Sheldon School

BE KIND | BE BRAVE | BE THE BEST YOU

Curriculum Plan

KS3 – Mathematics

Year 9

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 Junior Maths Challenge
- Weekly puzzle club
- Bletchley Park trip

Review and Evaluation

July 2024

Term 1

Topics & Substantive Knowledge	Assessment	Misconceptions	Key Vocabulary	Knowledge Tracking
Straight Line Graphs This block builds on Year 8 content where students plotted simple straight-line graphs. They now study y = mx + c as the general form of the equation of a straight line, interpreting m and c in abstract and real-life contexts, and reducing to this form in simple cases. This will be explored further in the next block when students rearrange formulae. Higher strand students will also consider inverse relationships and perpendicular lines. • develop algebraic and graphical fluency • recognise, sketch and produce graphs of linear and quadratic functions of one variable with appropriate scaling, using equations in x and y and the Cartesian plane • reduce a given linear equation in two variables to the standard form • y = mx + c ; calculate and interpret gradients and intercepts of graphs of such linear equations numerically, graphically and algebraically • use linear and quadratic graphs to estimate values of y for given values of x and vice versa and to find approximate solutions of simultaneous linear equations • solve problems involving direct and inverse proportion, including graphical and algebraic	End of Term 1 – In class, 45minute assessment on the first three blocks of learning.	Confusing x and y axis when plotting coordinates Not connecting the points on a straight-line graph Requiring the general form y=mx+c before identifying the gradient or y-intercept	Axis Curve Direct Proportion Function Gradient Horizontal Intercept Interpret Inverse Proportion Linear Negative Parallel Perpendicular Positive Rearrange Slope Steep Vertical Y-Intercept	**Already Seen:** Year 7 Term 1 - Algebraic Notation, Substitute into expressions Year 8 Term 2 - Using coordinates and plotting graphs **To Build Towards:** Year 10 Term 2 – Solve linear simultaneous equations graphically
Equations and Inequalities Students revisit and extend their knowledge of forming and solving linear equations and inequalities, including those related to different parts of the mathematics curriculum. They also explore rearranging formulae, seeing how this links to solving equations and reinforcing their understanding of the difference between equations, formulae, identities and expressions. • move freely between different numerical, algebraic, graphical and diagrammatic representations • use algebraic methods to solve linear equations in one variable • understand and use mathematical formulae; rearrange formulae to change the subject • model situations or procedures by translating them into algebraic expressions or formulae, and by using graphs		Not applying the inverse operation to both sides when solving equations When changing the subject, subtracting a term and not including it in the next line	Balance Coefficient Form Formula Formulae Greater than Inequality Inverse Inverse Operation Less than Rearrange Satisfy Solution Solve Subject Substitute Unknown Variable	**Already Seen:** Year 7 Term 4 - Form and solve two-step equations Year 8 Term 3 - Solve inequalities Year 8 Term 4 - Identify and use formulae, expressions, identities and equations **To Build Towards:** Year 10 Term 1 – Represent solutions to inequalities on number line Year 10 Term 2 – Form and solve linear simultaneous equations

continued next page

Curriculum Plan
KS3 – Mathematics
Year 9

	Topics & Substantive Knowledge	Assessment	Misconceptions	Key Vocabulary	Knowledge Tracking
Term 1 (continued)	**Testing Conjectures** Revisit primes, factors and multiples, which provides a wealth of opportunity to make and test simple conjectures. Students also develop their algebraic skills through developing chains of reasoning and learning how to expand a pair of binomials, which Higher strand students met in Y8. • make and test conjectures about patterns and relationships; look for proofs or counterexamples • begin to reason deductively in geometry, number and algebra • use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, HCF, LCM, prime factorisation • simplify and manipulate algebraic expressions by expanding products of two binomials	(see above)	Confusing factors and multiples. Only multiplying the first term in a single bracket when expanding. When expanding double brackets, if one term is negative, subtracting instead of multiplying.	Binomial Common Conjecture Counterexample Demonstrate Expand Express Expression Factor Factorise Multiple Prime Prove Quadratic Term Verify	**Already Seen:** Year 8 Term 3 - Find the rule for the nth term of a linear sequence, Expand a single bracket **To Build Towards:** Year 10 Term 5 – Revise and extend KS3 content

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Curriculum Plan

KS3 – Mathematics

Year 9

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Term 2	**Three Dimensional Shapes** This is the first time students have studied 3-D shapes formally at KS3, so will be reminded about the associated vocabulary. As well as surface area and volume, students will also explore plans and elevations. For students following the Higher strand, there is a step on investigating volumes of other 3-D shapes. • use language and properties precisely to analyse numbers, algebraic expressions, 2-D and 3-D shapes • use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D • derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders)	End of Term 2 – In class, 45minute assessment all Term 1 & 2 topics.	Calling a cube a square (or cuboid a rectangle) Getting perimeter and area mixed up.	Base Compound Cone Cross-section Curved Surface Area Dimensions Edge Face Formulae Front/Side Elevation Net Perpendicular Height Perspective Plan Polygon Prism Pyramid Tetrahedron Vertex	**Already Seen:** Year 7 Term 1 - perimeter problems and areas of rectangles, parallelograms and triangles. Year 8 Term 5 - Areas of trapezia, circles and compound shapes **To Build Towards**: Year 10 Term 3 – Surface areas and volumes of cylinders, cones and spheres
	Constructions and Congruency This block builds on the constructions studied during Years 7 and 8 to formally look at the idea of a locus and the standard constructions using a straight edge and a pair of compasses. Congruency is also explored, again taking a practical approach to compare congruent figures of all kinds before looking at the formal aspect of identifying congruent triangles. • draw and measure line segments and angles in geometric figures, including interpreting scale drawings • Construct triangles using SSS, SAS & ASA • Construct quadrilaterals and more complex polygons • derive and use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/ at a given point, bisecting a given angle); recognise and use the perpendicular distance from a point to a line as the shortest distance to the line • describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric • use the standard conventions for labelling the sides and angles of triangle ABC, and know and use the criteria for congruence of triangles		When using AAS, not checking that the side is matching. When using SAS, not checking that the angle is included. If there is a right angle, using the RHS test and ignoring the possibility of SAS.	Acute Arc Bisector Congruent Construction Lines Conversion Corresponding side Equidistant Equilateral Isosceles Line Segment Locus/Loci Multiplier Net Obtuse Pair of Compasses Path Perpendicular Prism Protractor Ratio Reflect Reflection Scale Scalene	**Already Seen:** Year 7 Term 5 - Geometric notation, Draw lines angles and simple shapes Properties of triangles and quadrilaterals Year 8 Term 1 - Work with scale factors Year 8 Term 5 - Revise and extend year 7 coverage. **To Build Towards:** Year 10 Term 1 – Similarity and enlargement

Curriculum Plan
KS3 – Mathematics
Year 9

Term 3

Topics & Substantive Knowledge	Assessment	Misconceptions	Key Vocabulary	Knowledge Tracking
Reasoning with Number Students will develop their knowledge of the number system to include rational and real numbers, with the higher strand also looking at simple surds. The block provides plenty of opportunity for students to revisit and practise their number skills both with and without a calculator as necessary. Standard form and HCF/LCM are also revisited. • Use the four operations, including formal written methods, applied to integers, decimals, proper and improper factions, and mixed numbers, all both positive and negative. • Use the concepts and vocabulary of prime numbers, factors (divisors), multiples, • common factors, common multiples, highest common factor, lowest common • multiple, prime factorisation, including using product notation and the unique • factorisation theorem. • Interpret and compare numbers in standard form A x 10n • where $1 \leq A < 10$ and n is a positive or negative • integer or zero. • Appreciate the infinite nature of the sets of integers, real and rational numbers.	End of Term 3 – In class, 45minute assessment on the three Term 3 blocks of learning.	Incorrectly writing standard form where the value at the front is not between 1 and 10. Not converting between standard units correctly.	Common Factor/ Multiple Exponent HCF Index Irrational LCM Operation Power Prime Product of primes Rational Real Standard Form	**Already Seen:** Year 7 Term 2 – Use the four operations with positive integers and decimals, Use calculator Year 7 Term 4 – Add and subtract fractions including mixed numbers Year 8 Term 4 - Knowledge and understanding of types of number, standard form, HCF and LCM, real and rational numbers, fraction arithmetic **To Build Towards:** Year 10 Term 5 – Calculate with surds Year 10 Term 6 – Calculate with standard form
Using Percentages Building on their revision of fractions in the last block, students relate these to fractions and decimals, extending their learning in Year 8. All students will look at 'reverse' percentage problems with higher attainers stretched by looking at repeated percentage change. Both calculator and non-calculator methods are encouraged, with the use of decimal multipliers again key. • Interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively • express one quantity as a percentage of another • compare two quantities using percentages • work with percentages greater than 100%. • Solve problems involving percentage change, including percentage increase/ decrease, and original value problems and simple interest including in financial mathematics.		Incorrect use of multipliers (e.g. 5% increase is 0.05, not 1.05). Not dividing by multipliers to find reverse percentages. Incorrect multipliers for increase/decrease. Not dividing by the multiplier for reverse percentages. Thinking the 'new' is the 'original'.	Bar Model Change Convert Decrease Equivalent Increase Multiplier Proportion Repeated Reverse	**Already Seen:** Year 7 Term 2 – Interchange between fractions, decimals and percentages up to 100% Year 8 Term 4 - Coverage of fractions, percentages and decimals. **To Build Towards:** Year 10 Term 4 – Simple and compound interest, Find original values

continued next page

Curriculum Plan
KS3 – Mathematics
Year 9

	Topics & Substantive Knowledge	Assessment	Misconceptions	Key Vocabulary	Knowledge Tracking
Term 3 (continued)	**Maths and Money** Students practise their number skills in various financial contexts in this block. The language of financial mathematics, already introduced in Years 7 and 8, is further developed. Simple ideas of tax and wages are introduced, and the percentages studied in the last block are applied in various contexts including simple and compound interest. • solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics • select and use appropriate calculation strategies to solve increasingly complex problems • interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning. • develop their use of formal mathematical knowledge to interpret and solve problems, including in financial mathematics	(see above)	(see above)	Annual Appreciate Balance Bill Compound Credit Debit Deposit Depreciate Expense Interest Loss Per Annum Principal Profit Rate Salary Simple Tax Unit VAT Wage	**Already Seen:** Year 8 Term 4 - Work in the context of financial mathematics. **To Build Towards:** Year 10 Term 6 – Simple and compound interest, Finding original values

Curriculum Plan
KS3 – Mathematics
Year 9

	Topics & Substantive Knowledge	Assessment	Misconceptions	Key Vocabulary	Knowledge Tracking
Term 4	**Deduction** Students revise and extend their knowledge of angles rules and properties of shapes, applying them to increasingly complex problems. • Angles in parallel lines • Solve angle problems using chains of reasoning • Angle problems with algebra • Conjectures with angles • Conjectures with shapes • Link constructions and geometrical reasoning (H)	End of Term 4 – In class, 45minute assessment all Term 3 & 4 topics.	Not remembering angles around a point sum to 360, thinking it's 180. Adding all angles on the same line together even if they are in different places Giving the wrong reasons for angle reasoning questions. Confusing alternate and corresponding angles. Incorrectly label or interpret shape labels (e.g. not understanding what angle ABC means). Not using conventions correctly, especially small letters for sides, capitals for angles. Incorrect use of symbols for labelling shapes (e.g. using >> for equal length not parallel)	Alternate Bisect Bisector Co-interior Conjecture Construct Corresponding Counterexample Equidistant Exterior Interior Isosceles Justify Kite Locus Parallel Parallelogram Perpendicular. Prove Regular Rhombus Transversal	**Already Seen:** Year 7 Term 5 – Angles at a point, Adjacent angles on a straight line, vertically opposite angles, angles in triangles and quadrilaterals Year 8 Term 5 – Angles in parallel lines **To Build Towards:** Year 11 Term 4 - Re-visit and extend KS3 and year 10 work, Loci
	Rotation and Translation Building on their study of line symmetry and reflection in Year 8, students now look at rotational symmetry and rotation. They then move on to study translations which are described in vector form. They compare the different effects of transformations studied so far, noticing that the objects and images are congruent. • Identify the order of rotational symmetry of a shape • Compare & contrast rotational symmetry with line symmetry • Rotate a shape about a point on a shape • Rotate a shape about a point not on a shape • Translate points and shapes by a given vector • Compare rotation & reflection of shapes • Find the result of a series of transformations (H)		Translating one corner of the shape correctly but then incorrectly drawing the rest of the shape. Rotating the shape the wrong direction and missing clockwise/anti-clockwise instruction. Always reflecting the shape over an axis rather than using the correct mirror line on a graph. Reflecting the shape multiple times (into each quadrant)	Anti-clockwise Clockwise Image Invariant Irregular Mirror Reflect Regular Rotation(al) Symmetry Translate Vector Vertex	**Already Seen:** Year 8 Term 5 - Recognise line symmetry, Reflect shapes in a given line **To Build Towards:** Year 10 Term 1 - Similarity and enlargement Year 10 Term 3 - Parts of a circle

continued next page

Curriculum Plan
KS3 – Mathematics
Year 9

	Topics & Substantive Knowledge	Assessment	Misconceptions	Key Vocabulary	Knowledge Tracking
Term 4 (continued)	**Pythagoras' Theorem** Students revise squares and square roots before moving on to investigate the relationship between the sides of a right angled triangle. The converse of the theorem is emphasised so that the students are aware that of the sides of a triangle satisfy the rule a^2 + b^2 = c^2 then the triangle must be right angled. Students explore using the theorem in a variety of contexts, including on coordinate axes and a higher step is included using 3D shapes • Squares & square roots (R) • Identify the hypotenuse of a right-angled triangle • Determine whether a triangle is right-angled • Calculate the hypotenuse of a right-angled triangle • Calculate missing sides in right-angled triangles • Use Pythagoras' Theorem on coordinate axes • Explore proofs of Pythagoras' Theorem • Use Pythagoras' Theorem in 3D shapes (H)	(see above)	Not square rooting in the final step in Pythagoras. Forgetting to use the re-arranged formula when finding a shorter side, not the hypotenuse.	Adjacent Decimal places Gradient Hypotenuse Line segment Opposite Origin Quadrant Significant figures Square root	**Already Seen:** Year 8 Term 5 – Find and prove simple geometric facts **To Build Towards:** Year 10 Term 1 - Revise Pythagoras' Theorem, Use Trigonometry to find missing sides and angles in right-angled triangles, Exact trig values, Angle of a general triangle Year 10 Term 3 - Revisit Pythagoras' Theorem and trigonometry in the context of bearings

Curriculum Plan
KS3 – Mathematics
Year 9

	Topics & Substantive Knowledge	Assessment	Misconceptions	Key Vocabulary	Knowledge Tracking
Term 5	**Enlargement and Similarity** Students develop their knowledge of transformations to include enlargement, learning the mathematical meaning of the word similar. Linking back to other transformations as necessary. If appropriate students can move on to negative scales factors. Finding unknown sides in similar shapes and this can be extended to formal similar triangles problems. • construct similar shapes by enlargement, with and without coordinate grids • use scale factors, scale diagrams and maps • apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides • understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction • use Pythagoras' Theorem in similar triangles to solve problems involving right-angled triangles	End of Term 5 – In class, 45minute assessment on the three Term 5 blocks of learning.	Similar shapes - when drawn together, not drawing separately and getting correct length. Using non-corresponding sides to find scale factor	Corresponding Enlargement Image Inverted Object Orientation Ratio Rotation Scale Factor	**Already Seen:** Year 8 Term 2 - Scale factors, scale diagrams and similar shapes. **To Build Towards:** Year 10 Term 1 - Enlargement, Area and volume similarity (H)
	Ratio and Proportion Building on students' experience in previous years, here they solve all types of ratio problems and make the links with direct proportion and graphs. Students formally study inverse proportion for the first time, and if following the Higher strand they also look at graphs of inverse relationships. If appropriate, students could also look at more complex problems involving algebra. Students also revisit 'best buys' comparing unit pricing from earlier in the year with alternative methods such as using scaling. • 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 • 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		Ratio amounts are often confused with fractions involving the same digits. For instance, 2 : 3 is confused with ⅔ or 1 : 2 = ½ When solving problems involving proportion students tend to struggle with forming a ratio. For instance, 3 apples cost 45p would form the ratio apples : cost.	Constant Direct/Inverse Proportion Gradient Linear Multiplier Non-Linear Proportional Ratio Relationship Unit Cost Variable	**Already Seen:** Year 8 Term 1 - Understanding and using ratio notation **To Build Towards:** Year 10 Term 1 - General trigonometry is introduced

continued next page

Curriculum Plan
KS3 – Mathematics
Year 9

	Topics & Substantive Knowledge	Assessment	Misconceptions	Key Vocabulary	Knowledge Tracking
Term 5 (continued)	**Rates** Students develop their knowledge of inverse relationships to explore speed, distance and time in detail. They also look at graphs and the link between the speed/distance/time formulae and density/mass/volume. Students go on to explore other compound units including exploring flow problems such as how long it will take to fill/empty tanks of different shapes at different rates. Students following the Higher strand will also look at converting compound units such as m/s to km/h. • use compound units such as speed, unit pricing and density to solve problems • understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction • change freely between related standard units [for example time, length, area, volume/capacity, mass]	(see above)	Thinking a line going in the opposite direction, even with the same gradient, indicates a different speed.	Accuracy Average Axes Constant Rate Convert Curve Density Flow Rate Imperial Mass Metric Origin Prism Rearrange Substitute Units Volume Volume	**Already Seen:** Year 8 Term 1 - Gradient **To Build Towards:** Year 10 Term 4 – Repeated percentage change including compound interest, Growth and decay problems

Curriculum Plan
KS3 – Mathematics
Year 9

Term 6

Topics & Substantive Knowledge	Assessment	Misconceptions	Key Vocabulary	Knowledge Tracking
Probability In this block, students build on their learning in Year 7 and 8 to calculate the probabilities of single and combined events. A key focus is the introduction of the idea of independent events. Students will also look at a variety of diagrams that support probability such as sample space diagrams, two way tables and Venn diagrams. Tree diagrams considering both with and without replacement are included as higher steps. • Single event probability (R) • Relative frequency - including convergence • Expected outcomes • Independent events • Use tree diagrams (H) • Use tree diagrams to solve without replacement problems (H) • Use diagrams to work out probabilities	End of Term 6 – End of Year assessment on all Year 9 topics. In class - 45minutes.	All events are equally likely. Later events may be affected by or compensate for earlier ones. When determining probability from statistical data, simple size is irrelevant Results of games of skill are unaffected by the nature of the participants "Lucky/Unlucky" numbers, etc. can influence random events In random events involving selection, results are dependent on numbers rather than ratios If events are random then the results of a series of independent events are equally likely, e.g. Heads Heads (HH) is as likely as Heads Tails (HT) When considering spinners, probability is determined by number of sections rather than size of angles	(Relative) Frequency Biased Event Expected Experiment Fair Independent Intersection Outcome Sample Space Trial Two-way Table Unbiased Union Venn Diagram	**Already Seen:** Year 7 Term 6 - Calculate simple probabilities, Use the probability scale Sample spaces, Understand and use set notation (including Venn diagrams), Know the sum of probabilities is 1 Year 8 Term 2 - Construct sample spaces to find probability, Use tables and Venn diagrams to find probabilities **To Build Towards:** Year 10 Term 4 - Effect of sample space of estimated probabilities, Use tree diagrams Year 11 Term 4 - Review using sample spaces and probability rules

continued next page

Curriculum Plan
KS3 – Mathematics
Year 9

	Topics & Substantive Knowledge	Assessment	Misconceptions	Key Vocabulary	Knowledge Tracking
Term 6 (continued)	**Algebraic Representation** Students extend their knowledge of graphs to look at interpretation and creation of different types of graphs. The first non-linear graph explored is the quadratic graph, where students are encouraged to look at the symmetry of the curve and read off x/y values. They also explore reciprocal end exponential graphs. Students knowledge of straight line graphs is extended by looking at inequalities graphical, and these are also represented as number lines. In addition, solution of simultaneous equations by graphical methods is also included as a Higher step. • 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, including piece-wise linear, exponential and reciprocal graphs • use linear graphs to estimate values of y for given values of x and vice versa and to find approximate solutions of simultaneous linear equations understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors	(see above)		Discontinuous Exponential Intersection Parabola Quadratic Reciprocal Simultaneous Solution Set Symmetry Turning Point Vertex	**Already Seen:** Year 7 Term 1 - Algebraic Notation Year 8 Term 3 - Form and solve equations and inequalities **To Build Towards**: Year 10 Term 1 – Factorising quadratics, Represent solutions to inequalities on number lines Year 10 Term 2 – Form and solve linear simultaneous equations