(GCSE Mathematics - FT) Year 10 Long Term Plan

Rationale (with end points): In year 10 we continue with the GCSE course and aim to finish at the end of year 10. Throughout the year students will look deeper into the key areas of maths; Algebra, Number, Ratio and proportion, Shape and space and Probability and statistics.

Term	Topic	Knowledge	Skills	*Reading /wider reading*
Autumn term 1	Unit 1: Number	• Calculations • Decimals • Place value • Indices, powers & roots • Factors, multiples & primes	• Find squares and cubes: – recall integer squares up to 10 x 10 and the corresponding square roots; – understand the difference between positive and negative square roots; – recall the cubes of 1, 2, 3, 4, 5 and 10; • Use index notation for squares and cubes; • Recognise powers of 2, 3, 4, 5; • Evaluate expressions involving squares, cubes and roots: – add, subtract, multiply and divide numbers in index form; – cancel to simplify a calculation; • Use index notation for powers of 10, including negative powers; • Use the laws of indices to multiply and divide numbers written in index notation; • Use brackets and the hierarchy of operations with powers inside the brackets, or raising brackets to powers; • Use calculators for all calculations: positive and negative numbers, brackets, square, cube, powers and roots, and all four operations. • List all three-digit numbers that can be made from three given integers; • Recognise odd, even and prime (two digit) numbers; • Identify factors and multiples and list all factors and multiples of a number systematically; • Find the prime factor decomposition of positive integers and write as a product using index notation; • Find common factors and common multiples of two numbers;	Murderous Maths: Trigonometry the Fiendish Angletron by Kjartan Poskitt

			• Find the LCM and HCF of two numbers, by listing, Venn diagrams and using prime factors: include finding LCM and HCF given the prime factorisation of two numbers; • Understand that the prime factor decomposition of a positive integer is unique – whichever factor pair you start with – and that every number can be written as a product of two factors; • Solve simple problems using HCF, LCM and prime numbers.	
	Unit 2: Algebra	● Algebra – the basics ● Expressions and substation into formulae	● Solve simple problems using HCF, LCM and prime numbers. ● Use notation and symbols correctly; ● Write an expression; ● Select an expression/equation/formula/identity from a list; ● Manipulate and simplify algebraic expressions by collecting 'like' terms; ● Multiply together two simple algebraic expressions, e.g. $2a \times 3b$; ● Simplify expressions by cancelling, e.g. $\frac{4x}{2} = 2x$; ● Use index notation and the index laws when multiplying or dividing algebraic terms; ● Understand the ≠ symbol and introduce the identity ≡ sign; ● Multiply a single number term over a bracket; ● Write and simplify expressions using squares and cubes; ● Simplify expressions involving brackets, i.e. expand the brackets, then add/subtract; ● Argue mathematically to show algebraic expressions are equivalent; ● Recognise factors of algebraic terms involving single brackets; ● Factorise algebraic expressions by taking out common factors; ● Write expressions to solve problems representing a situation; ● Substitute numbers into simple algebraic expressions; ● Substitute numbers into expressions involving brackets and powers; ● Substitute positive and negative numbers into expressions; ● Derive a simple formula, including those with squares, cubes and roots; ● Substitute numbers into a (word) formula;	

	Unit 3: Graphs, tables & charts	• Tables, charts & graphs • Pie charts • Scatter graphs •	• Use suitable data collection techniques (data to be integer and decimal values); • Design and use data-collection sheets for grouped, discrete and continuous data, use inequalities for grouped data, and introduce ≤ and ≥ signs; Sort, classify and tabulate data, both discrete and continuous quantitative data, and qualitative data; Extract data from lists and tables; • Use correct notation for time, 12- and 24-hour clock and work out time taken for a journey from a timetable; • Construct tables for time-series data; • Design, complete and use two-way tables for discrete and grouped data; • Calculate the total frequency from a frequency table; • Read off frequency values from a table; • Read off frequency values from a frequency table; • Find greatest and least values from a frequency table; • Identify the mode from a frequency table; • Identify the modal class from a grouped frequency table; • Plotting coordinates in first quadrant and read graph scales in multiples; • Produce and interpret: – pictograms; – composite bar charts; – dual/comparative bar charts for categorical and ungrouped discrete data; – bar-line charts; – vertical line charts; – line graphs; – line graphs for time-series data; – histograms with equal class intervals; – stem and leaf (including back-to-back); • Calculate total population from a bar chart or table; • Find greatest and least values from a bar chart or table; • Find the mode from a stem and leaf diagram; • Identify the mode from a bar chart; • Recognise simple patterns, characteristic and relationships in bar charts and line graphs;	

			• Interpret and discuss any data. • Interpret tables; represent data in tables and charts; • Know which charts to use for different types of data sets; • Draw circles and arcs to a given radius; • Know there are 360 degrees in a full turn, 180 degrees in a half turn, and 90 degrees in a quarter turn; • Measure and draw angles, to the nearest degree; Construct pie charts for categorical data and discrete/continuous numerical data; • Interpret simple pie charts using simple fractions and percentages; $\frac{1}{2}$, $\frac{1}{4}$ and multiples of 10% sections; • From a pie chart: – find the mode; – find the total frequency; • Understand that the frequency represented by corresponding sectors in two pie charts is dependent upon the total populations represented by each of the pie charts.	
Autumn 2	Unit 4: Fractions & percentages	• Fractions, decimals & percentages • Percentages	• Use diagrams to find equivalent fractions or compare fractions; • Write fractions to describe shaded parts of diagrams; • Express a given number as a fraction of another, using very simple numbers, some cancelling, and where the fraction is both < 1 and > 1; • Write a fraction in its simplest form and find equivalent fractions; • Order fractions, by using a common denominator; • Compare fractions, use inequality signs, compare unit fractions; • Convert between mixed numbers and improper fractions; • Add and subtract fractions; • Add fractions and write the answer as a mixed number; • Multiply and divide an integer by a fraction; • Multiply and divide a fraction by an integer, including finding fractions of quantities or measurements, and apply this by finding the size of each category from a pie chart using fractions; • Understand and use unit fractions as multiplicative inverses; • Multiply fractions: simplify calculations by cancelling first;	How Tall How Short How Faraway by D Adler

			• Divide a fraction by a whole number and another fraction; • Recall the fraction-to-decimal conversion and convert fractions to decimals; • Convert a fraction to a decimal to make a calculation easier, e.g. $0.25 \times 8 = \frac{1}{4} \times 8$, or $\frac{3}{8} \times 10 = 0.375 \times 10$; • Recognise recurring decimals and convert fractions such as $\frac{3}{7}$, $\frac{1}{3}$ and $\frac{2}{3}$ into recurring decimals; • Compare and order fractions, decimals and integers, using inequality signs; • Understand that a percentage is a fraction in hundredths; • Express a given number as a percentage of another number; • Convert between fractions, decimals and percentages; • Order fractions, decimals and percentages, including use of inequality signs. • Express a given number as a percentage of another number; • Find a percentage of a quantity without a calculator: 50%, 25% and multiples of 10% and 5%; • Find a percentage of a quantity or measurement (use measurements they should know from Key Stage 3 only); • Calculate amount of increase/decrease; • Use percentages to solve problems, including comparisons of two quantities using percentages; • Percentages over 100%; • Use percentages in real-life situations, including percentages greater than 100%: – Price after VAT (not price before VAT); – Value of profit or loss; – Simple interest; – Income tax calculations; • Use decimals to find quantities; • Find a percentage of a quantity, including using a multiplier; • Use a multiplier to increase or decrease by a percentage in any scenario where percentages are used; • Understand the multiplicative nature of percentages as operators.	

	Unit 5: Equations & Inequalities	• Equations & Inequalities • Sequences •	• Select an expression/equation/formula/identity from a list; • Write expressions and set up simple equations including forming an equation from a word problem; • Use function machines; • Solve simple equations including those: – with integer coefficients, in which the unknown appears on either side or on both sides of the equation; – which contain brackets, including those that have negative signs occurring anywhere in the equation, and those with a negative solution; – with one unknown, with integer or fractional coefficients; • Rearrange simple equations; • Substitute into a formula, and solve the resulting equation; • Find an approximate solution to a linear equation using a graph; • Solve angle or perimeter problems using algebra. • Show inequalities on number lines; • Write down whole number values that satisfy an inequality; • Solve an inequality such as $-3 < 2x + 1 < 7$ and show the solution set on a number line; • Solve two inequalities in x, find the solution sets and compare them to see which value of x satisfies both; • Use the correct notation to show inclusive and exclusive inequalities; • Construct inequalities to represent a set shown on a number line; • Solve simple linear inequalities in one variable, and represent the solution set on a number line; • Round answers to a given degree of accuracy; • Use inequality notation to specify simple error intervals due to truncation or rounding. • Recognise sequences of odd and even numbers, and other sequences including Fibonacci sequences; • Use function machines to find terms of a sequence; • Write the term-to-term definition of a sequence in words; • Find a specific term in the sequence using position-to-term or term-to-term rules;	

			• Generate arithmetic sequences of numbers, triangular number, square and cube integers and sequences derived from diagrams; • Recognise such sequences from diagrams and draw the next term in a pattern sequence; • Find the next term in a sequence, including negative values; • Find the nth term – for a pattern sequence; – a linear sequence; – of an arithmetic sequence; • Use the nth term of an arithmetic sequence to – generate terms; – decide if a given number is a term in the sequence, or find the first term over a certain number; – find the first term greater/less than a certain number; • Continue a geometric progression and find the term-to-term rule, including negatives, fraction and decimal terms; • Continue a quadratic sequence and use the nth term to generate terms; • Distinguish between arithmetic and geometric sequences.	
Spring 1	Unit 6: Angles	● Properties of shapes, parallel lines and angle facts ● Interior and exterior angles of polygons	• Estimate sizes of angles; • Measure angles using a protractor; • Use geometric language appropriately; • Use letters to identify points, lines and angles; • Use two-letter notation for a line and three-letter notation for an angle; • Describe angles as turns and in degrees and understand clockwise and anticlockwise; • Know that there are 360° in a full turn, 180° in a half turn and 90° in a quarter turn; • Identify a line perpendicular to a given line on a diagram and use their properties; • Identify parallel lines on a diagram and use their properties; • Find missing angles using properties of corresponding and alternate angles; • Understand and use the angle properties of parallel lines.	Do you feel lucky? Murderous Maths

			• Recall the properties and definitions of special types of quadrilaterals, including symmetry properties; • List the properties of each special type of quadrilateral, or identify (name) a given shape; • Draw sketches of shapes; • Classify quadrilaterals by their geometric properties and name all quadrilaterals that have a specific property; • Identify quadrilaterals from everyday usage; • Given some information about a shape on coordinate axes, complete the shape; Understand and use the angle properties of quadrilaterals; • Use the fact that angle sum of a quadrilateral is 360°; • Recall and use properties of angles at a point, angles at a point on a straight line, right angles, and vertically opposite angles; • Distinguish between scalene, equilateral, isosceles and right-angled triangles; • Derive and use the sum of angles in a triangle; • Find a missing angle in a triangle, using the angle sum of a triangle is 180°; • Understand and use the angle properties of triangles, use the symmetry property of isosceles triangle to show that base angles are equal; • Use the side/angle properties of isosceles and equilateral triangles; • Understand and use the angle properties of intersecting lines; • Understand a proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices; Use geometrical language appropriately, give reasons for angle calculations and show step-by-step deduction when solving problems. • Recognise and name pentagons, hexagons, heptagons, octagons and decagons; • Understand 'regular' and 'irregular' as applied to polygons; • Use the sum of angles of irregular polygons; • Calculate and use the sums of the interior angles of polygons; • Calculate and use the angles of regular polygons; • Use the sum of the interior angles of an n-sided polygon; • Use the sum of the exterior angles of any polygon is 360°; • Use the sum of the interior angle and the exterior angle is 180°; • Identify shapes which are congruent (by eye);	

			• Explain why some polygons fit together and others do not;	
	Unit 7: Averages & range	• Statistics, sampling and averages	• Specify the problem and: – plan an investigation; – decide what data to collect and what statistical analysis is needed; – consider fairness; • Recognise types of data: primary secondary, quantitative and qualitative; • Identify which primary data they need to collect and in what format, including grouped data; • Collect data from a variety of suitable primary and secondary sources; • Understand how sources of data may be biased and explain why a sample may not be representative of a whole population; • Understand sample and population. • Calculate the mean, mode, median and range for discrete data; • Interpret and find a range of averages as follows: – median, mean and range from a (discrete) frequency table; – range, modal class, interval containing the median, and estimate of the mean from a grouped data frequency table; – mode and range from a bar chart; – median, mode and range from stem and leaf diagrams; – mean from a bar chart; • Understand that the expression 'estimate' will be used where appropriate, when finding the mean of grouped data using mid-interval values; • Compare the mean, median, mode and range (as appropriate) of two distributions using bar charts, dual bar charts, pictograms and back-to-back stem and leaf; • Recognise the advantages and disadvantages between measures of average.	
	Unit 8: Perimeter, area & volume 1	• Perimeter, area and volume	• Indicate given values on a scale, including decimal value; • Know that measurements using real numbers depend upon the choice of unit; • Convert between units of measure within one system, including time and metric units to metric units of length, area and volume and capacity e.g. 1ml = $1cm^3$;	

			• Make sensible estimates of a range of measures in everyday settings; • Measure shapes to find perimeters and areas using a range of scales; • Find the perimeter of – rectangles and triangles; – parallelograms and trapezia; – compound shapes; • Recall and use the formulae for the area of a triangle and rectangle; • Find the area of a trapezium and recall the formula; • Find the area of a parallelogram; • Calculate areas and perimeters of compound shapes made from triangles and rectangles; • Estimate surface areas by rounding measurements to 1 significant figure; • Find the surface area of a prism; • Find surface area using rectangles and triangles; • Identify and name common solids: cube, cuboid, cylinder, prism, pyramid, sphere and cone; • Sketch nets of cuboids and prisms; • Recall and use the formula for the volume of a cuboid; • Find the volume of a prism, including a triangular prism, cube and cuboid; • Calculate volumes of right prisms and shapes made from cubes and cuboids; • Estimate volumes etc by rounding measurements to 1 significant figure;	
Spring 2	Unit 9: Graphs	• Real-life graphs • Straight line graphs	• Use input/output diagrams; • Draw, label and scale axes; • Use axes and coordinates to specify points in all four quadrants in 2D; • Identify points with given coordinates and coordinates of a given point in all four quadrants; • Find the coordinates of points identified by geometrical information in 2D (all four quadrants); • Find the coordinates of the midpoint of a line segment; Read values from straight-line graphs for real-life situations; • Draw straight line graphs for real-life situations, including ready reckoner graphs, conversion graphs, fuel bills graphs, fixed charge and cost per unit;	Sir Cumference and the Dragon of Pi: A Math Adventure by Cindy Neuschwander

			• Draw distance-time graphs and velocity-time graphs; • Work out time intervals for graph scales; • Interpret distance-time graphs, and calculate: the speed of individual sections, total distance and total time; • Interpret information presented in a range of linear and non-linear graphs; • Interpret graphs with negative values on axes; • Find the gradient of a straight line from real-life graphs; • Interpret gradient as the rate of change in distance-time and speed-time graphs, graphs of containers filling and emptying, and unit price graphs. • Use function machines to find coordinates (i.e. given the input x, find the output y); • Plot and draw graphs of $y = a$, $x = a$, $y = x$ and $y = -x$; • Recognise straight-line graphs parallel to the axes; • Recognise that equations of the form $y = mx + c$ correspond to straight-line graphs in the coordinate plane; • Plot and draw graphs of straight lines of the form $y = mx + c$ using a table of values; • Sketch a graph of a linear function, using the gradient and y-intercept; • Identify and interpret gradient from an equation $y = mx + c$; • Identify parallel lines from their equations; • Plot and draw graphs of straight lines in the form $ax + by = c$; • Find the equation of a straight line from a graph; • Find the equation of the line through one point with a given gradient; • Find approximate solutions to a linear equation from a graph.	
	Unit 10: Transformations	• Transformations •	• Identify congruent shapes by eye; • Understand that rotations are specified by a centre, an angle and a direction of rotation; • Find the centre of rotation, angle and direction of rotation and describe rotations fully using the angle, direction of turn, and centre; • Rotate and draw the position of a shape after rotation about the origin or any other point including rotations on a coordinate grid; • Identify correct rotations from a choice of diagrams;	

			• Understand that translations are specified by a distance and direction using a vector; • Translate a given shape by a vector; • Use column vectors to describe and transform 2D shapes using single translations on a coordinate grid; • Understand that distances and angles are preserved under rotations and translations, so that any figure is congruent under either of these transformations; • Understand that reflections are specified by a mirror line; • Identify correct reflections from a choice of diagrams; • Identify the equation of a line of symmetry; • Transform 2D shapes using single reflections (including those not on coordinate grids) with vertical, horizontal and diagonal mirror lines; • Describe reflections on a coordinate grid; • Scale a shape on a grid (without a centre specified); • Understand that an enlargement is specified by a centre and a scale factor; • Enlarge a given shape using (0, 0) as the centre of enlargement, and enlarge shapes with a centre other than (0, 0); • Find the centre of enlargement by drawing; • Describe and transform 2D shapes using enlargements by: – a positive integer scale factor; – a fractional scale factor; • Identify the scale factor of an enlargement of a shape as the ratio of the lengths of two corresponding sides, simple integer scale factors, or simple fractions; • Understand that distances and angles are preserved under reflections, so that any figure is congruent under this transformation; • Understand that similar shapes are enlargements of each other and angles are preserved – define similar in this unit.	
Summer 1	Unit 11: Ration & proportion	• Ratio • Proportion •	• Understand and express the division of a quantity into a of number parts as a ratio; • Write ratios in their simplest form; • Write/interpret a ratio to describe a situation;	Fractions in disguise by Edward Einhorn

			• Share a quantity in a given ratio including three-part ratios; • Solve a ratio problem in context: – use a ratio to find one quantity when the other is known; – use a ratio to compare a scale model to a real-life object; – use a ratio to convert between measures and currencies; – problems involving mixing, e.g. paint colours, cement and drawn conclusions; • Compare ratios; • Write ratios in form 1 : m or m : 1; • Write a ratio as a fraction; • Write a ratio as a linear function; • Write lengths, areas and volumes of two shapes as ratios in simplest form; • Express a multiplicative relationship between two quantities as a ratio or a fraction.	
	Unit 12: Right-angled triangles	● Right-angled triangles	• Understand, recall and use Pythagoras' Theorem in 2D, including leaving answers in surd form and being able to justify if a triangle is right-angled or not; • Calculate the length of the hypotenuse and of a shorter side in a right-angled triangle, including decimal lengths and a range of units; • Apply Pythagoras' Theorem with a triangle drawn on a coordinate grid; • Calculate the length of a line segment AB given pairs of points; • Understand, use and recall the trigonometric ratios sine, cosine and tan, and apply them to find angles and lengths in general triangles in 2D figures; • Use the trigonometric ratios to solve 2D problems including angles of elevation and depression; • Round answers to appropriate degree of accuracy, either to a given number of significant figures or decimal places, or make a sensible decision on rounding in context of question; • Know the exact values of sin θ and cos θ for θ = 0°, 30°, 45°, 60° and 90°; know the exact value of tan θ for θ = 0°, 30°, 45° and 60°.	
	Unit 13: Probability	● Two events ● Experimental probability	• Distinguish between events which are impossible, unlikely, even chance, likely, and certain to occur;	

		• Venn diagrams • Tree diagrams	• Mark events and/or probabilities on a probability scale of 0 to 1; • Write probabilities in words or fractions, decimals and percentages; • Find the probability of an event happening using theoretical probability; • Use theoretical models to include outcomes using dice, spinners, coins; • List all outcomes for single events systematically; • Work out probabilities from frequency tables, frequency trees, and two way tables; • Record outcomes of probability experiments in tables; • Add simple probabilities; • Identify different mutually exclusive outcomes and know that the sum of the probabilities of all outcomes is 1; • Using $1 - p$ as the probability of an event not occurring where p is the probability of the event occurring; • Find a missing probability from a list or table including algebraic terms; • Find the probability of an event happening using relative frequency; • Estimate the number of times an event will occur, given the probability and the number of trials – for both experimental and theoretical probabilities; • List all outcomes for combined events systematically; • Use and draw sample space diagrams; • Work out probabilities from Venn diagrams to represent real-life situations and also 'abstract' sets of numbers/values; • Use union and intersection notation; • Compare experimental data and theoretical probabilities; • Compare relative frequencies from samples of different sizes; • Find the probability of successive events, such as several throws of a single dice; • Use tree diagrams to calculate the probability of two independent events; • Use tree diagrams to calculate the probability of two dependent events.	
Summer 2	Unit 14: Multiplicative reasoning	• Multiplicative reasoning	• Understand and use compound measures: – density; – pressure; – speed: • convert between metric speed measures;	Murderous Maths: The Perfect Sausage by Kjartan Poskitt

			• read values in km/h and mph from a speedometer; • calculate average speed, distance, time – in miles per hour as well as metric measures; • use kinematics formulae to calculate speed, acceleration (with formula provided and variables defined in the question); • change d/t in m/s to a formula in km/h, i.e. d/t × (60 × 60)/1000 – with support; • Express a given number as a percentage of another number in more complex situations; • Calculate percentage profit or loss; • Make calculations involving repeated percentage change, not using the formula; • Find the original amount given the final amount after a percentage increase or decrease; • Use compound interest; • Use a variety of measures in ratio and proportion problems: – currency conversion; – rates of pay; – best value; • Set up, solve and interpret the answers in growth and decay problems; • Understand that X is inversely proportional to Y is equivalent to X is proportional to $\frac{1}{Y}$; • Interpret equations that describe direct and inverse proportion.	
	Unit 15: Constructions, loci & bearings	• Plans and elevations • Constructions, loci and bearings	• Understand clockwise and anticlockwise; • Draw circles and arcs to a given radius or given the diameter; • Measure and draw lines, to the nearest mm; • Measure and draw angles, to the nearest degree; • Know and use compass directions; • Draw sketches of 3D solids; • Know the terms face, edge and vertex; • Identify and sketch planes of symmetry of 3D solids;	

			• Make accurate drawings of triangles and other 2D shapes using a ruler and a protractor; • Construct diagrams of everyday 2D situations involving rectangles, triangles, perpendicular and parallel lines; • Understand and draw front and side elevations and plans of shapes made from simple solids; • Given the front and side elevations and the plan of a solid, draw a sketch of the 3D solid. • Understand congruence, as two shapes that are the same size and shape; • Visually identify shapes which are congruent; • Use straight edge and a pair of compasses to do standard constructions: – understand, from the experience of constructing them, that triangles satisfying SSS, SAS, ASA and RHS are unique, but SSA triangles are not; – construct the perpendicular bisector of a given line; – construct the perpendicular from a point to a line; – construct the bisector of a given angle; – construct angles of 90°, 45°; • Draw and construct diagrams from given instructions, including the following: – a region bounded by a circle and an intersecting line; – a given distance from a point and a given distance from a line; – equal distances from two points or two line segments; – regions may be defined by 'nearer to' or 'greater than'; • Find and describe regions satisfying a combination of loci; • Use constructions to solve loci problems (2D only); • Use and interpret maps and scale drawings; • Estimate lengths using a scale diagram; • Make an accurate scale drawing from a diagram; • Use three-figure bearings to specify direction; • Mark on a diagram the position of point B given its bearing from point A; • Give a bearing between the points on a map or scaled plan; • Given the bearing of a point A from point B, work out the bearing of B from A; • Use accurate drawing to solve bearings problems; • Solve locus problems including bearings.	
