



SUBJECT	MATHS	YEAR	Year 12
<p>Why do we study maths? The maths curriculum provides me with the knowledge I need to be mathematically fluent and develops my mathematical reasoning and problem-solving skills.</p>			
<b>What will I learn about this year?</b>		<b>What have I learnt about before?</b>	
<b>Algebra and functions</b>			
<p>Laws of indices for all rational exponents            Surds – using and manipulating including rationalising the denominator (including using conjugate)            Quadratic functions – solving, understanding their graphs, completing the square, using the discriminant, identifying disguised quadratics            Polynomials – finding products and quotients of two polynomials, using the Factor Theorem and sketching polynomials            The binomial expansion of <math>(a + bx)^n</math>, where n is a positive integer            Straight line graphs – deepening understanding of linear graphs and becoming familiar with different forms of the equations of a straight line            Solving linear/linear and linear/quadratic simultaneous equations            Solving linear and quadratic inequalities (single variable) and representing solutions on a number line, using set notation and on a graph            The effects of simple transformations on graphs, combining transformations (Yr13 content)            Proportional relationships and their graphs            Equations of a circle – extending to circles not centred at (0,0) and solving problems with lines and circles            The structure of mathematical proof and using methods of proof – proof by deduction, exhaustion and disproof by a counter example            Using function notation, defining domains and ranges, composite functions and inverse functions (Yr13 content)            Using the modulus function (Yr13 content)</p>		<p>Rules of indices including negative integer and fractional powers            Calculating exactly with surds and simplifying surd expressions involving squares and rationalising the denominator            Expanding products of two or more binomials and recognising difference of two squares            Solving quadratic equations by factorising, using the quadratic formula and completing the square            Recognising, sketching and interpreting quadratic and cubic functions            Straight line graphs – plotting and understanding <math>y=mx+c</math> and equations of parallel and perpendicular lines            Solving linear (one and two variables) and quadratic inequalities (one variable) and representing solutions on a number line, using set notation and on a graph            Solving linear/linear and linear/quadratic simultaneous equations            Sketching translations and reflections of given functions            Constructing and interpreting equations representing direct &amp; inverse proportion and sketching reciprocal functions            Recognising and using the equations of a circle with a centre at the origin and finding equations of tangents            Circle theorems – angle in a semi-circle is right angle, the perpendicular from the centre to the chord bisects the chord, angle between a radius &amp; a tangent is <math>90^\circ</math>            Forming algebraic proofs            Functions including inverse and composite functions</p>	
<b>Calculus</b>			
<p>Differentiation - Finding the derivative of <math>f(x)</math> and understanding that it is the gradient of the tangent to the curve at a general point <math>(x,y)</math>.            Interpreting the first derivative as a rate of change of <math>f(x)</math>, sketching gradient functions and interpreting the second derivative as the rate of change of <math>f'(x)</math>            Differentiating <math>x^n</math> for rational values of n and proving results using differentiation from first principles            Finding gradients of tangents and normals, identifying and classifying stationary points and solving optimisation problems            Integration – Defining integration as the inverse of differentiation and integrating <math>x^n</math> (excluding <math>n=-1</math>)            Using the Fundamental Theorem of Calculus            Evaluating definite integrals and using them to find the area under a curve</p>		<p>Calculating gradients between two points            Calculating or estimating gradients of graphs and areas under graphs (including non-linear graphs) and interpreting the results eg on velocity – time graphs            Interpreting the gradient at a point on a curve as the instantaneous rate of change and the gradient between two points as the average rate of change            Laws of indices for all rational exponents            Parallel and perpendicular gradients and equations of straight lines</p>	
<b>Logarithms and Exponentials</b>			
<p>Defining <math>\log_a x</math> as the inverse of <math>a^x</math> and <math>\ln x</math> as the inverse of <math>e^x</math>            Using the laws of logarithms and solving equations of the form <math>a^x = b</math>            Using the graphs of exponential functions and <math>\ln x</math>            Finding and using the gradient of <math>e^{kx}</math> and using exponential functions to model growth and decay, considering the limitations and refinements of models            Use logarithmic graph to estimate parameters in relationships of the form <math>y = ax^n</math> and <math>y = kb^x</math></p>		<p>Laws of indices for all rational exponents             Recognising, sketching and interpreting exponential functions            Setting up and solving growth and decay problems including compound interest and general iterative processes</p>	
<b>Trigonometry</b>			
<p>Definitions and graphs of the sine, cosine and tangent functions            Trigonometric identities <math>\tan \theta \equiv \frac{\sin \theta}{\cos \theta}</math> and <math>\sin^2 x + \cos^2 x \equiv 1</math> and using them to construct proofs            Solving trigonometric equations in a given interval            Applying the sine rule, cosine rule and  <math>A = \frac{1}{2} ab \sin C</math> formula for area of any triangle to more complex problems            Radians as a unit for measuring angle- inverse trigonometric functions, arcs and sectors and small angle approximations (Yr13 content)</p>		<p>Recognising, sketching and interpreting trigonometric functions            Pythagoras and trigonometry in right-angled triangles            Applying the sine rule, cosine rule and  <math>A = \frac{1}{2} ab \sin C</math> formula for area of any triangle</p>	
<b>Vectors and Mechanics</b>			
<p>Vectors – Working with vectors in 2D, calculating magnitude and direction of a vector and finding and using position vectors            Adding vectors diagrammatically and adding vectors and multiplying them by scalars in both i, j form and column vector form            Using vectors to geometrical problems            Mechanics –            Kinematics – interpreting graphs for motion in a straight line, using calculus to find acceleration, velocity and displacement, deriving and using the formulae for constant acceleration, including motion under gravity            Forces and Newton's laws – Using Newton's first, second and third law for motion in a straight line, including problems involving smooth pulleys and connected particles</p>		<p>Applying addition, subtraction and scalar multiplication of vectors            Using diagrammatic and column vector representations of vectors            Using vectors to construct geometric arguments and proofs            Differentiating <math>x^n</math> for rational values of n and identifying and classifying stationary points            Integrating <math>x^n</math> (excluding <math>n=-1</math>) and evaluating definite integrals, using them to find the area under a curve</p>	
<b>Statistics</b>			
<p>Statistics -            Interpreting measures of central tendency and spread, extending to standard deviation, identifying outliers            Different sampling methods and their limitations diagrams            Presenting data - cumulative frequency, box plots, histograms            Working with a large data set            Interpreting scatter diagrams and regression lines for bivariate data            Probability -            Identifying independent events and mutually exclusive events            Calculating probabilities from two-way tables and tree diagrams            Using discrete probability distributions including the binomial distribution            Conducting a statistical hypothesis test for the proportion in a binomial distribution</p>		<p>Collecting data including using samples and understanding the limitations of sampling            Presenting data – in tables and in graphs and charts            Calculating and using averages and range, including grouped data            Drawing and interpreting scatter graphs, understanding correlation does not imply causality and the difference between interpolation and extrapolation</p>	
<b>Where can I find out more?</b>			
<p>Humans – Matt Haig            The Simpsons and their Mathematical Secrets – Simon Singh            The Art of Statistics – David Spiegelhalter            How To Make The World Add Up – Tim Harford            The Tiger That Isn't – Michael Blastland            Fermat's Last Theorem - Simon Singh            Factfulness – Hans Rosling            Humble Pi: A comedy of maths errors - Matt Parker            Hello World, How to be Human in the age of the machine - Dr Hannah Fry            Power in Numbers: The Rebel Women of Mathematics - Talithia Williams</p>			