(GCSE Mathematics - HT) Year 11 Long Term Plan

Rationale (with end points): Year 11 is for students to practise their retrieval of the past 2 years of content. Students look at the 4 main areas of maths and use these skills to help solve problems solving questions and develop their mathematical reasoning

Term	Topic	Knowledge	Skills	*Reading /wider reading*
Autumn term 1	Unit 16: Circle theorems	• Circle theorems • Circle geometry	• Recall the definition of a circle and identify (name) and draw parts of a circle, including sector, tangent, chord, segment; • Prove and use the facts that: – the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference; – the angle in a semicircle is a right angle; – the perpendicular from the centre of a circle to a chord bisects the chord; – angles in the same segment are equal; – alternate segment theorem; – opposite angles of a cyclic quadrilateral sum to 180°; • Understand and use the fact that the tangent at any point on a circle is perpendicular to the radius at that point; • Find and give reasons for missing angles on diagrams using: – circle theorems; – isosceles triangles (radius properties) in circles; – the fact that the angle between a tangent and radius is 90°; – the fact that tangents from an external point are equal in length. • Select and apply construction techniques and understanding of loci to draw graphs based on circles and perpendiculars of lines; • Find the equation of a tangent to a circle at a given point, by: – finding the gradient of the radius that meets the circle at that point (circles all centre the origin); – finding the gradient of the tangent perpendicular to it; – using the given point; • Recognise and construct the graph of a circle using $x^2 + y^2 = r^2$ for radius r centred at the origin of coordinates.	The Simpsons and Their Mathematical Secrets by Simon Singh

	Unit 17: More Algebra	• Changing subject of formulae (more complex) • Solving equations from algebraic fractions • Rationalise surds • Proof	• Rationalise the denominator involving surds; • Simplify algebraic fractions; • Multiply and divide algebraic fractions; • Solve quadratic equations arising from algebraic fraction equations; • Change the subject of a formula, including cases where the subject occurs on both sides of the formula, or where a power of the subject appears; • Change the subject of a formula such as $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$, where all variables are in the denominators; • Solve 'Show that' and proof questions using consecutive integers (n, $n + 1$), squares a^2, b^2, even numbers $2n$, odd numbers $2n + 1$; • Use function notation; • Find f(x) + g(x) and f(x) − g(x), 2f(x), f($3x$) etc algebraically; • Find the inverse of a linear function; • Know that $f^{-1}(x)$ refers to the inverse function; • For two functions f(x) and g(x), find gf(x).	
Autumn 2	Unit 18: Vectors and geometric proof	• Vectors and geometric reasoning	• Understand and use vector notation, including column notation, and understand and interpret vectors as displacement in the plane with an associated direction. • Understand that 2**a** is parallel to **a** and twice its length, and that **a** is parallel to −**a** in the opposite direction. • Represent vectors, combinations of vectors and scalar multiples in the plane pictorially. • Calculate the sum of two vectors, the difference of two vectors and a scalar multiple of a vector using column vectors (including algebraic terms). • Find the length of a vector using Pythagoras' Theorem. • Calculate the resultant of two vectors. • Solve geometric problems in 2D where vectors are divided in a given ratio. • Produce geometrical proofs to prove points are collinear and vectors/lines are parallel.	Seventeen Equations that Changed the World by Professor Ian Stewart

	Unit 19: Proportion and graphs	• Reciprocal and exponential graphs • Gradients under graphs • Direct and inverse proportion	• Recognise, sketch and interpret graphs of the reciprocal function $y = \frac{1}{x}$ with $x \neq 0$ • State the value of x for which the equation is not defined; • Recognise, sketch and interpret graphs of exponential functions $y = k^x$ for positive values of k and integer values of x; • Use calculators to explore exponential growth and decay; • Set up, solve and interpret the answers in growth and decay problems; • Interpret and analyse transformations of graphs of functions and write the functions algebraically, e.g. write the equation of $f(x) + a$, or $f(x - a)$: – apply to the graph of $y = f(x)$ the transformations $y = -f(x)$, $y = f(x)$ for linear, quadratic, cubic functions; – apply to the graph of $y = f(x)$ the transformations $y = f(x) + a$, $y = f(x + a)$ for linear, quadratic, cubic functions; • Estimate area under a quadratic or other graph by dividing it into trapezia; • Interpret the gradient of linear or non-linear graphs, and estimate the gradient of a quadratic or non-linear graph at a given point by sketching the tangent and finding its gradient; • Interpret the gradient of non-linear graph in curved distance-time and velocity-time graphs: – for a non-linear distance-time graph, estimate the speed at one point in time, from the tangent, and the average speed over several seconds by finding the gradient of the chord; – for a non-linear velocity-time graph, estimate the acceleration at one point in time, from the tangent, and the average acceleration over several seconds by finding the gradient of the chord; • Interpret the gradient of a linear or non-linear graph in financial contexts; • Interpret the area under a linear or non-linear graph in real-life contexts; • Interpret the rate of change of graphs of containers filling and emptying; • Interpret the rate of change of unit price in price graphs. • Recognise and interpret graphs showing direct and inverse proportion; • Identify direct proportion from a table of values, by comparing ratios of values, for x squared and x cubed relationships;	

			• Write statements of proportionality for quantities proportional to the square, cube or other power of another quantity; • Set up and use equations to solve word and other problems involving direct proportion; • Use $y = kx$ to solve direct proportion problems, including questions where students find k, and then use k to find another value; • Solve problems involving inverse proportion using graphs by plotting and reading values from graphs; • Solve problems involving inverse proportionality; • Set up and use equations to solve word and other problems involving direct proportion or inverse proportion.	
Spring 1	Exam preparation			
Spring 2	Exam preparation			
Summer 1	Exam preparation & Exams			
Summer 2	Students not present after exams			