

KS4 Curriculum Map – Mathematics:

Topic	Substantive Knowledge This is the specific, factual content for the topic, which should be connected into a careful sequence of learning.	Disciplinary Knowledge (Skills) This is the action taken within a particular topic in order to gain substantive knowledge.	Assessment Opportunities What assessments will be used to measure student progress?
Expressions and Formulae	<ul style="list-style-type: none"> • Algebraic Fractions • Solve linear equations • Expanding Brackets • Expression/ Equation/ Formula/ Identity • Mathematical Arguments • Factorising and Solving Quadratics • Changing the Subject 	<ul style="list-style-type: none"> • Simplify and manipulate algebraic fractions Including linear and quadratic • Use the four operations with algebraic fractions • Solve equations involving algebraic fractions • Solve linear equations in one unknown with integer and fractional coefficients • Construct, derive and solve linear equations from any situation, including geometrical and written. • Expanding a product of two or three linear expressions • Identify special cases such as squaring a linear expression, a difference of two squares. • Expand trinomials • Distinguish between and use vocabulary for expressions/ equations/ formulae/identities. • Argue mathematically to show algebraic expressions are equivalent and to prove simple identities • Factorising quadratic expressions • Solving quadratic equations by factorisation 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 1 Assessment

		<ul style="list-style-type: none"> • Change the subject of a formula including where the subject is on both sides 	
Transformations	<ul style="list-style-type: none"> • Translations • Reflections • Rotations • Enlargements 	<ul style="list-style-type: none"> • Reflection in the equations of a straight line • Rotations by any angle • Enlarge 2D shapes by negative and fractional scale factors • Transform 2D shapes by combinations of translations, rotations, reflections and enlargements 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 1 Assessment
Statistics	<ul style="list-style-type: none"> • Frequency tables • Averages • Scatter Diagrams • Frequency Polygons • Time Series • Comparing Distributions 	<ul style="list-style-type: none"> • Identify possible sources of bias and plan how to minimise it • Construct frequency tables for discrete and continuous data • Estimate/Find the mean, median and modal class from frequency tables • Construct and interpret scatter diagrams • Understand types of correlation and plot lines of best fit • Construct and interpret frequency polygons • Construct and interpret time series graphs • Compare averages or summary statistics of two distributions and make inferences • Calculate possible values of the set of data given summary statistics 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 2 Assessment
Indices and Standard Form	<ul style="list-style-type: none"> • Indices • Standard Form 	<ul style="list-style-type: none"> • Understand and simplify negative indices • Understand and simplify fractional indices • Convert between ordinary and standard form representations • Use the Four Operations with Standard Form 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 2 Assessment

Accuracy of measure	<ul style="list-style-type: none"> • Bounds • Recurring Decimals 	<ul style="list-style-type: none"> • Identify the upper and lower bounds • Define error intervals. • Convert a recurring decimal to a fraction • Use recurring decimal conversion in problems 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 2 Assessment
Inequalities	<ul style="list-style-type: none"> • Inequalities on a Number Line • Solving Inequalities • Set Notation 	<ul style="list-style-type: none"> • Representing inequalities on a number line • Write down whole number values that satisfy an inequality • Solve linear inequalities in one variable • Solve two simultaneous linear inequalities algebraically • Represent the solution set for inequalities using set notation • Use inequality notation to specify simple error intervals due to truncation or rounding 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 3 Assessment
Loci	<ul style="list-style-type: none"> • Bearings • Loci 	<ul style="list-style-type: none"> • Understand bearings • Produce shapes and paths by using descriptions of loci • Understand loci about a point, line and corner. • Draw the locus equidistant between 2 points or two lines, or from a point or around a line • Use construction to find the locus of a point that moves according to a rule 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 3 Assessment

Circle Geometry	<ul style="list-style-type: none"> • Circle Theorems 	<ul style="list-style-type: none"> • Understand and apply that the angle at the centre is twice the angle at the circumference • Understand and apply that the angle in a semi-circle is a right angle • Understand and apply that angles in the same segment are equal • Understand and apply that opposite angles in a cyclic quadrilateral sum to 180° • Understand and apply that the angle between a chord and the tangent is equal to the angle in the alternate segment 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 3 Assessment
Similar Shapes	<ul style="list-style-type: none"> • Congruency • Similarity 	<ul style="list-style-type: none"> • Understand and apply the concepts of congruence and similarity, including the relationship between lengths • Proving triangles are congruent • Understand that in similar 2D shapes corresponding angles are equal and corresponding sides are in the same ratio. • Understand the effect of enlargement on perimeter, area and volume in similar shapes 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 3 Assessment
Probability	<ul style="list-style-type: none"> • Tree diagrams • Independent events • Relative Frequency 	<ul style="list-style-type: none"> • Use tree diagrams to represent outcomes of two or more events and to calculate probabilities of combinations of independent events. • Know when to add or multiply two probabilities • Understand relative frequency as an estimate of probability and use this to compare outcomes of experiments • Compare relative frequencies from samples of different sizes • Identify conditions for a fair game 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 4 Assessment

Measures and Mensuration	<ul style="list-style-type: none"> • Surface area • Volumes • Units • Circles • Compound shapes 	<ul style="list-style-type: none"> • Solve problems involving surface area and volumes of cylinders, including answers in terms of π • Convert between units of area and convert between units of volume • Calculate the length of an arc of a circle • Calculate the area of a sector, including answers in terms of π • Calculate the volumes of compound shapes made up of prisms 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 4 Assessment
Trigonometry	<ul style="list-style-type: none"> • 3D Pythagoras' Theorem • Trigonometry in right angle triangles 	<ul style="list-style-type: none"> • Apply Pythagoras' Theorem to 3D problems, including calculating the length of the diagonal of a cuboid • Understand and use trigonometric relationships in right-angled triangles, and use these to solve problems, including simple problems involving bearings • Use the trigonometric keys of a calculator • Use the trigonometric relationships in a wide variety of situations • Apply Trigonometry to 3D shapes 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 4 Assessment
Flowcharts	<ul style="list-style-type: none"> • Flowcharts • Networks • Graphs 	<ul style="list-style-type: none"> • Create and Interpret Flowcharts • Definitions of different types of networks and graphs • Create graphs/networks from given information 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 4 Assessment
Graphs	<ul style="list-style-type: none"> • Quadratic functions • Completing the square • Turning points 	<ul style="list-style-type: none"> • Recognise, generate points and plot graphs of quadratic functions • Deduce turning points by completing the square • Identify the line of symmetry of a quadratic graph • Identify and interpret roots, intercepts and turning points of a quadratic graph • Sketch a graph of a quadratic by factorising, identifying roots, y-intercept and the turning point 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 5 Assessment

Trigonometry	<ul style="list-style-type: none"> • Area of a triangle • Sine Rule • Cosine Rule 	<ul style="list-style-type: none"> • Find missing sides and angles of a triangle using sine rule • Find missing sides and angles of a triangle using cosine rule • Find the area of a triangle using trigonometry 	<ul style="list-style-type: none"> • In Class Teacher Assessment • Fluency and Mastery Homework • Module 5 Assessment
Number	<ul style="list-style-type: none"> • Converting recurring decimals to fractions • Upper and Lower Bounds 	<ul style="list-style-type: none"> • Review the technique to convert recurring decimals to fractions and apply this to more challenging problems. • Use knowledge of bounds to add, subtract, multiply and divide with upper and lower bounds and apply in context • Calculate to an appropriate degree of accuracy in the context of bounds 	<ul style="list-style-type: none"> • Fluency and mastery homework • Teacher assessment during lesson • End of module 1 test
Algebra	<ul style="list-style-type: none"> • Changing the subject of a formula • Solving quadratic equations • Constructing quadratic equations • Sketching quadratic graphs 	<ul style="list-style-type: none"> • Apply the inverse operation to both sides of an equation when rearranging. • Link to single-bracket factorisation to isolate a variable when rearranging. • Rearrange equations with fractions in, where required variable is in the denominator. • Solve quadratic equations by factorising • Re-cap the difference of two squares as a method to factorise and solve quadratic equations. • Complete the square algebraically and use this to solve quadratic equations. • Use the quadratic formula to solve quadratic equations. Include the idea of number of roots. • Construct and solve quadratic equations • Understand the relationship between the roots of a quadratic equation and where the quadratic graph crosses the x-axis • Sketch graphs by using key facts from algebraic methods, including: 	<ul style="list-style-type: none"> • Fluency and mastery homework • Teacher assessment during lesson • End of module 1 test

		<ul style="list-style-type: none"> • Points of intersection with axes (by solving and letting $x=0$) • Turning points from understanding of completing the square • General shape for quadratic graphs. 	
Indices, surds and standard form.	<ul style="list-style-type: none"> • Index laws • Surds • Standard form 	<ul style="list-style-type: none"> • Use index laws (including fractional and negative) to simplify algebraic expressions • Solve equations involving indices • Simplify surds • Understand and apply laws of surds (addition, subtraction need a common surd base, multiplication and division rules) • Rationalise surds • Convert between standard form and ordinary numbers • Perform calculations involving standard form 	<ul style="list-style-type: none"> • Fluency and mastery homework • Teacher assessment during lesson • End of module 2 test
Probability	<ul style="list-style-type: none"> • Sets and Venn Diagrams • Regions of Venn Diagrams • Link probability and Venn diagrams • Tree diagrams • Frequency Tree Diagrams 	<ul style="list-style-type: none"> • Populate Venn diagrams from a variety of contextual questions. • Identify key regions in Venn diagrams using set notation. • Link this to probability using the idea of x out of y. Include compound events. • Use tree diagrams for probability and the concept of AND and OR for traversing them • Understand and use the knowledge that each set of branches on a tree diagram has a probability that sums to 1. • Understand the impact of independent and dependent events have on tree diagrams and be able to apply this in context. • Draw a frequency tree based on given information and use this to find probability and expected outcome 	<ul style="list-style-type: none"> • Fluency and mastery homework • Teacher assessment during lesson • End of module 2 test • SMSC task

<p>Constructions and Loci</p>	<ul style="list-style-type: none"> • Constructions • Loci 	<ul style="list-style-type: none"> • Create standard constructions using straight edge and compasses • Relate these constructions to properties of intersecting circles with equal radii • Draw the locus of a point using standard mathematical language. • Identify regions (as loci) satisfying given conditions • Find the locus of a point (including regions) in context, including using bearings. 	<ul style="list-style-type: none"> • Fluency and mastery homework • Teacher assessment during lesson • End of module 2 test • SMSC task
<p>Sequences</p>	<ul style="list-style-type: none"> • Arithmetic (linear) sequences • Geometric sequences • Special sequences • Quadratic sequences 	<ul style="list-style-type: none"> • Find the term-to-term rule and nth term for arithmetic sequences by identifying a common difference and apply this knowledge in a variety of contexts, including checking if a number is in a sequence. • Find the term-to-term rule and nth term for a geometric sequence with a common ratio (this may be a surd) and apply this knowledge in a variety of contexts • Identify and understand special sequences such as square, cube, triangle and Fibonacci sequences • Understand the term-to-term rule and nth term of the triangle numbers is $\frac{1}{2}n(n+1)$ by considering the arrangement of dots. • Be able to generate nth term for a quadratic sequence using the table method and apply this to a variety of contextual situations. 	<ul style="list-style-type: none"> • Fluency and mastery homework • Teacher assessment during lesson • End of module 2 test
<p>Area and Volume</p>	<ul style="list-style-type: none"> • Convert between metric units for area and volume • Volume of a pyramid, cone and sphere • Calculate the volumes of compound shapes • Calculate the surface area of a prism and other shapes • Use bounds when solving problems involving area and volume 	<ul style="list-style-type: none"> • Convert between metric units of area and volume • Calculate the volume of pyramid, cone and sphere in context and in terms of pi and not. • Use knowledge of volumes to calculate volumes of compound shapes in context, such as frustums and other shapes. 	<ul style="list-style-type: none"> • Fluency and mastery homework • Teacher assessment during lesson • End of module 3 test

	<ul style="list-style-type: none"> • Use axes and coordinates to specify and find points in 3D 	<ul style="list-style-type: none"> • Understand surface area is 2D as the sum of the areas of the surfaces of a 3D shape and apply this in a variety of contexts. • Link with bounds previously and be able to apply shape understanding with bounds, understand how this impacts the use of the standard formulae for the shapes. • Understand that 3D coordinates are an extension to the 2D cartesian coordinate system, that coordinates are in the form (x,y,z) and be able to plot them on a standard 3D set of axes. 	
<p style="text-align: center;">Statistics</p>	<ul style="list-style-type: none"> • Populations and Samples • Peterson capture-recapture method • Mean, median and mode from a frequency table • Cumulative frequency graphs • Box Plots • Compare distributions • Histograms • Anomalies (outliers) • Time series graphs • Extension - moving averages • Extension - Skew 	<ul style="list-style-type: none"> • Apply statistics to describe a population, to include the calculation of summary statistics from a sample (mean, median, range, etc), knowing that these are estimates for the population • Understand and use random sampling and stratified sampling and the advantages and disadvantages of both • Consider bias when selecting a sample, and how this may impact random and stratified samples • Understand Peterson capture-recapture method and apply in context. • Calculate and interpret mean, median and mode from frequency tables (including grouped) and understand why (if grouped) this is only an estimate. Use linear interpolation to estimate the median in grouped frequency tables. • Construct and interpret Cumulative Frequency graphs from frequency tables. • Draw box plots from a CF graph, and from Q1, Q2 and Q3 calculations on raw data. Use multiple Box Plots to compare sets of data by looking at the shape (spread and position) of data. 	<ul style="list-style-type: none"> • Fluency and mastery homework • Teacher assessment during lesson • SMSC activity • End of module 3 test

		<ul style="list-style-type: none"> Understand and apply frequency as area in histograms; draw and interpret histograms in context. Understand that height is frequency density and that histograms are used for grouped data. Construct and use time series graphs in context Calculate and interpret moving averages Investigate the concept of skew 	
Circle Geometry	<ul style="list-style-type: none"> Equilateral and isosceles triangles in circles Circle theorems Proofs of circle theorems. 	<ul style="list-style-type: none"> Identify equilateral and isosceles triangles in circles and use angles facts to solve problems involving circles. Use circle theorems to solve problems, using correct terminology Understand and apply the proofs of all the circle theorems, using correct notation and language. 	<ul style="list-style-type: none"> Fluency and mastery homework Teacher assessment during lesson End of module 4 test
Graphs	<ul style="list-style-type: none"> Straight line graphs Curved graph plotting Gradients of curved graphs Areas under curved graphs 	<ul style="list-style-type: none"> Rearrange equations of straight lines into the form $y=mx+c$ Draw straight lines in the form $y=mx+c$ by plotting points in a table of values Understand m and c as gradient and y-axis intercept in $y=mx+c$ and use this to sketch curves and find equations. Understand and interpret straight line graphs in context Calculate the gradient of a line using 2 points Calculate the equation of a line given 2 points or a point and a gradient using $y=mx+c$ and $y - y_1 = m(x - x_1)$ Plot and interpret graphs (inc. reciprocal, exponential and non-standard functions) in real contexts finding approximate solutions to problems such as simple kinematic problems 	<ul style="list-style-type: none"> Fluency and mastery homework Teacher assessment during lesson SMSC activity End of module 4 test

		<ul style="list-style-type: none"> • Estimate gradients by drawing a tangent to a curve at a point • Apply gradients of curves in context, including kinematics and financial situations. • Use the idea that areas under curves can be split into smaller shapes (trapezia); consider over/under approximations when estimating area under curves • Apply areas under curves in context, including kinematics and financial situations. 	
Algebraic fractions and proof	<ul style="list-style-type: none"> • Simplify, operate and solve with algebraic fractions. • Algebraic proofs and identities. 	<ul style="list-style-type: none"> • Simplify algebraic fractions by dividing by common factors and factorising linear or quadratic numerators and/or denominators when appropriate. • Add and subtract with algebraic fractions by finding common denominators and simplify results when necessary. • Use methods to multiply and divide numerical fractions to multiply/divide and simplify algebraic fractions, using factorisation of linear and quadratic expressions when appropriate. • Solve linear and quadratic equations resulting from the manipulation and rearrangement of algebraic fractions. • Use algebra to support and construct arguments and proofs. • Argue mathematically to show algebraic expressions are equivalent. 	<ul style="list-style-type: none"> • Weekly controlled homework. • Teacher assessment during lesson. • End of module 5 test.
Pythagoras' Theorem and Trigonometry	<ul style="list-style-type: none"> • Solve 3D problems involving Pythagoras' Theorem and Trigonometry. • Find the area of non-right-angled triangles. • Find missing lengths and angles in non-right-angled triangles. 	<ul style="list-style-type: none"> • Apply Pythagoras' Theorem $a^2+b^2=c^2$ and the trigonometric ratios for Sine, Cosine and Tangent to find missing lengths and angles in triangles in 3D shapes. • Apply $0.5ab\sin C$ to find the area of non-right-angled triangles. 	<ul style="list-style-type: none"> • Weekly controlled homework. • Teacher assessment during lesson. • End of module 5 test.

		<ul style="list-style-type: none"> Recognise when to apply the Sine or Cosine rules to find missing lengths and angles in non-right-angled triangles in both 2D and 3D shapes. Understand and use the key language to find angles between lines and planes. 	
Direct and Inverse Proportion	<ul style="list-style-type: none"> Solve problems involving direct and inverse proportion. 	<ul style="list-style-type: none"> Derive statements of proportionality and formulae for direct and inverse proportion statements. Use algebraic and graphical representations to solve problems involving direct and inverse proportion. Solve proportionality problems involving squares, roots and cubes. 	<ul style="list-style-type: none"> Weekly controlled homework. Teacher assessment during lesson. End of module 5 test.
Simultaneous Equations	<ul style="list-style-type: none"> Solve linear and quadratic simultaneous equations graphically Solve linear and quadratic simultaneous equations algebraically. 	<ul style="list-style-type: none"> Plot two linear equations on the same axes and interpret the solution of the simultaneous equations. Plot one linear and one quadratic equation on the same axes and interpret the solution of the simultaneous equations. Use methods of elimination and substitution to solve two linear simultaneous equations algebraically. Use algebraic substitution to solve one linear and one quadratic equation simultaneously. 	<ul style="list-style-type: none"> Weekly controlled homework. Teacher assessment during lesson. Mock assessments.
Equations of Circles	<ul style="list-style-type: none"> Use and apply the equation of a circle. Tangent to a circle. 	<ul style="list-style-type: none"> Recognise and use the equation of a circle with the centre at the origin. Sketch/plot a circle from a given equation. Interpret the graph of a linear equation and a circle as the solution to the simultaneous equations. Find the equation of a tangent to a circle at a specific point. 	<ul style="list-style-type: none"> Weekly controlled homework. Teacher assessment during lesson. Mock assessments.

<p>Vectors</p>	<ul style="list-style-type: none"> Solving problems involving 2D vectors. Vector proofs. 	<ul style="list-style-type: none"> Apply addition and subtraction of vectors. Multiply vectors by a scalar. Use and understand diagrammatic and column representations of vectors. Use vectors to construct geometric arguments and proofs. 	<ul style="list-style-type: none"> Weekly controlled homework. Teacher assessment during lesson. Mock assessments.
<p>Inequalities</p>	<ul style="list-style-type: none"> Solve linear inequalities graphically. Solve linear inequalities algebraically. Solve quadratic inequalities. Represent solutions on number lines. 	<ul style="list-style-type: none"> Solve linear inequalities in one and two variables graphically. Solve quadratic inequalities in one variable, by factorising and sketching the graph to find critical values. Solve two simultaneous inequalities, where one is linear and one quadratic, and show the solution set on a number line. Use set notation to define solutions to inequalities. 	<ul style="list-style-type: none"> Weekly controlled homework. Teacher assessment during lesson. Mock assessments.
<p>Similar shapes, congruency and geometrical proof</p>	<ul style="list-style-type: none"> Similar lengths, areas and volumes. Congruency. Geometric proof. 	<ul style="list-style-type: none"> Apply the concept of similarity, including the relationships between lengths, areas and volumes in similar figures. Use basic congruence criteria for triangles (SSS, SAS, ASA and RHS). Apply angle facts, triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides, including Pythagoras' theorem and the fact that the base angles of an isosceles triangle are equal, and use known results to obtain simple proofs. 	<ul style="list-style-type: none"> Weekly controlled homework. Teacher assessment during lesson. Mock assessments.
<p>Exponential growth and decay and iteration</p>	<ul style="list-style-type: none"> Exponential growth and decay. Iterative processes. 	<ul style="list-style-type: none"> Use multipliers to explore exponential growth and decay (to include iterative processes eg, $P_{n+1} = kP_n$). Set up, solve and interpret the answers in real-life growth and decay problems, including compound interest. Work with general iterative processes. 	<ul style="list-style-type: none"> Weekly controlled homework. Teacher assessment during lesson. Mock assessments.

Trigonometry and Functions	<ul style="list-style-type: none">• Trigonometric equations.• Function notation.• Transformations of functions.	<ul style="list-style-type: none">• Graphs of trigonometric functions ($y = \sin \theta$, $\cos \theta$ and $\tan \theta$) and exact values when $\theta = 0, 30, 45, 60$ and 90).• Solutions of simple trigonometric equations• Use and understand function notation.• Find and interpret inverse functions and composite functions.• Transformations of graphical functions (translations and reflections, $y = k/x$ and $y = ka^x$).	<ul style="list-style-type: none">• Weekly controlled homework.• Teacher assessment during lesson.• Mock assessments.
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