MATHS Y11 - CURRICULUM PLANNING SEQUENCE

Subject	Year	Term		NUMBER	ALGEBRA	RATIO AND PROPORTION	SHAPE AND SPACE	DATA - PROBABILITY	DATA - STATISTICS
Maths	Year 11	Term 1 - 56hrs	9		• Estimate the gradient of a curved graph by drawing a tangent, and interpret the result in different contexts. • Estimate the area under a graph, using the trapezium rule or other approximate method, and interpret the result (e.g. distance travelled). • Understand and interpret the equation of a circle with its centre at the origin. • Work out the equation of the tangent to a circle at any given point. • For any function f(x), sketch and interpret the graphs of $y = f(x + a)$, $y = af(x)$, $y = -f(x)$ and $y = f(-x)$. • Use iteration to solve equations to a given degree of accuracy. • Work with sequences defined by an iterative formula.	• Distinguish between instantaneous rate of change (gradient of tangent) and average rate of change (gradient of chord), and interpret the result (e.g. in terms of velocity or acceleration, or in a financial context). • Solve problems involving growth and decay, including compound interest.	• Use the standard circle theorems to prove results in geometry. • Use the sine and cosine rules to calculate lengths and angles in 3D. • Use vectors to prove results in geometry.		
			8	• Work out the upper and lower bounds of multi-stage calculations, where the numbers involved are expressed to a known degree of accuracy. • Appreciate that the set of integers is a subset of the set of rational numbers, which is a subset of the set of real numbers. • Understand the concept of an irrational number. • Plot or sketch the graphs of $y = \sin x$, $y = \cos x$, and $y = \tan x$, where x is measured in degrees.	• Understand the 'composition' of two functions to make a third function. • Work out the inverse function $f^{-1}(x)$ for any given suitable function f(x). • Manipulate and simplify expressions involving the addition, subtraction, multiplication and division of algebraic fractions.	• Use numerical, algebraic or graphical methods to solve problems involving more complex forms of proportion (e.g. P proportional to $\sqrt{Q}$, P inversely proportional to Q^2).	• Know and derive the standard circle theorems and use them to work out angles between radii, chords and tangents. • Use the sine and cosine rules to calculate lengths and angles in 2D. • Understand and use the formula ½ab sin C to calculate the area of a triangle.		
			7	• Convert any fraction into a decimal, with or without a calculator. • Express any simple recurring decimal as a fraction in its simplest form. • Rationalise the denominator of any fraction where the denominator is expressed in terms of a surd. • Calculate with a range of expressions involving surds.	• Recognise geometric sequences whose common ratio is positive, and work out an expression for the nth term. • Manipulate algebraic expressions involving surds. • Express quadratic functions in the form $p(x + q)^2 + r$. • Solve quadratic equations by completing the square. • Solve quadratic equations by using the quadratic formula. • Simplify algebraic fractions by cancelling common factors. • Understand the effect of translating the graph of a quadratic function, or reflecting it in the co-ordinate axes, on its equation. • Work out the co-ordinates of the turning point of the graph of a quadratic function.	• Understand and use the relationship between scale factor, area factor and volume factor, expressing this in ratio form when required.	• Use straight-edge and compasses to construct angles of 30°, 45° and 60°. • Calculate lengths and angles in 3D shapes by identifying right-angled triangles. • Solve problems using the ratios of areas and volumes of similar shapes in 2D and 3D. • Know the formal conditions for triangles to be congruent, and use them in geometrical proofs.		• Understand and calculate frequency density, and draw and interpret histograms with unequal class widths.
		Term 2 - 48hrs	6	• Understand the uniqueness of prime decomposition, and use it to solve problems (including working out HCFs and LCMs). • Appreciate the infinite nature of the set of rational numbers (e.g. that there are an infinite number of rationals between any two rationals). • Express surds as multiples of smaller surds (for example, $\sqrt{18} = 3\sqrt{2}$). • Manipulate and simplify expressions involving surds. • Understand the relationship between negative indices and reciprocals, and between fractional indices and roots. • Work out the upper and lower bounds of calculations involving a single operation, where the numbers involved are expressed to a known degree of accuracy.	• Work out an expression for the nth term of a quadratic sequence. • Work with sequences which involve surds. • Change the subject of an equation or formula, where the new subject appears twice. • Factorise quadratic expressions of the form $ax^2 + bx + c$. • Solve quadratic equations of the form $ax^2 + bx + c = 0$ by factorisation, including those which require rearrangement. • Find the solution of two simultaneous equations, one of which is linear and the other quadratic. • Use a graph to find approximate solutions to simultaneous equations, one of which is quadratic. • Solve quadratic inequalities in one variable, expressing the solution on a number line or using set notation. • Use the x-y plane to represent the solution to one or more inequalities in two variables. • Identify perpendicular lines, given their equations, re-arranging them into gradient-intercept form where necessary. • Plot exponential graphs, including those arising from a given context, and interpret the key features. • Prove results using algebra.	• Understand sin, cos and tan as the ratios of sides of right-angled triangles, and the link with similar triangles. • Solve problems of direct and inverse proportion by forming and solving an equation.	• Work with combinations of transformations in 2D, knowing the properties that are invariant and those that are not. • Enlarge shapes by a negative scale factor from a centre of enlargement, with or without a co-ordinate grid.	• Use Venn diagrams and two-way tables, along with expected frequencies, to work out conditional probabilities. • Calculate the probability of two or more combined events in a wide range of contexts. • Understand and use the addition law in the form $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$.	• Use a range of information, including measures of central tendency, measures of spread, consideration of outliers and graphical representations (including box plots), to describe a population and compare distributions.
				• Know how to add, subtract, multiply and divide numbers expressed in standard form, without a calculator. • Use a calculator to calculate with numbers in standard form, where the numbers are more 'difficult'. • Use approximations to estimate answers to calculations involving more than one operation. • Understand the lower and upper bounds of numbers expressed to a particular degree of accuracy (for example, if $x = 4.5$ to 1 d.p., this means that $4.45 \le x < 4.55$).	• Recognise simple quadratic sequences and find an expression for the nth term 'by inspection'. • Solve linear equations in one variable involving fractions. • Solve linear equalities in one variable and represent the solution on a number line, using conventional symbols for the end-point(s). • Find the solution of two linear simultaneous equations. • Interpret the solution of linear simultaneous equations as the intersection of two straight lines. • Factorise quadratic expressions of the form $x^2 + bx + c$ and $x^2 - a^2$.	• Appreciate that the gradient of a straight line graph represents the rate of change of a function, and apply this in context where required. • Work with the graphs of two quantities which are in direct proportion, and realise that there is a linear relationship between them. • Work with the graphs of two quantities which are in inverse proportion, and realise that there is a reciprocal relationship between them. • Given the result of a percentage or fractional change, calculate the original value of the quantity. • Use index notation to solve problems involving compound interest and depreciation. • Solve problems involving compound units (e.g. density, cost per 100 grams).	• Work out the volume and surface area of spheres, pyramids, cylinders, cones and composite 3D shapes. • Calculate the length of a circular arc and the area of a sector. • Work out the exact values of $\sin x$, $\cos x$ and $\tan x$ for $x = 0°$, 30°, 45°, 60° and 90°. • Use tree diagrams and other methods to calculate the probability of combined independent events. • Recognise similar shapes, identify equal ratios and use these to solve problems. • Use similar shapes to prove geometrical results, including Pythagoras' Theorem. • Use trigonometry to calculate lengths and angles in right-angled triangles in 2D.	• Understand the idea of 'independent' events, and use the multiplication law to calculate the probability of a succession of independent events. • Understand and use the term 'mutually exclusive', and use the addition law to calculate the probability of a combination of mutually exclusive events. • Use the multiplication law for dependent events, using the idea of conditional probability. • Use tree diagrams to calculate the probability of combined dependent events.	• Use and understand terminology relating to samples and populations. • Understand the practicalities of sampling and the reliability of the results. • Work out the quartiles and interquartile range of a simple data set. • Draw a cumulative frequency graph, and use it to work out the median, quartiles and interquartile range for continuous data.

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4	• Understand the reciprocal function and its use in evaluating numerical expressions. • Appreciate that there are an infinite number of integers. • Understand the rationale behind standard index form, and how it can be used to express and compare large and small numbers. • Use approximations to estimate answers to calculations involving one operation (for example, $31.8 \times 0.053 \approx 30 \times 0.05 = 1.5$).	• Multiply out and simplify the product of two binomial expressions. • Understand the laws of indices and simplify expressions involving powers. • Manipulate and simplify a wide range of expressions involving sums, products and differences, including simple expressions involving surds. • Solve linear equations with integer coefficients where the unknown appears on both sides of the equation. • Understand how sequences can be generated from a position-to-term rule. • Recognise arithmetic sequences and know how to find an expression for the nth term. • Recognise and use Fibonacci-type sequences. • Draw graphs of simple linear functions, expressed in the form $y = mx + c$ or $ax + by = c$. • Draw and interpret graphs arising from real-life situations, such as distance-time graphs.	• Understand and use the relationship between fractions and ratios. • Perform calculations relating to distance, speed and time, using standard units (e.g. mph, kilometres per hour, metres per second). • Use numerical methods to solve problems involving inverse proportion. • Solve simple problems involving compound interest and depreciation.	• Use Pythagoras' Theorem to calculate lengths in right-angled triangles in 2D. • Solve problems involving the use of bearings. • Calculate the area of a circle and simple fractions of a circle, expressing the answer in terms of π when required. • Calculate the area of trapeziums and compound plane shapes. • Calculate the volume of cylinders and of prisms with more complex cross-sections (e.g. compound shapes). • Use alternate, corresponding and supplementary angles to solve problems involving parallel lines. • Work out the sum of the interior and exterior angles in any polygon, and deduce angle facts about regular polygons. • Construct the perpendicular bisector of two points and bisect a given angle, using straight edge and compasses only.	• Use relative frequency to estimate probability where theoretical probabilities cannot be calculated.	• Draw lines of best fit on scatter diagrams, know how to use these to make predictions, and when it is valid to do so, and know that correlation does not imply cause. • Work with time series data and their associated line graphs. • Calculate the mean of a frequency distribution for grouped or ungrouped data, and identify the modal class.
3	• Convert fluently, without a calculator, between terminating decimals and fractions (for example, $2.24 = 2\frac{6}{25}$). • Round to a degree of accuracy appropriate to the context, using significant figures. • Estimate powers and roots of positive numbers. • Express any simple recurring decimal as a fraction in its simplest form. • Rationalise the denominator of any fraction where the denominator is expressed in terms of a surd. • Calculate with a range of expressions involving surds.	• Understand how sequences can be generated from a term-to-term rule. • Recognise the sequences of triangle, square and cube numbers. • Simplify expressions by collecting like terms. • Multiply a bracket by a single term, realising that the resulting expression is equivalent. • Understand and use the word 'factor' in the context of algebra, and factorise expressions by taking out a common factor. • Use 'function machines' as a means of representing simple expressions. • Understand the idea of an 'equation', and solve linear equations in one variable where the unknown appears once only.	• Convert fluently between standard units (e.g. m and cm, litres and millilitres, hours and minutes). • Interpret and work with scale diagrams and maps. • Understand and use simple scale factors in the context of similar shapes. • Understand and use ratios to describe unequal sharing in a variety of contexts, using part:part or part:whole form as appropriate. • Use ratios to describe the relationship between two quantities, where appropriate. • Express one quantity as a fraction of another, where the fraction is greater than 1. • Express any percentage change as a fraction, decimal or percentage (for example, a 40% increase can be expressed using 140%, 1.4 or $\frac{7}{5}$.) • Increase a quantity by a fraction or percentage, with or without a calculator as appropriate. • Solve problems involving simple interest. • Use numerical methods to solve problems involving proportion.	• Use and understand 2D representations of 3D shapes, including plans and elevations. • Reflect, rotate and translate shapes on a Cartesian grid (including the use of vector notation). • Use a given positive integer scale factors to draw similar shapes on a square grid. • Understand and use standard terms when working with circles: 'centre', 'radius', 'chord', 'diameter', 'circumference', 'tangent', 'arc', 'sector' and 'segment'. • Calculate the circumference of a circle. • Work out the area and perimeter of compound shapes made from rectangles. • Identify different types of triangle and quadrilateral, and know and use their angle properties. • Know and use the formulae for the area of a triangle and parallelogram, and understand how they are obtained. • Know and use the formulae for the volume of a cuboid and the volume of a simple prism (excluding cylinders).	• List the equally likely, mutually exclusive outcomes of a combination of events using a systematic list or sample space diagram and use them to calculate probabilities.	• Construct and interpret pie charts. • Construct and interpret scatter diagrams and use these to help describe the correlation, if any, between two quantities. • Understand the meaning of the term 'outlier' and use it appropriately in describing distributions.
2	• Understand how different operations work in combination with each other. • Use and understand the idea of inverse operations. • Use efficient listing strategies and/or simple products to help with counting. • Work out common factors (including the HCF) and common multiples (including the LCM). • Express any positive integer as a product of primes, using index notation • Round to a degree of accuracy appropriate to the context, using decimal places. • Know the formal methods for adding, subtracting, multiplying and dividing integers and decimals. • Apply the four rules with fractions and mixed numbers. • Apply the four rules with negative numbers. • Understand and use positive integer powers and roots. • Know the squares of numbers up to 15, and numbers related to these (for example, $40^2 = 1600$), and recognise the related square roots. • Recognise cubes of numbers up to 5, and of numbers related to these, and recognise the related cube roots. • Use a calculator to work out square and cube roots, realising when it gives only an approximate answer. • Apply the conventional rules governing priority of operations, including brackets, powers and roots.	• Substitute numbers into expressions, including formulae used in science. • Construct expressions to describe simple everyday situations. • Understand and use the words 'expression' and 'term'.	• Express one quantity as a fraction of another, where the fraction is less than 1. • Express one quantity as a percentage of another, with or without a calculator as appropriate • Understand and use the fact that fractions and percentages can be interpreted as operators.	• Understand the idea of 'area' as the number of unit squares contained within a shape. • Understand the idea of 'perimeter' as the total length of the boundary of a shape. • Understand and use standard terms and notation when working with plane geometry: 'parallel', 'perpendicular', labelling sides and angles (e.g. 'angle PQR', 'length PQ') • Understand the term 'congruent'. • Understand and use the terms 'face', 'edge' and 'vertex' when working with solid shapes, and recognise common solids. • Draw x and other simple shapes accurately, given the required lengths and angles. • Draw simple loci to solve problems (e.g. the locus of points at, within or beyond a fixed distance from a line or point). • Understand how to rotate shapes around a point, and identify rotation symmetry.	• Use theoretical probabilities to predict the results of future experiments. • Analyse the results of simple probability experiments, compare them with theoretical outcomes, and draw appropriate conclusions.	• Use graphical representations to compare distributions of a single variable. • Work out the mean, median, mode and range of an ungrouped data set, and use these measures to compare distributions.
1	• Compare and order positive and negative integers • Compare and order decimals (positive and negative) • Use and understand the vocabulary of multiples, factors and prime numbers. • Use common units of measurement in simple contexts (e.g. £ and p, minutes and seconds, m and cm), including those involving decimals • Know when it is appropriate to use a calculator, and how to use it accurately.	• Understand how algebraic notation works, including that used for multiplication and division, squaring and cubing, and brackets. • Understand the equivalence between expressions such as $p \times p$, $p + p$ and $4p$, and between $3a$ and $a/4$. • Work with co-ordinates, including those involving negative numbers.	• Understand and use ratio as a means of describing patterns, sizes, scales, as appropriate. • Use the unitary method to solve simple problems of direct proportion. • Understand the idea of percentages as hundredths, and their use in making comparisons.	• Understand and use the angle sum around a point, the angle sum at a point on a straight line, the angle sum in a triangle, and that vertically opposite angles are equal. • Understand and use standard vocabulary when describing angles: 'acute', 'obtuse', 'reflex', 'right angle'. • Measure and draw angles, including reflex angles, to the nearest degree. • Understand how to reflect shapes in a mirror line, and identify reflection symmetry.	• Know the types of process which have random outcomes, and understand the notion of fairness. • Use the probability scale from 0 to 1 and use appropriate terminology connected with probability. • Distinguish between cases when outcomes are equally likely and those where they are not, and develop the notion of fairness. • Use equally likely outcomes to determine the probability of an event as a fraction. • Use the fact that the sum of probabilities of all possible outcomes of an event is 1.	• Summarise information in tables, including grouping of data into frequency tables. • Present grouped, ungrouped and categorical data in simple charts and diagrams, including bar charts, pictograms and vertical line charts.

		Term 3 - 24 hrs	5		• Solve quadratic equations of the form $x^2 + bx + c = 0$ by factorisation, including those which require simple rearrangement.		• Realise that the shortest distance from a point to a given line is the perpendicular from that line to the point, and construct the perpendicular using straight-edge and compasses only.		
					• Change the subject of an equation or formula, where the new subject appears once.		• Enlarge shapes by a positive fractional scale factor from a centre of enlargement, with or without a co-ordinate grid.		
					• Use and understand the word 'identity', and prove whether algebraic expressions are identically equal.		• Understand the use of vectors to describe displacements.		
					• Work out the gradient of a straight line, and understand the equation $y = mx + c$ as the standard form of a straight line graph.				
					• Identify parallel lines, given their equations, rearranging them into gradient-intercept form where necessary.				
					• Work out the equation of a line, given two points on the line, or given its gradient and one point on the line.				
					• Plot the graph of a quadratic, cubic or reciprocal function, and locate and interpret the roots, intercept and turning-point of a quadratic function				
					• Distinguish between linear, quadratic, cubic and reciprocal graphs, and recognise the key features of these types of graph.				
					• Model a range of different situations algebraically, and use algebra to argue mathematically.				
					• Use graphs to solve problems set in a range of contexts, including kinematic problems involving speed and acceleration.				

	• Compare and order fractions (positive and negative).					
	• Compare and order different fractions (positive and negative).					
	• Understand the concept of equivalent fractions.					
	• Appreciate the equivalence between percentages, fractions and decimals, and convert between them, using a calculator where necessary.					