KS4 Curriculum

CURRICULUM INTENT? What does Maths help young people achieve at KS4? Why have you made these curriculum choices?

Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, essential to furthering and maintaining our modern society. It is essential to everyday life, science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world and an ability to play an active role in our modern society.

TERM BY TERM BREAKDOWN – Knowledge acquired and skills developed:

	Year 10 Course Outline	Year 11 Course Outline (Adjusted for Covid)	Opportunities beyond the classroom

Autumn Term	*Knowledge:* • *Congruence Similarity and enlargement* • *Trigonometry* • *Representing solutions of equations and inequalities* • *Simultaneous equations* *Key Skills:* – *Understand the difference between similarity and congruence* – *Enlarge a shape about a given point understand and use similarity* – *Find missing sides in similar shapes including pairs of similar triangles* – *Understand and us the conditions of congruence for triangles* – *Understand trigonometric ratios* – *Work out missing lengths and angles in right angled triangles* – *Know and use exact values of key angles* – *Form and solve equations and inequalities in a range of contexts including with unknowns on both sides* – *Represent solutions to inequalities on a number line* – *Represent solutions to equations graphically* – *Understand the meaning of solution appreciating that some equations have multiple solutions* – *Form and solve a pair of linear simultaneous equations graphically* – *Form and solve a pair of linear simultaneous equations algebraically*	*Knowledge:* • *Expressions and Formulae* • *Graphs* • *Pythagoras and Trigonometry* • *Angles* • *Ratio and Proportion* • *Transformations* • *Vectors* *Key Skills:* – *Simplify algebraic expressions including collecting like terms* – *Substitute numerical values into expressions and formulae (including SUVAT)* – *Rearrange formulae* – *Solve equations using iteration* – *Drawing accurate axes using appropriate scales* – *Calculating the value of the gap on an axis* – *Plot graphs of linear, quadratic, cubic, reciprocal and trigonometric graphs* – *Find equations of straight lines from a graph* – *Find equations of straight lines that are parallel or perpendicular to a point or line* – *Substitute values into a formula and rearrange as needed to find the required value* – *Model situations mathematically by representing as a diagram or series of diagrams* – *Identify which formula needs to be used* – *Solve problems involving Pythagoras and trigonometry which involve multiple steps.* – *Drawing and measuring angles accurately* – *Identifying which angle rule to use in a situation* – *Calculate missing angles* – *Calculate missing lengths* – *Prove standard circle theorems* – *Simplifying ratios* – *Sharing an amount in a given ratio* – *Applying ratios to solve problems* – *Solving problems involving proportion* – *Constructing and using proportionality formulae* – *Calculating the area under a curve* – *Describing fully a type of symmetry* – *Describing fully a reflection*	❖ Congruent triangles are used in supporting structures such as bridges as they are strong and do not buckle or bend. ❖ Similar triangles can be used in finding the height of buildings. ❖ The use of linear programming is used for finding the maximum or minimum number of a particular variable to calculate information such as profit, loss etc ❖ Calculating wages based on an hourly pay rate ❖ Calculating medicine doses based on patients' weights ❖ Calculating the perimeters of squares is used in painting, decorating, gardening etc. ❖ Hiring a car if a deposit is paid and there is an hourly charge ❖ Rate, Distance and Time - calculate the best routes for your running or cycling schedule by creating a mathematical expression that takes into account the distance and your average speed for various parts of the route. You can use the equations to set different goals, such as to maximize time for build endurance, or to maximize speed for performance. ❖ The Best Deal - find out the better deal when renting a car, and you're comparing two rental companies. By putting the variable and fixed costs, such as the per-mile and daily rate, into an algebraic expression, then solving for the total cost, you can see which company saves you money for different amounts of driving. ❖ An air traffic controller can use simultaneous equations to ensure two airplanes don’t intersect at the same time.

		– *Describing fully a rotation* – *Describing fully a translation* – *Describing fully an enlargement* – *Transform a shape given type and key information* – *Sketch reflections and translations of graphs from two functions given algebraically* – *Identify how a transformation of a graph will change the algebraic form of the function* – *Write a column vector to describe a movement* – *Represent a vector in a diagram* – *Add and subtract vectors* – *Multiply vectors by a scalar* – *Use vectors to construct geometric arguments and proof*	❖ Formulae are used in science lessons and those who have a scientific career will use them. ❖ Formulae are also used on spreadsheets. ❖ Iteration is on the A level maths syllabus ❖ Graphs used to model situations in real life and solve problems, especially in engineering where quadratic parabolas are used to model things like bridges etc. ❖ Techniques learnt all have a direct application in A Level maths. ❖ Graphs can be used in a number of other subjects; business studies, science, PE, Geography, History all use graphs to display data. ❖ Pythagoras' theorem and trigonometry used in building and construction to ensure walls are perpendicular and calculate heights. ❖ Bearings are used by airplanes and ships ❖ Interior angles of polygons explain which shapes tesselate and therefore what shapes can be used in building work such as tiles/paving slabs ❖ Speed, density and pressure formulae used in science. ❖ Unit pricing is used in supermarkets on shelves and customers can calculate their own to decide on the 'best buy'. ❖ Patterns on tiles usually have symmetry and good examples can be seen in many cultural heritages including those in the Islamic world. ❖ Used to model and solve problems in science and engineering.

Spring Term	*Knowledge:* • *Angles and Bearings* • *Working with Circles* • *Vectors* • *Ratio and fractions* • *Percentages and interest* • *Probability* *Key Skills:* – *Review KS3 angle rules* – *Understand and use bearings* – *Review area and circumference of circles* – *Name parts of a circle and perform related calculations* – *Find areas and volumes related to circles – cylinder, cone, sphere etc.* – *Understand vector notation* – *Vector arithmetic – addition and subtraction, multiplication by a scalar* – *Vectors and translations* – *Use ratios including with mixed units* – *Fractions in ratios* – *Fractions from ratios* – *Combining ratios* – *Unit pricing (best buys)* – *Currency conversions* – *Convert fractions, decimals and percentages* – *Find percentages and percentage change* – *Find one number as a percentage f another* – *Calculate simple and compound interest* – *Evaluate exponential change e.g. depreciations* – *Find original values* – *Review of single event probability comparing theoretical and experimental* – *understand and work with mutually exclusive and independent events* – *Construct and interpret tree diagrams* – *Find probabilities form frequency trees, tables and Venn diagrams*	- *Knowledge:* • *Fractions decimals and percentages* • *Equations and inequalities* • *Indices and Surds* • *Number and Accuracy* • *Area and Volume* • *Processing data* - *Key Skills:* - *Calculating a fraction, decimal or percentage of an amount* - *Calculating percentage increases, decreases and percentage change* - *Solving problems involving percentages* - *Work with growth, decay and exponential graphs* - *Convert recurring decimals to fractions* - *Manipulating algebraic fractions* - *Reading solutions of an equation from a graph* - *Solving a wide variety of equations using algebraic methods* - *Representing inequalities on number lines* - *Solving linear and quadratic inequalities* - *Evaluate numerical expressions involving powers and roots* - *Use the laws of indices to simplify expressions* - *Convert between ordinary numbers and standard form* - *Do calculations and solve problems involving standard form* - *Simplify expressions involving surds* - *Do calculations and solve problems involving surds* - *Add, subtract, multiply and divide all types of number* - *Identify which of the four operations is needed to solve a problem* - *Identify upper and lower bounds of rounded numbers* - *Perform calculations using rounded values or limits of accuracy* - *Calculating perimeter and area of a variety of 2-D shapes* - *Calculating the volume of a variety of 3-D shapes* - *Solve real-life problems involving perimeter, area and volume* - *Calculate the mean, median, mode and range from a list of data*	❖ Directions/bearings – steering ships, aircraft ❖ Scale drawings – maps, building plans, models ❖ The armed forced use bearings an scales to target positions and destinations. ❖ Engineers and architects use angles for designs, roads, buildings and sporting facilities. ❖ Athletes use angles to enhance their performance. ❖ Carpenters use angles to make chairs, tables and sofas. ❖ Calculating the distance of the visible horizon. ❖ A photographer may use circles for focusing the lens. The radius of the lens is used to determine focal length. Also, the aperture of the camera depends on the diameter of the lens. More light is taken in by the camera when the area of the lens is more. Theorems of circles are important to know when taking a clear picture. ❖ being a construction worker is a career that involves using theorems of circles. construction workers use theorems of circles when they create stadiums or domes that are circular ❖ Vectors have many real-life applications, including situations involving force or velocity. For example: ❖ consider the forces acting on a boat crossing a river. The boat's motor generates a force in one direction, and the current of the river generates a force in another direction. Both forces are vectors. ❖ From launching satellites into the air, ❖ Targeting enemies in a battlefield ❖ Performing complex calculations inside computers

		- *Calculate the mean, median, mode and range from frequency tables* - *Calculate the mean, median, mode and range from grouped frequency tables* - *Draw and interpret diagrams for categorical data* - *Draw and interpret time series* - *Draw and interpret diagrams for ungrouped discrete data* - *Draw and interpret diagrams for grouped discrete data and continuous data* - *Compare distributions*	❖ Finding your location using GPS or a map, we rely on vector quantities like displacement, acceleration, force, etc. ❖ Ratios are applied when converting from one currency to another. For example, you can convert Pounds to Euros or to Dollars by using ratios. ❖ Winnings on a bet are calculated using a ratio. ❖ You can use ratios to calculate the number of bottles of drinks you need for a party. ❖ Ratios can used in a recipe to prepare a certain meal. ❖ Eating at a restaurant: Think about a time you go to a restaurant with friends and the waitress brings a single bill. To divide the total amongst the friends, you use fractions. ❖ Shopping: Think about the time you went shopping for a new school bag. There was half off on everything due to a sale, so you calculate the new price using fractions. ❖ Following a recipe: Recipes sometimes suggest using a teaspoon of sugar, a tablespoon of salt. Some recipes also have quantities to serve 2. If we are making the same dish to serve 3 people, fractions are used to adjust the ingredients accordingly. ❖ Sports: Fractions are frequently used to analyse the performance of a particular player and team. ❖ Fitness: We use fractions to understand our body mass index (BMI) to determine whether we are in a healthy range of body mass or not. ❖ Percentage change is used in banking such as savings accounts. ❖ Decay is used in science when talking about radioactive substances.

			❖ Recording growth in a company's finances such as profits, turn over etc. ❖ Percentages used in retail for sales, pay rises and interest in financial contexts ❖ Should cover cost of borrowing e.g. comparing interest rates on credit cards ❖ Link growth, decay and exponential functions to modelling in science and in particular R-value to show how the Coronavirus is spreading! ❖ Quadratic functions are used to model in real-life, such as bridges, path of objects etc ❖ Solving equations, especially quadratic equations, is used extensively at A level ❖ Inequalities is used in 'linear programming' which is used to solve problems in business contexts ❖ Standard form is used in science and Geography to interpret population growth, multiplication of cells, magnification on a telescope or distances in space. Students need to be able to interpret answers from their calculator that are given in standard form ❖ Use of numbers in real-life contexts such as temperature, money etc. ❖ Real-life uses involving decorating, volume of liquid in drinks cans, swimming pools etc ❖ Links to engineering/technology (including exam questions) ❖ Times series has uses in business for identifying trends ❖ Various uses for data interpretation include market research, census data etc.

Summer Term	*Knowledge:* • *Collecting, representing and interpreting data* • *Non- calculator methods* • *Types of number and sequences* • *Indices and roots* *Key Skills:* – *Understanding sampling, including possible limitations* – *Construct and interpret tables and line graphs for time series data* – *Understand and represent with grouped data* – *Understand and identify correlations* – *Use lines of best fit understanding dangers of extrapolations* – *Construct and interpret frequency polygons* – *Evaluate measures of location and dispersion* – *Use statistical diagrams and measures to compare distributions* – *Use four operations with integers (positive and negative) decimals and fractions with and without context* – *Work with exact answers e.g. area and volume* – *Evaluate calculations involving percentages* – *Use factors, multiples, primes and prime factorisation* – *Recognise arithmetic and geometric sequences* – *Recognise and use other sequences* – *Work out powers and roots* – *Use the rules of indices* – *Calculate numbers in standard index form*	*Knowledge:* • *Probability* • *Similarity* • *Sequences and Proof* • *Constructions and Loci* • *Revision* *Key Skills:* - *List outcomes of events including those from tables and frequency trees* - *Describe the likelihood of an event happening using words, fractions and decimals and place appropriately on the probability scale* - *Find missing probabilities using the rule that exhaustive probabilities sum to one* - *Calculate theoretical probabilities of single and combined events* - *Represent events and their outcomes in a variety of diagrams such as tables, Venn diagrams and tree diagrams; use these to calculate the probability of a given event* - *Calculate the probability of independent and dependent events* - *Calculate conditional probabilities using two-way tables, tree diagrams and Venn diagrams* - *Interpret probabilities* - *Recognise congruent and similar shapes* - *Calculate missing lengths in similar shapes* - *Calculate missing areas and volumes of similar shapes* - *Prove two triangles are congruent* - *Continuing sequences* - *Generating sequences from n^{th} terms* - *Calculating the n^{th} term of a sequence* - *Work systematically to show that one algebraic expression is equivalent to another* - *Prove key facts and theorems across different areas of mathematics* - *Construct triangles* - *Construct bisectors* - *Applying standard constructions to solve loci problems* - *Being able to complete exam papers* -	❖ Data collection is used in many disciplines such as science, social science, business and Geography. ❖ We can look at populations and samples to help us make generalisations across populations ❖ Sequences can relate to populations and nature. ❖ Standard form is used in science, Geography and Business when looking at growth and decay, or when understanding very large or very small numbers. ❖ We can look at traits of particular populations or at genetic relationships when studying hereditary aspects. ❖ Concepts of probability are used in such real-life examples such as to forecast the weather, to calculate the cost of insurance policies for people and in betting (worth spending some time using maths to show what a poor idea this is) ❖ Congruent shapes used in manufacturing and construction e.g. packs of biscuits, buildings such as sheds etc. It would be useful to explore why this is… ❖ Link to Technology lessons such as Graphic Products ❖ The Fibonacci sequence has links to nature ❖ Loci can be used to solve problems such as identifying gaps in the coverage provided by mobile phone masts; radar input from air traffic control at different airports etc. ❖ Loci concepts can be used in Argand Diagrams for complex numbers in a level Further Maths

Key Independent Learning Resources	GREAT READS
Corbett maths Mathswatch Mymaths Tassomai	**Hidden Figures:** By Margot Lee Shetterly **Genius: The Game** By Leopoldo Gout **The Martian** by Andy Weir **Ready Player One** by Ernest Cline