# KS4 CORE LEARNING VISION

| Develop fluency | Reason mathematically | Solve problems |
|---|---|---|
| ● Consolidate their numerical and mathematical capability from key stage 3 and extend their understanding of the number system to include powers, roots {and fractional indices}.<br>● Select and use appropriate calculation strategies to solve increasingly complex problems, including exact calculations involving multiples of $\pi$ {and surds}, use of standard form and application and interpretation of limits of accuracy.<br>● Consolidate their algebraic capability from key stage 3 and extend their understanding of algebraic simplification and manipulation to include quadratic expressions, {and expressions involving surds and algebraic fractions}.<br>● Extend fluency with expressions and equations from key stage 3, to include quadratic equations, simultaneous equations and inequalities.<br>● Move freely between different numerical, algebraic, graphical and diagrammatic representations, including of linear, quadratic, reciprocal, {exponential and trigonometric} functions.<br>● Use mathematical language and properties precisely.<br>● Extend and formalise their knowledge of ratio and proportion, including trigonometric ratios, in working with measures and geometry, and in working with proportional relations algebraically and graphically.<br>● Extend their ability to identify variables and express relations between variables algebraically and graphically.<br>● Make and test conjectures about the generalisations that underlie patterns and relationships; look for proofs or counter-examples; begin to use algebra to support and construct arguments {and proofs}.<br>● Reason deductively in geometry, number and algebra, including using geometrical constructions.<br>● Interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning.<br>● Explore what can and cannot be inferred in statistical and probabilistic settings, and express their arguments formally.<br>● Assess the validity of an argument and the accuracy of a given way of presenting information. | ● Extend and formalise their knowledge of ratio and proportion, including trigonometric ratios, in working with measures and geometry, and in working with proportional relations algebraically and graphically.<br>● Extend their ability to identify variables and express relations between variables algebraically and graphically.<br>● Make and test conjectures about the generalisations that underlie patterns and relationships; look for proofs or counter-examples; begin to use algebra to support and construct arguments {and proofs}.<br>● Reason deductively in geometry, number and algebra, including using geometrical constructions.<br>● Interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning.<br>● Explore what can and cannot be inferred in statistical and probabilistic settings, and express their arguments formally.<br>● Assess the validity of an argument and the accuracy of a given way of presenting information. | ● Develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems.<br>● Develop their use of formal mathematical knowledge to interpret and solve problems, including in financial contexts.<br>● Make and use connections between different parts of mathematics to solve problems.<br>● Model situations mathematically and express the results using a range of formal mathematical representations, reflecting on how their solutions may have been affected by any modelling assumptions.<br>● Select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems; interpret their solution in the context of the given problem. |

# Year 11 Higher Tier Term 1

## HIGHER TIER

ALGEBRA, NUMBER AND STATISTICS

| | Learning Outcomes | National Curriculum Links | Key Words |
|---|---|---|---|
| **Module 1 (2 Weeks)** | • Simplifying Algebraic Expressions<br>• Expanding and Simplifying Double Brackets<br>• Finding the Product of Three Binomials<br>• Factorising Common Factors<br>• Factorising Simple Quadratics<br>• Transformation of Polynomial Functions<br>• Transformation of Trigonometric Functions<br>• Composite and Inverse Functions | • Simplify and manipulate algebraic expressions (including those involving surds {and algebraic fractions} by: factorising quadratic expressions of the form $x^2 + bx + c$ , including the difference of two squares; {factorising quadratic expressions of the form $ax^2 + bx + c$ }.<br>• Where appropriate, interpret simple expressions as functions with inputs and outputs; {interpret the reverse process as the 'inverse function'; interpret the succession of two functions as a 'composite function'}. | • Expressions<br>• Factorise<br>• Bracket<br>• Common Factor<br>• Binomial<br>• Polynomial |
| **Module 2 (2 Weeks)** | • Indices (Including fractional & negative)<br>• Algebraic Indices<br>• Writing Numbers in Standard Form<br>• Multiplying Numbers Expressed in Standard Form<br>• Dividing Numbers Expressed in Standard Form<br>• Manipulating Surds | • Simplify expressions involving sums, products and powers, including the laws of indices<br>• Estimate powers and roots of any given positive number.<br>• Calculate with roots, and with integer {and fractional} indices.<br>• Calculate with numbers in standard form $A \times 10n$ , where $1 \leq A < 10$ and n is an integer.<br>• calculate exactly with fractions, {surds} and multiples of π; {simplify surd expressions involving squares [for example = rationalise denominators} = × = 2 3 ] and | • Indices<br>• Root<br>• Square<br>• Cube<br>• Indices<br>• Standard Form<br>• Surds |
| **Module 3 (2 Weeks)** | • Extracting Information from Tables and Graphs<br>• Two-Way Tables<br>• Interpreting Composite Bar Charts<br>• Cumulative Frequency<br>• Box Plots<br>• Histograms<br>• Comparing Sets of Data | • Interpret and construct tables and line graphs for time series data.<br>• Interpret, analyse and compare the distributions of data sets from univariate empirical distributions through: appropriate graphical representation involving discrete, continuous and grouped data, {including box plots}.<br>• Appropriate graphical representation involving discrete, continuous and grouped data, {including box plots}<br>• Apply statistics to describe a population. | • Cumulative<br>• Frequency<br>• Composite<br>• Compare<br>• Table |

## AUTUMN HALF TERM BREAK

# Year 11 Higher Tier Term 2

GEOMETRY

## HIGHER TIER

| | Learning Outcomes | National Curriculum Links | Key Words |
|---|---|---|---|
| **Module 4 (2 Weeks)** | • Angle Facts and Reasoning<br>• Names and Properties of Triangles and Quadrilaterals<br>• Sum of the Interior Angles of a Polygon<br>• Properties of a Circle<br>• Manipulating Angles in Parallel Lines<br>• Interior and Exterior Angles of a Polygon | • Calculate arc lengths, angles and areas of sectors of circles.<br>• Identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment. | • Polygon<br>• Interior<br>• Exterior<br>• Circular |
| **Module 5 (2 Weeks)** | • Area of Triangles<br>• Perimeter and Area of other 2D Shapes<br>• Perimeter and Area of Compound Shapes<br>• Circular Mensuration (Circumference and Area)<br>• Perimeter and Area of Semicircles | • Calculate arc lengths, angles and areas of sectors of circles.<br>• Calculate surface areas and volumes of spheres, pyramids, cones and composite solids. | • Perimeter<br>• Area<br>• Compound Shape<br>• Mensuration<br>• Circumference<br>• Semicircle |
| **Module 6 (2 Weeks)** | • Pythagoras' Theorem<br>• Pythagoras' Theorem in 3D<br>• Exact Trigonometric Values<br>• Trigonometry (SOH CAH TOA)<br>• Area of a Triangle using Trigonometry (0.5abSinC)<br>• Cosine Rule<br>• Sine Rule<br>• Trigonometry in 3D | • Estimate powers and roots of any given positive number.<br>• Apply Pythagoras' Theorem and trigonometric ratios to find angles and lengths in right-angled triangles {and, where possible, general triangles} in two {and three} dimensional figures.<br>• Know and apply the sine rule, $a = \sin A\ b\ \sin B = c\ \sin C$ , and cosine rule, $a^2 = b^2 + c^2 - 2bc \cos A$ , to find unknown lengths and angles.<br>• Know the exact values of $\sin\theta$ and $\cos\theta$ for $\theta = 0\ 0$ , $30^0$ , $45^0$ , $60^0$ and $90^0$ ; know the exact value of $\tan\theta$ for $\theta = 0^0$ , $30^0$ , $45^0$ and $60^0$ | • Square<br>• Square root<br>• 3D<br>• Trigonometry<br>• Sine<br>• Cosine<br>• Tangent<br>• Exact<br>• Estimate |

## CHRISTMAS BREAK

# Year 11 Higher Tier Term 3

ALGEBRA

## HIGHER TIER

| | Learning Outcomes | National Curriculum Links | Key Words |
|---|---|---|---|
| **Module 7 (2 Weeks)** | • Writing Formulae<br>• Substituting into Formulae<br>• Rearranging Formulae<br>• Solving and Writing Equations<br>• Solving Quadratics by Factorisation and by Formula | • Simplify and manipulate algebraic expressions (including those involving surds {and algebraic fractions}) by:<br>• Where appropriate, interpret simple expressions as functions with inputs and outputs; {interpret the reverse process as the 'inverse function'; interpret the succession of two functions as a 'composite function'}. | • Expression<br>• Formula<br>• Substitute<br>• Rearrange<br>• Approximate |
| **Module 8 (2 Weeks)** | • Midpoint of a Line Segment<br>• Drawing Straight Line Graphs<br>• Gradient of a Straight Line<br>• Equation of a Straight-Line<br>• Parallel and Perpendicular Lines<br>• Equation of a Circle | • Use the form $y = mx + c$ to identify parallel {and perpendicular} lines; find the equation of the line through two given points, or through one point with a given gradient.<br>• Recognise and use the equation of a circle with centre at the origin; find the equation of a tangent to a circle at a given point} solve quadratic equations {including those that require rearrangement} algebraically by factorising, {by completing the square and by using the quadratic formula}; find approximate solutions using a graph solve two simultaneous equations in two variables (linear/linear {or linear/quadratic}) algebraically; find approximate solutions using a graph. | • Coordinate<br>• Midpoint<br>• Straight Line<br>• Gradient<br>• Parallel Line<br>• Perpendicular |
| **Module 9 (1 Week)** | • Interpreting the Solutions to a Quadratic Graph<br>• Drawing Conclusions from Real-Life Graphs<br>• Completing a Table of Values for Quadratic Graphs<br>• Drawing Quadratic Graphs<br>• Using Quadratic Graphs<br>• Turning points and Sketching Quadratic Graphs | • Recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function $y = 1$ with $x \neq 0$, {the exponential function $x\ y = k\ x$ for positive values of k, and the trigonometric functions (with arguments in degrees) $y = \sin x$ , $y = \cos x$ and $y = \tan x$ for angles of any size}.<br>• Plot and interpret graphs (including reciprocal graphs {and exponential graphs}) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration. | • Interpret<br>• Plot<br>• Conclusion<br>• Approximate<br>• Table of Values<br>• Turning Point<br>• Sketch |

## SPRING HALF TERM BREAK

# Year 11 Higher Tier Term 4

| | HIGHER TIER | | |
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| | **Learning Outcomes** | **National Curriculum Links** | **Key Words** |
| ALGEBRA AND GEOMETRY | **Module 10 (2 Weeks)**<br>● Solving Simultaneous Equations Algebraically<br>● Solving Simultaneous Equations Graphically<br>● Solving Simultaneous Equations with one Quadratic<br>● Using Inequalities on a Number Line<br>● Solving Linear Inequalities<br>● Solving Quadratic Inequalities | ● Solve linear inequalities in one {or two} variable{s}, {and quadratic inequalities in one variable}; represent the solution set on a number line, {using set notation and on a graph}.<br>● Recognise and use the equation of a circle with centre at the origin; find the equation of a tangent to a circle at a given point} solve quadratic equations {including those that require rearrangement} algebraically by factorising, {by completing the square and by using the quadratic formula}; find approximate solutions using a graph solve two simultaneous equations in two variables (linear/linear {or linear/quadratic}) algebraically; find approximate solutions using a graph. | ● Simultaneous<br>● Inequality<br>● Number Line<br>● Variable<br>● Coefficient |
| | **Module 11 (1 Week)**<br>● Linear Sequences<br>● Term to Term Rules<br>● Using the nth Term<br>● Finding the nth Term<br>● Quadratic Sequences<br>● Fibonacci and other Non-Linear Sequences | ● Recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions (r n where n is an integer, and r is a positive rational number {or a surd}) {and other sequences}.<br>● Deduce expressions to calculate the n th term of linear {and quadratic} sequences. | ● Sequence<br>● Linear Sequence<br>● Rule<br>● Term<br>● Common Difference<br>● Geometric Progression |
| | **Module 12 (2 Weeks)**<br>● Surface Area<br>● Plans and Elevations<br>● Volume of a Cylinder<br>● Volume of a Pyramid and Sphere<br>● Volume of a Prism<br>● Vector Arithmetic<br>● Vector Geometry | ● Construct and interpret plans and elevations of 3D shapes.<br>● Calculate surface areas and volumes of spheres, pyramids, cones and composite solids.<br>● Apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors; {use vectors to construct geometric arguments and proofs}.<br>● Describe translations as 2D vectors. | ● Plan<br>● Elevation<br>● Prism<br>● Cube<br>● Cuboids<br>● Vector |

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| | EASTER BREAK |

# Year 11 Higher Tier Term 5

| | HIGHER TIER | | | |
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| | | Learning Outcomes | National Curriculum Links | Key Words |

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| RATIO, PROPORTION, RATES OF CHANGE AND GEOMETRY | **Module 13 (2 Weeks)** | • Writing Numbers as Simple Ratios<br>• Dividing in a Given Ratio<br>• Proportion and Recipe<br>• Direct Proportion<br>• Inverse Proportion<br>• Standard Ratio Problems<br>• Proportional Graphs and Rates of Change<br>• Ratio Problems with Overlap | • Identify compare lengths, areas and volumes using ratio notation and/or scale factors; make links to similarity (including trigonometric ratios).<br>• Understand that X is inversely proportional to Y is equivalent to X is proportional to 1 ; Y {construct and} interpret equations that describe direct and inverse proportion.<br>• Interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion.<br>• Identify and work with fractions in ratio problems. | • Ratio<br>• Proportion<br>• Recipe<br>• Direct Proportion<br>• Inverse Proportion<br>• Overlap |
| | **Module 14 (2 Weeks)** | • Translations<br>• Reflections<br>• Reflections in Given Lines<br>• Rotations<br>• Enlargements (including fractional & negative)<br>• Describing Transformations<br>• Combination of Transformations | • Describe the changes and invariance achieved by combinations of rotations, reflections and translations.<br>• Interpret and use fractional {and negative} scale factors for enlargements<br>• Describe translations as 2D vectors. | • Translate<br>• Reflect<br>• Rotate<br>• Enlarge<br>• Vector |
| | **Module 15 (2 Weeks)** | • Congruent Shapes<br>• Proof of Congruent Triangles<br>• Similarity<br>• Linear Scale Factor<br>• Scale Factor including Area and Volume<br>• Exploring Similar Shapes in Context | • Apply the concepts of congruence and similarity, including the relationships between lengths, {areas and volumes} in similar figures. | • Congruent<br>• Similar Shape<br>• Scale Factor<br>• Surface Area<br>• Corresponding Side |
| | **SUMMER HALF TERM BREAK** | | | |

# Year 11 Higher Tier Term 6

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| | **HIGHER TIER** |

PROBABILITY AND STATISTICS

| | Learning Outcomes | National Curriculum Links | Key Words |
|---|---|---|---|
| **Module 16 (2 Weeks)** | • Calculating Probabilities<br>• Probability from Experiments<br>• Drawing Tree Diagrams<br>• Sets and Subsets<br>• Completing Venn Diagrams<br>• AND/OR Rules<br>• Conditional Probability | • Apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one.<br>• 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.<br>• {calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams}. | • Probability<br>• Conditional<br>• Tree Diagram<br>• Set<br>• Complement<br>• Union<br>• Intersection<br>• Venn Diagram |
| **KS4 LEARNING REVIEW AND SKILLS AUDIT** | | | |
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| **SUMMER BREAK** | | | |