



Yr 11	Golden Threads: There are six key areas of study throughout – Number, Algebra, Ratio and Proportion, Geometry and Measure, Probability, and Statistics. Whilst these areas can appear distinct students are encouraged to see the connections across mathematical ideas. We also look to develop their fluency, mathematical reasoning and competence in solving increasingly sophisticated problems.		Enrichment: UKMT Intermediate Maths Challenge Careers links		Review and evaluation: July 2024
	Title & Substantive Knowledge	Assessment	Misconceptions	Key Vocabulary	Knowledge tracking
Term 1	Indices and Roots This block consolidates the previous two blocks focusing on understanding powers generally, and in particular in standard form. Negative and fractional indices are explored in detail. Much of this content will be familiar from KS3, particularly for Higher tier students. - recognise and use sequences of square and cube numbers - calculate with roots, and with integer {and fractional} indices - calculate with numbers in standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer - simplifying expressions involving sums, products and powers, including the laws of indices	45 minute in class formative assessment covering - Types of number - Indices and Roots	Multiplying powers instead of adding with index laws. Just counting the zeros instead of the place value when converting between standard and ordinary form. Omitting to complete the power on the constant when expanding, for example, $(5x^3)^2$	Root Power Index Standard form Base Ordinary form Simplify Reciprocal Factorise Prove Counterexample	Already Seen: Year 10 Term 6 – Sequences, Work with powers and roots, Calculate with standard form To Build Towards: A Level Content – Yr12 T1 - Index Laws, manipulation to allow for differentiation and integration in Yr12 T2.
	Manipulating expressions Recap learning of equations and inequalities, providing revision and reinforcement for Foundation tier students and an introduction to algebraic fractions for those following the Higher tier. Students can revise fraction arithmetic to keep their skills sharp. Algebraic argument and proof are considered. - simplify and manipulate algebraic expressions by factorising quadratic expressions of the form $x^2 + bx + c$ {including those involving surds and algebraic fractions – Higher Only} - know the difference between an equation and an identity - argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments {and proofs – Higher Only}		When working with algebraic fractions, using addition and subtraction on the numerator and denominator to manipulate the expression	Coefficient Expression Term Identity Equivalent	Already Seen: Year 10 Term 1 – Factorising quadratics of the form (H) Year 8 Term 3 – Identify formulae, expressions, identities and equations To Build Towards: A Level Content - a golden thread at A-level is mathematical argument.
	Gradients and Lines Building on learning from Year 9 & 10, students will plot straight lines from a given equation, and find and interpret the equation of a straight line from a variety of situations and given information. There is the opportunity to revisit graphical solutions of simultaneous equations. Higher tier students also study the equations of perpendicular lines. - move between different numerical, algebraic, graphical & diagrammatic representations - plot and interpret graphs & interpreting the gradient of a straight line graph as a rate of change		- Not manipulating the expression to identify the gradient and y intercept when an equation of a line isn't in the $y=mx+c$ form - Trying to solving graphical simultaneous	Parallel Gradient Intercept Linear Reciprocal Perpendicular	Already Seen: Year 10 Term 2 – Form and solve linear simultaneous equations, Solve linear simultaneous equations graphically Year 9 Term 1 – Explore perpendicular lines (H) To Build Towards:



	- use the form $y = mc + c$ to identify parallel {and perpendicular} lines; find the equation of the line through two given points, or through one point with a given gradient - find approximate solutions to two simultaneous equations using a graph		equations algebraically. Only completing one of the negative reciprocal operations when finding the perpendicular gradient.		A Level Content – Yr12 T1 – Straight line graphs.
	Non-linear graphs Students develop their knowledge of non-linear graphs in this block, looking at quadratic, cubic and reciprocal graphs so they recognise the different shapes. They find the roots of quadratics graphically. Higher tier students also look at simple exponential graphs and the equation of a circle. Note that the equation of the tangent to a circle is covered later when the circle theorem of tangent/radius is met. Higher students also extend their understanding of gradient to include instantaneous rates of change considering the gradient of a curve at a point. - recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function 1 {and the exponential function $y = k^x$ - H only} - plot and interpret graphs (including reciprocal graphs {and exponential graphs}) - find approximate solutions using a graph - identify and interpret roots, intercepts of quadratic functions graphically recognise and use the equation of a circle with centre at the origin – H only		- Identifying roots as a co-ordinate rather than a value - Reading of x intercepts when asked to solve an equation not equal to zero - Not square rooting the constant to find the radius of a circle from the equation.	Quadratic Cubic Exponential Reciprocal Asymptote Gradient Solution Growth/ decay Tangent Radius	Already Seen: Year 9 Term 6 – Interpret graphs in various forms Year 10 Term 2 - Solve linear simultaneous equations graphically To Build Towards: A Level Content – Yr12 T1 – Sketching and transforming graphs
Term 2	Using graphs This block revises conversion graphs and reflection in straight lines. Students also study other real-life graphs, including speed/distance/time, constructing and interpreting these. - Plot & interpret graphs of non-standard functions in real contexts, to find approx. solutions to problems such as simple kinematic problems involving distance, speed and acceleration interpret the gradient at a point on a curve as the instantaneous rate of change; apply the concepts of instantaneous and average rate of change (gradients of tangents and chords) calculate or estimate gradients of graphs and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts	1.5 hour in class summative assessment covering all KS4 content to date – GCSE style paper.	- Not reading the scale when calculating the gradient in context - Omitting to identify the relationship between distance time graphs & speed.	Reflect Convert Gradient Direct proportion Interpret Constant Piece-wise Estimate Trapezium	Already Seen: Year 8 Term 2 – Exploring gradient and non-linear graphs Year 9 Term 1 – Use and interpret $y = mx + c$ To Build Towards: A Level Content – Yr12 T2 - Differentiation
	Expanding and factorising This block reviews expanding and factorising with a single bracket before moving on to quadratics. The use of algebra tiles to develop conceptual understanding is encouraged throughout. Context questions are included to revisit e.g. area and Pythagoras' theorem. - know the difference between an equation and an identity; argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments - simplify and manipulate algebraic expressions by: factorising quadratic expressions, including the difference of two squares - know the difference between an equation and an identity; solve quadratic equations {including those that require rearrangement} algebraically by factorising,		- Trying to factorise an expression such as $x^2 + 3x$ into 2 brackets. - Not expanding a single bracket squared as a double bracket	Expand Factorise Coefficient Difference of two squares Quadratic Solve Roots Solutions Turning point	Already Seen: Year 8 Term 3 – Form and solve equations with brackets Year 9 Term 1 – Form and solve equations and inequalities with unknowns on both sides Year 10 Term 2 – Solve quadratics equations and inequalities by factorising To Build Towards:



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Term 3	- solve quadratic equations by completing the square and by using the quadratic formula - H - identify and interpret roots; deduce roots algebraically {and turning points} - solve two simultaneous equations algebraically & find approximate solutions using a graph				A Level Content – Yr12 T1 – Completing the Square and Quadratic formula in more complex settings
	Changing the subject Students consolidate and build on their study of changing the subject in Year 9. There is time to review solving equations and inequalities before moving on to rearrangement of both familiar and unfamiliar formulae. Higher tier students also study solving equations by iteration. - solve linear inequalities in one variable - know the difference between an equation and an identity - mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments (and proofs) - translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution		- Not completing the inverse operation - Not completing an operation to all terms	Equation Subject Coefficient Inverse Rearrange Expand Factorise	Already Seen: Year 9 Term 1 – Form and solve equations and inequalities with unknowns on both sides Year 8 Term 3 – Identify formulae, expressions, identities and equations To Build Towards: A Level Content – Yr12 T1 – Algebraic manipulation
	Functions This block introduces formal function notation ($f(x) = \dots$) and builds on knowledge of quadratic functions and graphs from the previous block. This is also an opportunity to revisit trigonometric functions first met in Year 10 Term 2. - Function Machines and Substitution (Recap) - Use function notation to evaluate functions and solve equations involving functions. - Understand and use composite and inverse functions (Higher only) - Turning points and solutions to quadratic functions - Solve Quadratic Inequalities (Higher only) - Understand and use trigonometric functions (Recap)	Internal Assessments in January covering the entire syllabus up to that point. 1.5 hour Non-calculator and 1.5 hour Calculator paper in the hall. A further Calculator paper is completed in class.	- Identifying the difference between $f(3)$ and $f(x) = 3$ - Not returning to the original variable if using $y=$ to find the inverse function	Function Variable Operation Composite Inverse Input Output	Already Seen: Year 10 Terms 1 & 2 - Work on graphs where students will have been plotting various graphs. Year 7 Term 1 - Function Machines and Substitution Year 10 Term 1 - Solving quadratic equations and linear inequalities To Build Towards: A Level Content – Yr12 T1 – Quadratic Functions
	Multiplicative Reasoning Student develop their multiplicative reasoning through a range of contexts, from simple scale factors through to complex equations involving direct proportion. They link inverse proportion with the formulae for pressure and density. There is also the opportunity to review ratio problems. - Use scale factors (Recap) - Understand and use direct and inverse proportion – word problems and graphs. - Construct and use direct and inverse proportion equations (Higher only) - Calculate with Pressure and Density - Solve Ratio problems (Recap)		- Using direct proportion for an indirect proportion question - Not converting to the correct volume or area units when dealing with volume or pressure	Similar Linear Origin Constant of Proportionality Pressure Density	Already Seen: Year 8 Term 1 – Scale diagrams, Conversion graphs, Direct proportion graphs Year 9 Term 5 – Direct and inverse proportion Year 10 Term 1 – Enlargement, Area and volume Year 10 Term 4 – Ratios and fractions To Build Towards:
	Geometric Reasoning		Stating the opposite angles in a	Adjacent Vertically Opposite	Already Seen:



Term 4	Students consolidate their knowledge of angles facts and develop increasingly complex chains of reasoning to solve geometric problems. Higher tier students revise the first four circle theorems studied in Year 10 and learn the remaining theorems. Students also revisit vectors and the key topics of Pythagoras' theorem and trigonometry. - reason deductively in geometry, number and algebra, including using geometrical constructions - interpret and use bearings - apply addition & subtraction of vectors, multiplication by a scalar. Use vectors to construct geometric arguments and proofs. apply and prove the standard circle theorems.		quadrilateral sum to 180 when one vertex is at the centre	Parallel Perpendicular Bearing Interior Exterior Regular Polygon Radius Tangent Segment	Year 10 Term 1 – Proof with angle rules Year 10 Term 3 – Circle Theorems, Bearings Year 10 Term 4 - Vectors To Build Towards: A Level Content - a golden thread at A-level is mathematical argument.
	Algebraic Reasoning Students develop their algebraic reasoning in more complex situations, looking for patterns and counter examples to support and construct algebraic arguments. This topic allows for an opportunity to review simultaneous equations and solving equations algebraically. - Simplifying expressions - Finding nth term of linear and quadratic sequences - Solving linear simultaneous equations and simultaneous equations with one quadratic Forming algebraic proofs	Regular in class past papers.	- Treating all sequences as linear. - When proving, using n as an even value, rather than 2n and failing to state n must be an integer.	Expression Coefficient Linear Quadratic Eliminate Substitute Proof Justify	Already Seen: Year 8 Term 3 – Simplify expressions involving brackets, nth term of a linear sequence Year 10 Term 2 – Form and solve linear simultaneous equations To Build Towards: A Level Content – Yr12 T1 – solving complex quadratics & simultaneous equations
	Transforming and Constructing Students explores all transformation and constructions, both describing and performing the action. Emphasis is put on the language used to promote deeper thinking. Higher tier students explore the idea of invariance and use trigonometric graphs as a vehicle for exploring graph transformations. - Performing and describing reflections, rotations, enlargements (including negative scale factors) and translations. - Perform standard constructions and solve loci problems. Explore trigonometric graphs Identify and sketch graph transformations		- Not stating the type of transformation when asked to describe - Treating $f(x + a)$ as a translation of a units to the right	Reflection Rotation Enlargement Scale factor Translation Vector Rotational Symmetry Centre of enlargement Centre of rotation Mirror Line Invariant Bisector Perpendicular Mapping Loci Equidistant	Already Seen: Year 10 Term 1 – Enlargement and scale factors Year 9 Term 2 – Ruler and compass constructions To Build Towards: A Level Content – Y12 T2 – Transforming graphs, Trig ratios and equations
	Listing and Describing Students look at organising information, with links made to probability and other aspects of Data Handling. Higher tier students explore the product rule for counting. - Work with organised lists Product rule for counting - Complete and use Venn diagrams - Complete and interpret plans and elevations		- Not taking into account repeated options when listing - Not identifying the centre as being in A and	Systematic Exhaustive Outcomes Union Intersect Compliment Plan view Elevation	Already Seen: KS4 – Apply systematic listing strategies Year 8 Term 2 – Use tables and Venn diagrams Year 10 Term 5 – Compare distributions

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	- Compare data distributions		B if asked to find $P(A)$ from a Venn diagram.		To Build Towards: A Level Content – Yr12 T4 – Probability incl venn diagrams
	Show that Focus is put on exam technique and clear mathematical communication in a range of contexts. For higher tier students this extends to using algebraic and geometric arguments for proofs. “Show that” style questions involving number, algebra, shape, angles, data, vectors, congruent triangle Formal proof with congruent triangles		Solving identities as an equation, rather than proving that one is equal to the other.	Sum Product Coefficient Prove Similar Congruent Condition	Already Seen: This topic focusses on mathematical communication and draws upon knowledge from all years and topics To Build Towards: A Level Content – a golden thread at A-level is mathematical argument.
Term 5	N/A – Revision				
Term 6	N/A				