Box Plots.	To develop an appreciation of how data can be displayed, interpreted and used in the real world and how probability can be used to predict future events.
Year 9	Number, Ratio and Proportion – find the result of a percentage change, understand how a rounded value can have limits of accuracy (error intervals), further ratio work to include finding missing values and linking two or more ratios together, recognising the links between ratios and fractions understand and use the relationship between measures that create compound measures (eg speed)	Aims to build a deeper understanding of how percentages work and their link to fractions. Ratio work helps pupils see the relationships between proportions and ratios. Compound measures work can help pupils see the relationships between measures (eg distance / time = speed).
	Algebra – understand and use quadratic equations and graphs, rearrange formulae to make a different variable the subject, find equations of linear graphs, distance/time graphs.	Develops graph work further by exploring curves rather than just straight lines. Gives an understanding of graphs and their properties (turning points and roots etc).

	Geometry – learn how to use compasses to create constructions such as perpendicular bisectors, further 3D exploration of shapes. Use of Pythagoras' Theorem to find missing side lengths in right-angles triangles, Bearings, similarity and congruence. Introduction to vectors. Further Transformations to include Enlargement and Rotation.	Helps pupils see the links between side lengths of right-angled triangles – develops the basis for trigonometry work at GCSE. Links can be seen between vectors and translations. Transformations work helps pupils to reason well as often questions require explanations of their written solutions.
	Handling Data and Probability – Understand and use experiments and frequency trees, scatter diagram introduction to find relationships between variables. Comparing data. Drawing and interpreting Frequency Polygons.	To develop an appreciation of how data can be displayed, interpreted and used in the real world. Helps pupils reason in words by comparing two different distributions.
Year 8	Number, Ratio and Proportion – finding and using percentages, introduction to ratio and its relationships to fractions, introduction to standard form to be able to write large and small numbers.	Pupils develop an understanding of how to increase and decrease by a percentage, helping with proportion reasoning. They need to understand how large and small numbers can be written in an abbreviated way to make calculations simpler.
	Algebra – Use the rules of indices to simplify expressions involving them. Solving more complex equations., finding rules from sequences, linear graphs, inequalities and double brackets.	Familiarity of algebraic terminology and notation is vital, here we extend year 7 equations work by introducing brackets and more complex equations. Pupils are introduced to inequalities which is seen in many further areas in later years.
	Geometry – Understand how to find the area and perimeter of further 2D shapes such as trapezia and circles. Introduction to volume and surface area of 3D shapes. Introduction to transformations by looking at translation. Find and use the angles in polygons and on parallel lines.	Pupils need to be able to visualise different 3D shapes and their properties. They see translation and reflection to help with further transformations and their properties in later years.
	Handling Data and Probability – Introduction to venn diagrams, pie-charts and stem/leaf diagrams and their applications,	To develop an appreciation of how data can be displayed, interpreted and used in the real world. Pupils need also to have an understanding of venn diagrams, to assist with number work in later years.
Year 7	Number, Ratio and Proportion – recap the use of the four rules of arithmetic from KS2, work with negative numbers, types of number, finding and recognising the links between fractions, decimals and percentages.	Pupils develop an understanding of the number system and of place value. They need to develop a deep understanding of the links between the ways different numbers can be written to develop understanding of proportion, a topic that runs through the entire curriculum to Y11.
	Algebra – simplifying algebraic expressions to a more usable format, solving basic equations, substitution. Introduction to use of brackets in expressions and their corresponding expanded version. Introduction to coordinates.	Familiarity of algebraic terminology and notation is vital to be able to progress to later, more complex algebra manipulation. Here we look at the basics.
	Geometry – recognise and use the properties of 2D shapes, find perimeter and area of these shapes, introduction to angles and finding angles on lines and at points.	Pupils need to be able to visualise different 2D shapes and their properties (angles, edges etc). An introduction to angles and their properties at this stage will give them a basic understanding for when this is developed further in future years.
	Handling Data and Probability – Find and use averages and the range (incl. frequency tables), different representations (bar-charts and pictograms). Introduction to probability terminology.	To develop an appreciation of how data can be displayed, interpreted and used in the real world. Pupils need also to have an understanding of chance, in order to predict future events.