# Year 11 Higher: Curriculum Implementation Plan

| Mathematics – Year 11 Higher – Overview | | | | |
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| Knowledge and Skills – Students will be taught to… | Reading, Oracy, Literacy | Formative Assessment | Summative Assessment | Link to GCSE Content |
| Please see individual units below.<br><br>Note: The overview for Year 11 is *approximate* – teachers will use the results of all forms of assessment to identify the most appropriate learning for each individual group, in order to best use the available time in Year 11 to prepare them for GCSE exams. | • Reading worded questions to understand the context and decide how to approach a problem<br>• Paired discussion of problems<br>• Writing responses to worded questions such as "Explain why…"<br>• Expanding vocabulary of key mathematical terms<br>• Giving verbal responses in class question-and-answer | • Questioning in class<br>• Self-assessment<br>• Peer-assessment<br>• Starter and homework questions<br>• Mini-tests<br>• Show of hands and other forms of whole-class feedback<br>• Review of student work during lessons<br>• Mini-whiteboards<br>• Practice GCSE papers<br>• Knowledge tests | Full GCSE mock examinations in the Autumn and Spring terms. | Please see individual units below. |

| Mathematics – Unit 1 – Algebra | |
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| Knowledge and Skills – Students will be taught to… | Links to KS4 National Curriculum (red) & Exam board specification (blue/black) |
| • Find an expression for the inverse of a function by reversing a given flow chart<br>• Find an expression for the inverse of a function by rearrangement e.g. $y=x^2-3$<br>• Find the input of a function for a given numerical or algebraic output<br>• Find numerical and algebraic input and output values for a composite function<br>• Given an algebraic input and output for a composite function, form and solve an equation<br>• Find the result of a formula using upper and lower bounds<br>• Plot an exponential graph of the form $y = k^x\ (k > 0)$ using a table of values<br>• Know the key features of an exponential graph of the form $y = k^x (k > 0)$<br>• Sketch graphs of the form $y = k^x\ (k > 0)$, including two graphs on one set of axes, recognising how they differ e.g. $y = 3^x$ and $y = 5^x$<br>• Solve problems in context involving sketching and interpreting exponential graphs<br>• Plot and interpret graphs of non-standard functions in real contexts | **Interpret the reverse process of a function as the 'inverse function'**<br>**Interpret the succession of two functions as a 'composite function'**<br>**Interpret the reverse process of a function as the 'inverse function'**<br>**Interpret the succession of two functions as a 'composite function'**<br>**Recognise, sketch and interpret graphs of the exponential function $y=k^x$ (k>0)**<br>**Use a table of values to plot exponential graphs**<br>**Recognise and sketch graphs of exponential functions in the form $y = k^x$, k>0**<br>**Express exponential growth or decay as a formula**<br>**Solve and interpret answers in growth and decay problems**<br>Plot and interpret graphs to non-standard functions in real contexts, to find approximate solutions |

| Mathematics – Unit 2 – Further Trigonometry | |
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| Knowledge and Skills – Students will be taught to… | Links to KS4 National Curriculum (red) & Exam board specification (blue/black) |
| • Use Pythagoras' theorem in 3D to find the length of a given diagonal in a cuboid and use this to solve simple problems in context e.g. will the item fit in the box?<br>• Use Pythagoras' theorem to find the height of a pyramid from its slope length, or vice versa, given the dimensions of the base<br>• Use Pythagoras' theorem to solve a range of 3D problems in context<br>• REVISE BRIEFLY: exact values of sin and cos for 0°, 30°, 45°, 60°, 90° and exact values of tan for 0°, 30°, 45° 60°<br>• Apply the Sine and Cosine rules to problems involving bearings<br>• Find the angle between a line and a plane, or between two planes<br>• Understand the terms 'plane' and 'line of greatest slope'<br>• Use trigonometry to solve a range of 3D problems in context<br>• Know and use Area = ½ ab sin C to calculate the area, sides or angles of a triangle<br>• Calculate the area of a segment using areas of a sector and a triangle<br>• Practise a range of GCSE-style problems combining SOHCAHTOA, the Sine Rule, the Cosine Rule, Pythagoras' theorem and ½ ab sin C | **Apply trigonometric ratios to find angles and lengths in 3D**<br>**Know and apply ½absinC to calculate the area sides or angles of a triangle**<br>**Recall and use 1/2absinC for the area of a triangle**<br>**Apply the trigonometry of right-angled triangles in more complex figures, including 3D figures** |
| **Mathematics – Unit 3 – Further Surds** | |
| Knowledge and Skills – Students will be taught to… | Links to KS4 National Curriculum (red) & Exam board specification (blue/black) |
| • REVISE: simplifying surds and expressions involving surds, adding and subtracting surds, multiplying/dividing surds in simple cases, expanding single/double brackets with surds, rationalising a single-term denominator<br>• Rationalise the denominator of a more complex surd expression<br>• Factorise into a single bracket where the expression involves surds<br>• Simplify complex surd expressions by combining skills | **Calculate exactly surds**<br>**Simplify surd expressions involving squares e.g. $\sqrt{12}$**<br>**Rationalise denominators of surds**<br>**Use surds in exact calculations without a calculator**<br>**Simplify expressions with surds, including rationalising denominators** |

| Mathematics – Unit 4 – Algebra 2 | |
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| Knowledge and Skills – Students will be taught to… | Links to KS4 National Curriculum (red) & Exam board specification (blue/black) |
| • Complete the square for a quadratic expression with a > 1<br>• Solve a quadratic inequality where the coefficient of $x^2$ is 1 e.g. $x^2 + 5x < 6$ representing the solution set on a number line or using set notation<br>• Solve a quadratic inequality where the coefficient of $x^2$ is greater than 1 representing the solution set on a number line or using set notation<br>• Find approximate solutions to simultaneous equations using a graph, where one is linear and one quadratic<br>• Find approximate solutions to simultaneous equations using a graph, where one is linear and one is a circle<br>• Solve simultaneous equations in two variables algebraically using substitution, where one is linear and one is quadratic, and where one is linear and one is a circle<br>• Use algebra to find the point(s) of intersection of a line and a quadratic curve, or a line and a circle<br>• Solve other problems involving linear and quadratic simultaneous equations | **Complete the square on a quadratic expression**<br>**Deduce the turning points of quadratic functions by completing the square**<br>**Find approximate solutions to simultaneous equations using a graph, where one is linear and one is quadratic**<br>**Solve quadratic inequalities in one variable, representing the solution set on a number line**<br>**Solve quadratic inequalities in one variable**<br>**Solve two simultaneous equations where one is linear and one is quadratic**<br>**Set up and solve two simultaneous equations (one linear and one quadratic) in two variables**<br>**Know that the coordinates of the points of intersection of a curve and a straight line are the solutions to the simultaneous equations for the line and curve** |
| Mathematics – Unit 5 – Proportion 1 | |
| Knowledge and Skills – Students will be taught to… | Links to KS4 National Curriculum (red) & Exam board specification (blue/black) |
| • PRACTISE: solving more complex GCSE-style ratio problems<br>• REVISE BRIEFLY: the features of graphs and table that show a direct/inverse proportion<br>• REVISE: using a formula to solve a problem involving direct/inverse proportion, including relationships involving powers and roots e.g. $A \propto \frac{1}{\sqrt{x}}$<br>• PRACTISE: a range of more complex GCSE-style questions involving proportion<br>• PRACTISE: a range of GCSE-style questions involving percentage change<br>• Solve problems involving growth and decay<br>• Understand and use exponential formulae such as $N = Ak^t$ and $P = A \times (1+i)^n$ | **Formulate equations and solve problems involving a quantity in inverse proportion to a power or root of another quantity**<br>**Construct (and interpret) equations that describe direct and inverse proportion**<br>**Express exponential growth or decay as a formula**<br>**Solve and interpret answers in growth and decay problems**<br>Solve problems step-by-step involving multipliers over a given interval, for example compound interest, depreciation, etc. |

| Mathematics – Unit 6 – Probability | |
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| Knowledge and Skills – Students will be taught to… | Links to KS4 National Curriculum (red) & Exam board specification (blue/black) |
| • Practise a range of GCSE questions on probability, including conditional probability, deciding which methods to apply and diagrams to draw, including using tree diagrams, Venn diagrams, two-way tables and sample spaces<br>• Understand the formula P(A or B) = P(A) + P(B) – P(A and B)<br>• Understand the formula P(A and B) = P(A given B) x P(B) | Derive or informally understand and apply the formula p(A or B) = p(A) + p(B) - p(A and B)<br>**Recognise when a sample space is the most appropriate form to use when solving a complex probability problem**<br>**Use the most appropriate diagrams to solve unstructured questions where the route to the solution is less obvious**<br>**Construct tree diagrams, two-way tables or Venn diagrams to solve more complex probability problems (including conditional probabilities; structure for diagrams may not be given)**<br>**Understand the concept of conditional probability, and calculate it from first principles in known contexts e.g. In a random cut of a pack of 52 cards, calculate the probability of drawing a diamond, given a red card is drawn**<br>**Derive or informally understand and apply the formula p(A and B) = p(A given B) x p(B)**<br>**Know that events A and B are independent if and only if p(A given B) = p(A)**<br>**Calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams** |

| Mathematics – Unit 7 – Algebra 3 | |
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| Knowledge and Skills – Students will be taught to… | Links to KS4 National Curriculum (red) & Exam board specification (blue/black) |
| • Solve an equation involving algebraic fractions with numerical denominators<br>• Solve an equation involving algebraic fractions with algebraic denominators, including where this can be rearranged to form a quadratic equation<br>• Show that a solution to a complex equation lies between two given values<br>• Understand the meaning of an iterative process<br>• Rearrange an equation to form an iteration formula (of the form $x_{n+1} = \ldots$)<br>• Use an iterative formula to find approximate solutions to equations, including accurate to a given number of decimal places<br>• Know how to use the ANS key on a calculator to construct the formula, pressing = repeatedly to produce the chain of approximations; verify the first value manually<br>• REVISE BRIEFLY: the Fibonacci sequence, generating Fibonacci-type sequences and solving problems involving numerical Fibonacci-type sequences such as finding next terms and missing terms within the sequence<br>• Work with Fibonacci-type sequences involving algebra and surds<br>• Use other recurrence relationships, including using subscript notation e.g. $u_{n+1} = 2u_n + 5$ | **Simplify and manipulate algebraic fractions by factorising quadratic expressions, including a difference of two squares**<br>**Work with general iterative processes**<br>Recognise and use Fibonacci type sequences<br>Recognise Fibonacci sequences<br>**Use subscript notation for position-to-term and term-to-term rules** |

| Mathematics – Unit 8 – Using Histograms | |
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| Knowledge and Skills – Students will be taught to… | Links to KS4 National Curriculum (red) & Exam board specification (blue/black) |
| • Use a given histogram to find missing values in a frequency table<br>• Use a partially-completed histogram and table to complete both<br>• Identify a value from a histogram e.g. how many people earned over £12 000 ?<br>• Estimate a value from a histogram where the value is mid-bar<br>• Find or estimate the median and quartiles from a histogram<br>• Continue to compare data given in more than one form | Make simple comparisons<br>Compare data sets using 'like for like' summary values<br>Understand the advantages and disadvantages of summary values<br>Interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (including modal class) and spread (the range)<br>Apply statistics to describe a population<br>Infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling<br>**Interpret, analyse and compare the distributions of data sets from univariate empirical distributions using quartiles and the inter-quartile range**<br>**Interpret and construct diagrams for grouped data as appropriate,** including **histograms (with either equal or unequal class intervals)**<br>**Construct and interpret diagrams for grouped discrete data and continuous data,** including **histograms with equal and unequal class intervals, and know their appropriate uses** |

| Mathematics – Unit 9 – Proportion 2 | |
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| Knowledge and Skills – Students will be taught to… | Links to KS4 National Curriculum (red) & Exam board specification (blue/black) |
| • REVISE: estimating distance, instantaneous acceleration and average acceleration from a curved speed-time graph<br>• Solve a range of problems in context involving graphs and rates of change<br>• Understand the meanings of the unknowns in the kinematics formulae<br>• Know that these formulae apply in situations where acceleration is constant<br>• Select a suitable formula from the three given and substitute to solve a simple problem given in context<br>• Solve a quadratic equation resulting from a kinematics formula and interpret the result<br>• Use compound units in algebraic contexts | Convert between related compound units in algebraic contexts<br>Use the kinematics formulae $v=u+at$, $s=ut+1/2at^2$, $v^2=u^2+2as$<br>Use and convert standard units in algebraic contexts<br>Use and convert compound units in algebraic contexts<br>**Calculate or estimate areas under graphs, and interpret in contexts such as distance-time graphs, velocity-time graphs and financial graphs**<br>**Apply the concepts of average and instantaneous rate of change (gradients of chords or tangents) in numerical, algebraic and graphical contexts**<br>**Calculate or estimate gradients of graphs, and interpret in contexts such as distance-time graphs, velocity-time graphs and financial graphs**<br>**Interpret the gradient of a graph, or area under a graph, in cases such as distance-time graphs, velocity-time graphs and financial graphs**<br>**Interpret the gradient at a point on a curve as the instantaneous rate of change**<br>**Apply the concepts of instantaneous and average rates of change (gradients of tangents and chords) in numerical, algebraic and graphical contexts** |

| Mathematics – Unit 10 – Vectors and Proof | |
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| Knowledge and Skills – Students will be taught to… | Links to KS4 National Curriculum (red) & Exam board specification (blue/black) |
| • Calculate vectors in a diagram e.g. in terms of a and b<br>• Calculate vectors in a diagram in problems involving a midpoint e.g. in terms of a and b<br>• Calculate vectors in a diagram in problems where a side is divided in a ratio<br>• Understand why parallel vectors are multiples of one another<br>• Prove that two vectors within a given diagram are parallel<br>• Use the parallel properties of vectors to identify special quadrilaterals<br>• Prove that three points in a given diagram are collinear<br>• Prove the following circle theorems:-<br>- the angle in a semicircle is a right angle<br>- the angle at the centre is twice the angle at the circumference<br>- angles in the same segment are equal<br>- opposite angles in a cyclic quadrilateral add up to 180°<br>- the alternate segment theorem<br>• Practise a range of GCSE questions involving geometric proof with angles and expressing one angle algebraically in terms of another<br>• Set up and solve an equation to determine a missing angle | **Use vectors in geometric arguments and proofs**<br>**Use vectors to construct geometric arguments and proofs**<br>Apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors<br>**Prove the standard circle theorems**<br>**Apply angle properties in more formal proofs of geometrical results**<br>**Apply the standard circle theorems**<br>**Prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results**<br>**Apply the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results** |

| Mathematics – Unit 11 – Algebra 4 | |
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| Knowledge and Skills – Students will be taught to… | Links to KS4 National Curriculum (red) & Exam board specification (blue/black) |
| • Sketch the key features of the graphs of y = sin x, y = cos x and y = tan x, all for angles of any size<br>• Solve simple trig. equations in the interval [0, 360°] using a graph and a calculator e.g. $\sin x = 0.7$<br>• Explore the effects of translations and reflections of a curve<br>• Sketch translations and reflections of a known curve e.g. sketch $y = \sin(x + 45)$, $y = 3^{-x}$, $y = x^2 + 4$<br>• Sketch translations and reflections of an unfamiliar curve from its graph, including where the graph has turning point(s) and asymptote(s) e.g. given $y = x^4 - 3x^2$<br>• Label the co-ordinates of transformed points on the new sketch<br>• Given an original graph and its translation or reflection, identify the equation of the transformed graph e.g. $y = x^4 - 3x^2$ and a graph of $y = (x - 5)^4 - 3(x - 5)^2$<br>• Use algebra in proofs including odd/even numbers, multiples, consecutive numbers etc.<br>• Use algebra in a range of context problems, such as volume, area or pressure, including proving results. *(e.g. A cylinder with radius 2r & height h has the same volume as a sphere of radius 3r. Find a formula for h in terms of r.)* | **Recognise and sketch the graphs of y=sinx, y=cosx, y=tanx**<br>**Recognise, sketch and interpret graphs of y=sinx, y=cosx and y=tanx for angles in degrees of any size**<br>**Sketch translations and reflections of the graph of a given function**<br>**Identify and sketch translations and reflections of a given graph (or the graph of a given equation) e.g. y=sinx+2, y=(x+2)$^2$-1, y=-x$^2$**<br>**Apply angle properties in more formal proofs of geometrical results**<br>**Use the basic properties of isosceles, equilateral and right-angled triangles in more formal proofs of geometrical results e.g. circle theorems**<br>**Use algebra to construct proofs and arguments**<br>**Use algebra to support and construct proofs** |