Year 9 Higher: Curriculum Implementation Plan

Mathematics – Year 9 Higher – Overview				
Knowledge and Skills – Students will be taught to…	Reading, Oracy, Literacy	Formative Assessment	Summative Assessment	Link to GCSE Content
Please see individual units below.	- Reading worded questions to understand the context and decide how to approach a problem - Paired discussion of problems - Writing responses to worded questions such as "Explain why…" - Expanding vocabulary of key mathematical terms - Giving verbal responses in class question-and-answer	- Questioning in class - Self-assessment - Peer-assessment - Starter and homework questions - Mini-tests - Show of hands and other forms of whole-class feedback - Review of student work during lessons - Mini-whiteboards	Whole-class assessments towards the end of each term, based on work completed during the year to date, and including GCSE-style questions.	Please see individual units below.

Mathematics – Unit 1 – Algebra 1	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
- Solve 2-step linear equations, including with brackets (REVISION) - Solve a linear equation where the unknown term is negative e.g. $53 - 2x = 37$ - Solve a linear equation with the unknown on both sides when the solution is an integer, fraction or negative - Solve a linear equation with the unknown on both sides which involves brackets - Form and solve linear equations of the types listed above to solve problems e.g. perimeter, area, angles - Find the solution to a complex equation, to a required degree of accuracy, using 'trial and improvement' - Expand a double bracket, including a perfect square e.g. $(x - 3y)^2$ (REVISION) - Expand a difference of two squares e.g. $(x + 3)(x - 3)$ or $(2x - 5)(2x + 5)$ - Expand with more than 2 terms in a bracket e.g. $(x + 3)(x^2 + 3x - 5)$ - Use brackets in simple contexts e.g. an expression for the area of a rectangle	Recognise and use relationships between operations including inverse operations Use algebraic methods to solve linear equations in one variable Interpret mathematical relationships algebraically Simplify and manipulate algebraic expressions by expanding products of two or more binomials
Mathematics – Unit 2 – Graphs 1	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
- Use the form y = mx + c to identify gradients, intercepts and parallel lines, including where the equation needs rearranging into this form - Find the gradient and equation of a line from its graph - Find the gradient of the line segment joining two given points - Find the equation of a line through one point with a given gradient, or through one point and parallel to another given line - Find the equation of a line through two given points - Interpret the gradient of a straight line graph as a rate of change in context - Interpret the y-axis intercept of a straight line graph in context	Reduce a given linear equation in two variables to the standard form y=mx+c Calculate and interpret gradients and intercepts of graphs of linear equations numerically, graphically and algebraically Find approximate solutions to contextual problems from given graphs of a variety of functions Interpret mathematical relationships both graphically Use the form y=mx+c to identify parallel lines Interpret the gradient of a straight line graph as a rate of change
Mathematics – Unit 3 – Powers & Roots	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)

Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
• Evaluate expressions involving positive integer powers and small roots, without a calculator • Use a calculator to evaluate numerical expressions involving powers and roots • Use the laws of indices for multiplication, division, and power 0 with numerical and algebraic bases and powers (REVISION) • Use the index law for powers of powers (brackets) to numerical and algebraic bases and powers (REVISION) • Evaluate powers of -1 with numerical bases using the fact that $a^{-n} = (1/a)^n$ (REVISION) • Evaluate numerical expressions involving other negative powers • Evaluate more complex numerical expressions and solve problems using positive and negative powers e.g. evaluate $5^{-2} + 2^3$ • Manipulate algebraic expressions involving powers of -1 and other negative powers • Extend the order of operations to powers and roots, including negative powers	Use integer powers (square, cube and higher) Use real roots associated with integer powers (square, cube and higher) Recognise powers of 2, 3, 4, 5 Distinguish between exact representations of roots and their decimal approximations Use a calculator and other technologies to calculate results accurately and then interpret them appropriately Simplify expressions involving sums, products and powers, including the laws of indices Use conventional notation for the priority of operations, including brackets, powers and roots Calculate with square roots, and with integer indices Calculate with roots

Mathematics – Unit 4 – Loci & Construction	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
• Construct the perpendicular bisector of a line segment (REVISION) • Construct the perpendicular at a point on a line • Construct the perpendicular to a line from a point • Use construction to identify the shortest distance from a point to a line • Construct the locus of points a fixed distance from a point, and from a line • Construct the locus of points equidistant from two lines, and from two points • Understand and use the word equidistant • Construct a triangle with three given sides (SSS) (REVISION) • Bisect an angle (REVISION) • Use ruler and compasses to construct angles of 60° and 30° • Choose techniques to construct 2D shapes e.g. a rhombus	Draw and measure line segments in geometric figures Derive and use the standard ruler and compass constructions (perpendicular bisector of a line segment, bisecting a given angle) Derive and use the standard ruler and compass constructions (constructing a perpendicular to a given line from/at a given point) Recognise and use the perpendicular distance from a point to a line as the shortest distance to the line

Mathematics – Unit 5 – Geometry 1	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)

Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
- Explore the relationship between sides (or areas of squares on sides) in right-angled triangles - Know/use Pythagoras' theorem to calculate any side in a right-angled triangle - Know the meaning of a Pythagorean triple - Use Pythagoras' theorem to determine whether a given triangle is right-angled - Solve a range of 2D problems using Pythagoras' theorem - Construct a shape from its plan and elevations - Construct the plan and elevations of a given shape - Know the properties of a cube, cuboid, prism, cylinder, pyramid, cone and sphere - Calculate the volume of a cuboid or right prism - Understand the link between volume and capacity - Calculate the volume of a cylinder, including in terms of π	Use the standard conventions for labelling the sides and angles of triangle ABC Use Pythagoras' Theorem to solve problems involving right-angled triangles Apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides, including Pythagoras' Theorem, and use known results to obtain simple proofs Derive and apply formulae to calculate and solve problems involving the volume of cuboids (including cubes) and other prisms (including cylinders) Change freely between related standard units e.g. time, length, area, volume/capacity, mass Apply Pythagoras' Theorem in right-angled triangles in 2D Construct and interpret plans and elevations of 3D shapes Calculate exactly with multiples of π
Mathematics – Unit 6 – Number	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
- Convert fluently between fractions, terminating decimals and percentages (REVISION) - Calculate with combinations of fractions, terminating/recurring decimals and percentages (REVISION) - Order combinations of fractions, decimals and percentages - Know the correct notation for recurring decimals - Divide an integer or decimal by an integer where the result is a recurring decimal - Divide an integer or decimal by a decimal by transformation to division by an integer	Work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and 7/2 or 0.375 and 3/8) Use the four operations applied to decimals, proper and improper fractions, and mixed numbers, all both positive and negative Calculate exactly with fractions
Mathematics – Unit 7 – Approximation	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
- Round to any given number of significant figures - Understand and use the symbol ≈ - Estimate the result of a calculation which involves powers or roots - Estimate the result of a calculation which involves dividing by a decimal e.g. 0.41	Use approximation through rounding to estimate answers Round numbers and measures to an appropriate degree of accuracy e.g. to a number of decimal places or significant figures Calculate possible resulting errors expressed using inequality notation $a < x \leq b$ Apply and interpret limits of accuracy when rounding

- Understand the equivalence of $0.\dot{9}$ and 1
- Understand that this extends to other recurring decimals e.g. $0.24\dot{9}$ and 0.25
- Identify the minimum and maximum possible values, and error interval, of an integer quantity that has been rounded (e.g. number of people, number of items)
- Identify the upper and lower bounds (minimum and maximum values), and error interval, of a continuous quantity rounded to the nearest integer, 10, 100, 5, 20 etc.
- Identify the upper and lower bounds (minimum and maximum values), and error interval, of a continuous quantity that has been rounded to a given number of dp/sf
- Solve simple bounds problems involving one rounded quantity

Mathematics – Unit 8 – Algebra 2	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
- Identify an inequality represented on a number line - Draw a number line to represent an inequality - Extend solving linear inequalities to brackets and non-integer solutions - Solve problems by constructing and solving linear inequalities in one variable - Factorise a quadratic expression of the form x² + bx + c - Factorise a difference of two squares of the form x² – c - Solve quadratic equations of the form x^2 + bx + c = 0 by factorising - Substitute positive and negative integers, decimals and fractions into a range of formulae, including scientific formulae - Distinguish situations that can be modelled by an expression or a formula - Create an expression or a formula to describe a situation - Change the subject of a formula with two or more steps, including reciprocals	Use the symbols =, ≠, <, >, ≤, ≥ Simplify and manipulate algebraic expressions by expanding products of two or more binomials Model situations or procedures by translating them into algebraic expressions or algebraic formulae Rearrange formulae to change the subject Substitute numerical values into formulae, including scientific formulae Solve linear inequalities in one variable, representing the solution set on a number line Simplify and manipulate algebraic expressions by factorising quadratic expressions of the form $x^2 + bx + c$, including a difference of two squares
Mathematics – Unit 9 – Graphs 2	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)

Knowledge and Skills	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
- Plot graphs of quadratic functions - identify values of y for given values of x, and vice versa - Recognise and sketch the graphs of quadratic functions, using factorisation - Recognise that the gradient of a curve is not constant - Estimate the gradient of a quadratic or other curve at a point, using a tangent - Plot graphs of simple cubic functions - Recognise the graphs of cubic functions - Sketch simple cubic functions, such as $y=x^3$ and other pre-factorised cubic functions - Interpret the graphs of simple cubic functions; Identify values of y for given values of x, and vice versa - Plot graphs of $y = 1/x$ and other simple reciprocal functions - Recognise and sketch the graphs of simple reciprocal functions e.g. $y = 2/x$ - Sketch two simple reciprocal graphs on the same set of axes - Interpret the graphs of simple reciprocal functions; Identify values of y for given values of x, and vice versa	Recognise, sketch and produce graphs of quadratic functions of one variable with appropriate scaling, using equations in x and y and the Cartesian plane Use quadratic graphs to estimate values of y for given values of x and vice versa Find approximate solutions to contextual problems from given graphs of a variety of functions Recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, and the reciprocal function y=1/x

Mathematics – Unit 10 – Geometry 2	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
- Calculate the surface area of a cuboid or prism - Calculate the surface area of a cylinder - Solve practical problems involving volume/surface area of cuboids, prisms and cylinders - Calculate the perimeter and area of composite shapes involving circles or sections of a circle, including in terms of π - Round answers to an appropriate degree of accuracy - Extend knowledge of circle parts to: tangent, arc, sector, segment, chord - Simplify a fraction involving an unknown or π e.g. 35π/15 - Solve problems involving the arc length or perimeter of a sector, including in terms of π - Solve problems involving the area of a sector, including in terms of π - Calculate the angle/radius of a sector using the arc length or area	Calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes Derive and apply formulae to calculate and solve problems involving the volume of cuboids (including cubes) and other prisms (including cylinders) Use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, and cylinders to solve problems in 3D Calculate exactly with multiples of π Calculate arc lengths, angles and areas of sectors of circles

Mathematics – Unit 11 – Probability	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)

• Identify the relative frequency of an event from experimental data • Understand that increasing the sample size leads to outcomes that are closer to theoretical probability • Understand that repeating an experiment may change the outcome • Use theoretical or experimental probability to calculate expected outcomes	Record, describe and analyse the frequency of outcomes of simple probability experiments involving randomness, fairness, equally and unequally likely outcomes, using appropriate language and the 0-1 probability scale Use a probability model to predict the outcomes of future experiments; understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size

Mathematics – Unit 12 – Angles	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
• Understand and use 3-figure bearings, including in scale diagrams • Apply rules for opposite angles, angles at a point, on a straight line, in a triangle (including isosceles), and in a quadrilateral (REVISION) • Recognise and calculate with angles near parallel lines (corresponding, alternate and co-interior) (REVISION) • Calculate interior/exterior angles of polygons (REVISION) • Apply previously-met angle rules to forming and solving equations • Apply angle facts to derive results about angles and sides • Create a geometrical proof	Apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles Understand and use the relationship between parallel lines and alternate and corresponding angles Derive and use the sum of angles in a triangle and use it to deduce the angle sum in any polygon, and to derive properties of regular polygons Interpret and use bearings

Mathematics – Unit 13 – Surds	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
• Know the definition of a surd and a rational/irrational number • Add and subtract simple expressions involving surds e.g. $5\sqrt{3} + 2\sqrt{3} - \sqrt{3}$ • Understand and use multiplication of simple surds e.g. $\sqrt{5} \times \sqrt{7}$ • Simplify a surd e.g. $3\sqrt{50} = 3 \times \sqrt{25}\sqrt{2} = 15\sqrt{2}$ • Expand a single or double bracket involving surds • Understand and use division of simple surds e.g. $\frac{2\sqrt{50}}{\sqrt{10}} = 2\sqrt{5}$ • Rationalise a fraction where the denominator is a single term e.g. $2\sqrt{7}$ • Apply Pythagoras' theorem to problems involving surds	Calculate with roots Calculate with numbers in standard form Calculate exactly surds Simplify surd expressions involving squares e.g. $\sqrt{12}$ Rationalise denominators of surds

Mathematics – Unit 14 – Growth	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
- Find the result of a percentage change using a multiplier and calculator (REVISION) - Find the percentage of a given increase, decrease, profit or loss (REVISION) - Find the original amount before a percentage change (REVISION) - Calculate the result of a repeated percentage change - Calculate the final value of an investment involving compound interest - Calculate the final value of an investment involving simple interest - Solve a range of problems involving repeated percentage change, including comparing investments earning simple interest with those earning compound interest - Solve problems involving finding the result of a single fractional increase or decrease	Interpret percentages as operators Interpret fractions as operators Express one quantity as a percentage of another Set up, solve and interpret the answers in growth and decay problems, including compound interest
Mathematics – Unit 15 – Algebra 3	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
- Understand there are an infinite number of solutions to the equation $ax + by = c$ $(a \neq 0, b \neq 0)$, including by considering its graphical representation - Find approximate solutions to simultaneous equations using a graph - Solve two linear simultaneous equations in two variables by adding or subtracting, including where one or both equations need to be multiplied first - Solve problems by deriving two simultaneous equations, and interpret the solution - Extend using the four operations with simple algebraic fractions to more complex expressions, including using the laws of indices - Generate a sequence, including quadratic, from a position-to-term rule (REVISION) - Recognise the sequences of square and triangular numbers (REVISION) - Recognise the sequence of cube numbers - Find the nth term of a descending linear sequence - Use the nth term to decide whether a number is in a sequence and to find a later term	Generate terms of a sequence from either a term-to-term or a position-to-term rule Recognise arithmetic sequences Recognise geometric sequences and appreciate other sequences that arise Find the nth term of an arithmetic sequence Solve two linear simultaneous equations Find approximate solutions to two linear simultaneous equations using a graph Simplify algebraic fractions involving sums, products and powers, including using the laws of indices Recognise and use the sequences of triangular and square numbers, and simple arithmetic progressions Deduce expressions to calculate the nth term of linear sequences Recognise and use the sequence of cube numbers

- Justify a position to term rule in relation to a sequence of patterns

Mathematics – Unit 16 – Proportion	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
- Divide a value into a 2-part of 3-part ratio (REVISION) - Use a ratio and one part to find other part(s) or the whole - Solve simple problems given a ratio and a difference e.g. Tom has 10 more than Ella - Solve more complex ratio problems e.g. comparison, mixing, concentrations - Solve problems combining understanding of fractions and ratio - Solve simple problems involving combined ratios - Understand a relationship between two quantities which are in direct proportion - Know the features of graphs, tables and formulae that represent a direct proportion - Construct and use simple formulae describing direct proportion e.g. a=kb - Understand the relationship between two quantities that are inversely proportional - Know that 'y is inversely proportional to x' is equivalent to y ∝ 1/x - Know the features of graphs, tables and expressions that represent an inverse proportion - Construct and use simple formulae describing inverse proportion e.g. a=k/b - Solve simple and more complex problems involving speed, distance and time - Convert between units of speed - Solve simple problems involving density - Understand units for density e.g. g/cm^3	Use ratio notation Divide a given quantity into two parts in a given part:part or part:whole ratio; express the division of a quantity into two parts as a ratio Understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction Relate the language of ratios and the associated calculations to the arithmetic of fractions Solve problems involving direct and inverse proportion, including graphical and algebraic representations Use compound units such as speed, unit pricing and density to solve problems Identify and work with fractions in ratio problems Recognise and interpret graphs that illustrate direct proportion Understand that X is inversely proportional to Y is equivalent to X is proportional to 1/Y Interpret equations that describe direct and inverse proportion Recognise and interpret graphs that illustrate inverse proportion Construct (and interpret) equations that describe direct and inverse proportion
Mathematics – Unit 17 – Geometry 3	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)

- Identify the order of rotational symmetry of a shape - Rotate a shape through 90° or 180° on co-ordinate axes - Translate a shape using a vector - Enlarge a shape using a positive fractional scale factor and centre of enlargement - Identify the scale factor and centre of an enlargement with fractional scale factor - Solve geometrical problems involving using similarity to calculate missing lengths - Finding missing lengths in similar shapes when the scale factor is given as a ratio - Prove that two triangles are similar by consideration of angles	Derive and illustrate properties of triangles, quadrilaterals, circles, and other plane figures Identify properties of, and describe the results of, translations, rotations and reflections applied to given figures Describe translations as 2D vectors Compare lengths using ratio notation and/or scale factors; make links to similarity Apply the concepts of congruence and similarity, including the relationship between lengths in similar figures Make links between similarity and scale factors or ratios
Mathematics – Unit 18 – Data	
Knowledge and Skills – Students will be taught to…	Links to KS3 National Curriculum Content (green) and KS4 Content (red)
- Create a table and use it to group data, by tallying - Interpret statistics in context, including comparing data - Choose appropriate statistics to describe a set of data and to test statements - Use charts to identify probabilities - Compare data given in more than one form (including mixture of charts & statistics) - Construct pie charts by calculating angles, including with awkward totals (REVISION) - Construct a pie chart using information from a different type of chart/diagram - Recognise what can and cannot be deduced from a comparison of two pie charts - Construct and interpret stem and leaf diagrams - Identify the mode, median and range from a stem and leaf diagram - Identify the modal class for a table of grouped data (REVISION) - Estimate the mean from a table of grouped data (REVISION) - Identify the median from a table of ungrouped data (REVISION) - Identify the class interval containing the median for a table of grouped data - Estimate the range from a table of grouped data	Describe, interpret and compare observed distributions of a single variable through appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers) Describe, interpret and compare observed distributions of a single variable through appropriate graphical representation involving discrete, continuous and grouped data Construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts, pie charts, and pictograms for categorical data 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) Interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate graphical representation involving discrete, continuous and grouped data Apply statistics to describe a population Infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling