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Year 7 Arithmetic	Key Concepts	Introduction to arithmetic	Addition	Subtraction	Multiplication	Division
	Pupils should know… (Core knowledge and concepts to be learned)	Base number systems and order rational numbers	Laws of arithmetic under addition and adding rational numbers	Laws of arithmetic under subtraction and subtracting rational numbers.	Laws of arithmetic under multiplication and multiplying rational numbers.	Laws of arithmetic under division; Factorisation and dividing with rational numbers; factorisation; Prime factor decomposition; Highest common factor and Lowest Common multiple.
	Pupils should be able to… (Skills being developed)	To know the different sets of numbers: natural, integers, rational, real. To know how to write numbers in decimal form and portioned form To know how to multiply and divide decimals by positive and negative powers of 10 To extend knowledge of place value to binary To know how to order and compare integers and decimals To know how to use the symbols <, >, ≤, ≥; To know how to Convert between decimals and fractions. To know how to how to convert fractions to recurring decimals To know how to order rational numbers.	To know how to add integers and decimals efficiently using a formal written method. To know strategies for adding integers and decimals mentally. To know how to add decimals with any place value. To know how and when to use the commutative and associative laws for addition. To know how to convert between proper and improper fractions. To know how to add proper fractions. To know how to add improper fractions or mixed numbers. To know how to add mixed numbers efficiently. To know how to identify the additive inverse of a number. To know how to add negatives.	To know how to subtract integers and decimals efficiently using a formal written method To know strategies for subtracting integers and decimals mentally To know how and when to use the commutative and associative laws for subtraction To know how to use the commutative and associative law for subtraction To know how to subtract decimals with any place value To know how to subtract fractions. To know how to subtract mixed numbers. To know how to subtract negatives.	To know how to multiply integers and decimals efficiently using a formal written method To know strategies for multiplying integers and decimals mentally To know how and when to use the commutative and associative laws for multiplication To know how to use the distributive law of multiplication and division over addition and subtraction To identify the multiplicative inverse of a number To know how to apply the distributive law to expand single, double and triple brackets To know how to multiply with rationals. To know how to multiply with negatives**.**	Divide integers and decimals efficiently using a formal written method To know strategies for dividing integers and decimals mentally To know how and when to use the commutative and associative laws for division To know how to use the distributive law to factorise expressions To know how to use the distributive law of multiplication and division over addition and subtraction To know how to find factors and multiples of a number To know how to write a number as a product of its prime factors To know how to find the HCF and LCM of a number using listing strategies and prime factor decomposition
	Why are we doing this now? *How does it build on prior learning and prepare for knowledge and learning still to come?*	This key concept lays the foundations for the rest of the academic year by focusing on the fundamental principles of number. Representation and structure are principles of mastery, so we derive all mathematical learning from number lines where we possibly can.	Using the previous key concept, we will introduce the first of the 4 main operations and its laws for all rational numbers. These concepts will be continued into subtraction. Students will draw upon prior learning when using number lines to add negatives	We use the second of the 4 main operations and its laws for all rational numbers building on the previous concepts learning. This will be continued into multiplication. Students will draw upon prior learning when using number lines to subtract negatives	We use the third of the 4 main operations and its laws for all rational numbers building on the previous concepts learning. This will be continued into division Students will draw upon prior learning when using number lines to multiply rationals	We use the fourth of the 4 main operations and its laws for all rational numbers building on the previous concepts learning. Moving into year 8, students will learn to use further operations with all rational numbers. Students will draw upon prior learning when using number lines to divide rationals

Year 8 Arithmetic	Key Concepts	Powers	Mathematical Relationships	Calculating with Decimals	Ratio & Proportion
	Pupils should know… (Core knowledge and concepts to be learned)	Exponentiation, Radication., Surds, Rational exponents, Operations with powers.	Brackets and vincula, Hierarchy of operations, Mathematical relationships, Rearranging mathematical relationships.	Recurring and terminating decimals, Standard form, Approximation, Limits of accuracy.	Ratio, Proportion, Percentages, Growth and decay.
	Pupils should be able to… (Skills being developed)	To know square numbers to 15^2 and cube numbers to 6^3. To know how to calculate powers of a number and simplify expressions using index notation. To know how to evaluate powers with integer exponents. To know how to extract roots. To know how to multiply and divide surds. To know how to simplify surds. To know how to add and subtract surds. To know how to rationalise the denominator. To know how to apply the addition and subtraction rules for indices. To know how to work with negative and fractional indices. To know how to simplify rational exponents To know how to apply the six operations to powers.	To know the purpose of brackets and vincula To know the six order of operations and evaluate operations in the correct order. To know that inverse operations can be evaluated in any order To translate English into maths. To know how to calculate with the six operations in various orders. To know how to use brackets to change the value of an expression. To know how to use distributivity with brackets. To know there are four types of mathematical relationships: equations, identities, inequalities and approximation. To know the difference between equal and equivalent. To know mathematical relationships stay true when an operation is applied to both expressions. To know how to rearrange linear formulae. To know how to rearrange linear formulae. involving powers and roots. To know how to change the subject of a formulae by factorising.	To know how to identify terminating and recurring decimals from the denominator of a fraction using prime factors. To know how to convert recurring decimals into fractions. To know how to convert numbers into standard form. To know how to compare numbers in standard form. To know how to add and subtract numbers in standard form To know how to multiply and divide numbers in standard form. To know how to evaluate exponential operations in standard form. To know how to write numbers in standard form on the calculators. To know how to identify error intervals for rounding. To know how to identify error intervals for truncation. To know how to approximate the answer to a calculation by appropriate rounding. To know how to use a calculator effectively (including, but not limited to, surds, negatives, reciprocals, indices). To know how to use the upper and lower bounds in calculations.	To know how to interpret percentages with multiple representations. To know how to find the percentage of a number. To know how to increase and decrease a number by a percentage. To know how to find a number given a percentage of it. To know how to represent one number as a percentage of another. To know how to calculate a percentage change. To know how to find equivalent ratios and simplify ratios. To know how to divide a quantity into a ratio. To know how to write a ratio as a fraction To know how to write ratios in the form 1:n To know how to work with scale drawings and maps using ratio. To use decimal multipliers. To know how to find original value given a percentage change. To know how to use proportional reasoning to compare values such as exchange rates and best value calculations. To know how to use proportional reasoning to scale quantities up and down, such as in recipes r simple enlargements of shapes. To know how to solve problems of direct and inverse proportion numerically. To know how to calculate simple and a compound interest.
	Why are we doing this now? How does it build on prior learning and prepare for knowledge and learning still to come?	Exponentiation and radication are the fifth and sixth operations respectively. Students will explore using the four main operations with powers and with radicals so their schema must be strong.	Mathematical relationships begins to explore how operations work together. Previously, we have only studied one operation at a time. Students will acquire knowledge of numerical equations, inequalities and identities which lays the foundation for our work with algebra.	There are 4 few key skills remaining to cover in arithmetic which all fall under the umbrella of calculating with decimals. Students will explore working with inexact or unknown values which creates a good bridge to algebra.	The final key concept to explore in arithmetic is ratio and proportion which studies the multiplicative comparison of numbers. The students' multiplication and division schema will have been established to build upon during this unit.

Year 9 Algebra

Key Concepts	Introduction to Algebra	Sequences	Linear Functions	Quadratic Functions
Pupils should know… (Core knowledge and concepts to be learned)	Algebra, Expressions, Substitution, Forming and solving equations, Graphs, Functions, Operations with algebraic fractions, Proof	Sequences, Linear sequences**, Quadratic sequences.**	Linear equations, Linear inequalities, Simultaneous linear equations, Regions.	Quadratic equations, **Quadratic inequalities**, **Quadratic simultaneous** equations.
Pupils should be able to… (Skills being developed)	To know how to simplify algebraic expressions using addition, subtraction, multiplication and division. To know how to substitute into a variety of linear and non-linear formulae. To know the purpose of graphs and axes. To explore the purpose of a function in maths. To know how to simplify algebraic fractions. To know how to add, subtract multiply and divide algebraic fractions. To know how to write and read function notation. To know how to disprove by counterexample. To know how to proof by algebraic deduction.	To know how to generate a sequence given a term-to-term or position-to-term rule. To know how to find the nth term of a linear sequence. To recognise simple quadratic, geometric, Fibonacci sequences, as well as sequences such as square and triangular numbers. To know how to work with visual representations of different sequences. To know how to find the nth term of a quadratic sequence. To know how to solve geometric sequences where the common ration is a surd.	To know how to solve one and two-step equations, including with fractional coefficients. To know how to plot graphs of linear relationships. To know how to solve linear equations when there unknows on both sides. To know how to solve linear equations where the unknow is a denominator of a fraction. To know how to read values from a variety of linear graphs. To know how to identify the gradient, m, from a line. To know how to draw the graphs of $x = n$ and $y = n$. To know how to identify the gradient of a line using change in y/ change in x. To know how to identify the equation of a line in the form $y = mx + c$. To know how to plot a line using its y intercept and gradient. To know how to identify the gradients of perpendicular lines. To know how to identify parallel lines from their gradients. To know how to represent single and double inequalities on a number line. To know how to solve linear inequalities and represent their solution on a number line. To know how to use regions on a graph to represent linear inequalities. To know how to represent the solution to inequalities using set notation. To know how to solve simultaneous equations. To know how to write simultaneous equations from a context. To know how to solve simultaneous equations graphically.	To know how to factorise a quadratic. To know how to simplify algebraic fractions. To know how to plot a quadratic graph. To know how to find the roots of a quadratic. equation by factorising. To know how to find the roots of a quadratic. equation by using the quadratic formulae. To know how to complete the square on a quadratic. To know how to find the roots of a quadratic from the completed square form. To know how to solve a quadratic equation. To know how to solve quadratic inequalities. and represent their solutions on a number line using set notation. To know how to solve quadratic simultaneous equations. To know how to use surds to solve quadratic equations without a calculator.
Why are we doing this now? *How does it build on prior learning and prepare for knowledge and learning still to come?*	It is important that we signpost to the students that we are studying a new area of mathematics by starting algebra. Time will be spent generalising previously seen rules i.e. operations with algebraic fractions. This is also the perfect opportunity to introduce functions and graphs as these will be used in all future key concepts in algebra.	Sequences is a good stepping stone to exploring linear and quadratic functions. The only difference is that the domain for sequences is the set of naturals and the domain for linear functions is the real set of numbers.	Students will explore linear functions in their algebraic and graphical forms as far as linear regions. We will study linear equations at the same time as linear inequalities to build strong connections between the two.	Once linear functions have been mastered, it is logical to explore quadratics. Again, equations and inequalities will be studied in tandem in both algebraic and graphical forms. Links will be made back to linear functions during solving quadratic simultaneous equations.

Year 9 Algebra	Key Concepts	Advance functions	Transformations	Algebraic proportion	Approximate solutions
	Pupils should know… (Core knowledge and concepts to be learned)	Higher order functions**, Composite functions, Inverse functions.**	Translation, Reflection, Rotation, Enlargement, Transforming functions.	Direct proportion, Inverse proportion.	Solving graphically, **Iteration**, Estimating gradients, **Estimating area under curves.**
	Pupils should be able to… (Skills being developed)	To know how to find a composite function To know how to find an inverse function To know how to solve equations involving functions, their composites and their inverses. To know how to plot and interpret graphs of cubic, exponential and reciprocal functions. To know how to plot and interpret graphs of trigonometric functions.	To know how to translate a shape by a vector To know how to rotate a shape given and angle and centre. To know how to reflect a shape given a line of reflection. To know how to enlarge a shape given a rational scale factor and a centre. To know how to sketch translations and reflections of functions, and what equations produce these. To know how to find the turning point of a quadratic by completing the square, and how this relates to translations. To know that invariant points are points on a line or shape which do not move when a specific transformation is applied.	To know how to solve problems of direct proportion numerically, graphically and algebraically. To know how to solve problems of inverse proportion numerically, graphically and algebraically. To know how to solve problems of direct and inverse proportion where one of the variables is non-linear. To know how to plot the graph of an exponential function to represent exponential growth and decay. To know how to solve ratio problems, involving comparing ratios and writing equations from variables.	To know how to create an iteration formula. To know that a change in sign implies a root in an interval. To know how to solve a range of non-linear equations using iteration. To know how to find the area under a curve using the trapezium rule. To know how to find instantaneous and average rates of change by drawing tangents of curves. To know how to interpret rates of change and areas under a curve.
	Why are we doing this now? How does it build on prior learning and prepare for knowledge and learning still to come?	Linear and quadratic are not the only function types so we will explore the remainder during this key concept. The foundations that have been embedded in the previous key concepts will help students build upon their functions schema.	Transformations will build upon the graphical work that has been established during algebra. Including transforming functions in this key concept allows us to draw links between these ideas and follows on neatly from quadratic functions.	Ratio and proportion were key concepts in arithmetic and proportion will be built upon further during algebraic proportion. This key concept will be studied algebraically and graphically like all previous key concepts.	The idea of inaccuracy was formally defined within arithmetic via approximation. Approximate solutions applies a similar approach within algebra. These are the skills within algebra that we cannot, or do not need to, arrive at the accurate solution.

Year 10 Geometry	Key Concepts	Introduction to geometry	Polygons	Triangles	Circles
	Pupils should know… (Core knowledge and concepts to be learned)	Geometry, Angles, Bearings	1 – Rectangles, Triangles, Parallelograms. (description drawings), Trapezia, Kites, Angles of polygons, Compound 2D shapes.	Congruent triangles, Pythagorean theorem, Trigonometric functions, **Oblique triangles.**	Properties of a circle, Circumference and arc lengths, Discs and sectors, Equation of a circle, **Circle theorems**.
	Pupils should be able to… (Skills being developed)	To know how to use a ruler to measure lengths, and a protractor to measure angles. To know how to label line segments and angles correctly. To know how to write bearings and solve problems involving bearings.	To know how to label polygons correctly. To know how to name, label and recognise the features of triangles, including the sum of interior angles. To know how to name, label and recognise the features of quadrilaterals, including the sum of interior angles. To know how to find the sum of the interior angles of any polygon and the size of these angles in regular and irregular polygons. To know how to find the exterior angle of any polygon. To know how to find missing angle in parallel lines. To know how to find the area of rectilinear shapes. To know how to find the area of a triangle. To know how to find the area of quadrilaterals including parallelograms, kites, trapezia and compounds of these shapes.	To know how to use Pythagoras' Theorem to find the lengths of sides in right-angled triangles. To know how to use trigonometric ratios to find missing sides and angles in right-angled triangles. To know how to use exact values of sine, cosine and tangent for angles of 0, 30, 45, 60 and 90 degrees. To know how to use Pythagoras' Theorem and the trigonometric ratios on right-angled triangles. To know how to find the area of any triangle using $\frac{1}{2}ab\sin C$. To know how to find missing sides and angles in non-right-angled triangles using the sine and cosine rules.	To know how to use compasses to construct circles given a radius and a diameter. To know how to label the different parts of a circle. To know how to calculate the circumference of a circle, giving exact and rounded values. To know how to calculate the area of a circle, giving exact and rounded values. To know how to calculate the lengths of arcs and perimeters of sectors. To know how to calculate the area of sectors. To know how to find missing angles in circles using circle theorems. To know how to prove the circle theorems. To know how to find the area of a segment of a circle. To know how to draw the graph of, and write the equation of, a circle centred at the origin. To know how to find the equation of a tangent of a circle.
	Why are we doing this now? How does it build on prior learning and prepare for knowledge and learning still to come?	This key concept highlights the transition to another area of maths. Geometry requires strong algebraic manipulation in order to solve problems involving shape and space. Angles will be revisited throughout most key concepts in Geometry so it will be introduced at the start.	There are many shapes to explore in geometry so it makes sense to organise them by dimension. Polygons are 2D shapes made with straight lines. As we increase the number of sides in each polygon, we can investigate the effect this has on the interior and exterior angles.	The study of triangles is a broad focus in maths and has many real-world applications in engineering. We will explore triangles more deeply by looking at the similarities and differences of right angled and non-right angled (oblique) triangles.	Much like triangles, circles is a broad focus in maths. The area and perimeter work has already been established in polygons so these ideas should seem familiar. Sectors and arcs are fractions of areas and the circumference so this work will reinforce the operations with fractions in arithmetic.

Year 10 Geometry	Key Concepts	Construction and Loci	3D Shapes	Geometric Ratio	Vectors
	Pupils should know… (Core knowledge and concepts to be learned)	Constructions, Loci.	Cuboids, Prisms and cylinders, Pyramids and cones, Spheres, Compound 3D shapes.	Congruence and similarity, Compound Measures	Vectors, Vector addition, Scalar multiplication, **Vector proof.**
	Pupils should be able to… (Skills being developed)	To know how to use a ruler and compasses to construct a perpendicular bisector, a perpendicular from a point to and on a line, and an angle bisector. To know that the shortest distance from a point to a line is the perpendicular. To know how to use a ruler and compasses to construct a square and a hexagon. To know how to use a ruler or compasses to construct triangles.	To know how to convert between units of measurement in 2D and 3D. To know how to use Euler's formula for a polyhedron. To know how to draw 3D shapes on isometric and plain paper. To know how to represent 3D shapes using plans and elevations. To know how to construct the net of a 3D shape. To know how to find the volume and surface area of polyhedra and solids, including prisms, pyramids, cylinders, cones, spheres and frustums.	To know how to identify congruent shapes by sight. To know how to tesselate the plane with congruent shapes and to know which shapes tesselate and why. To know that an object and image are congruent under rotation, reflection and translation. To know that an object and image are similar under enlargement. To know how to find missing length given similar shapes. To know how to work with the compound units of speed, density and pressure. To know how to convert between compound units.	To know that a vector is and contrast with a scalar. To know how to represent vectors as a column and in algebraic form. To know how to represent a path through addition of vectors. To know that parallel vectors are multiples of one another. To know how to represent unknown paths in terms of multiples of known vectors. To know how to find unknown components of vectors by equating coefficients.
	Why are we doing this now? How does it build on prior learning and prepare for knowledge and learning still to come?	Constructions and loci will be covered at the end of the 2D key concepts because the extra exposure to powerful language will enable the pupils to access precise vocabulary more easily.	3D shapes will introduce one shape at a time for investigation, like in polygons. This key concept will be rich in precise vocabulary which helps the students to unlock future skills i.e. similar shapes.	Ratio and proportion are a theme running throughout every area of maths. Ratio appears in geometry when comparing lengths, areas and volumes in similar shapes. Compound measures are fundamentally formulae however in geometry, we can signpost the significance of units such as speed, distance, time, etc.	Vector addition and scalar multiplication draw on the laws of arithmetic seen in year 7. Vector proof should be made more accessible due to the number of times we have used proof to get to this point in the journey.

Year 11 Applied Mathematics

Key Concepts	Probability	Probability	Statistics	Statistics
Pupils should know… (Core knowledge and concepts to be learned)	Probability, Theoretical vs experimental probability.	Combinations, Unconditional probability, Conditional probability.	Statistics, Sampling, Frequency tables, Central tendency, Variance, Pictograms, Bar charts, Pie charts.	Scatter graphs, **Cumulative frequency and box plots, Histograms.**
Pupils should be able to… (Skills being developed)	To know how to place events on a probability scale. To know how to find the theoretical probability of an event. To know how to find the relative frequency experimental probability of an event. To know that the sum of the probabilities of exhaustive mutually exclusive events is 1. To know how to generate theoretical sample spaces and use these to calculate probabilities. To know how to construct a frequency tree and two-way table and use these to find probabilities To know how to use experiments to predict probability and to know that experimental probability is more accurate as the numbers of trials increase.	To know how to draw a Venn diagram and use it to find probabilities. To know how to draw a Venn diagram to represent sets. To know how to write sets using formal notation. To know how to identify intersections and unions of sets and write them using formal notation. To know how to apply the 'AND' and 'OR' rules for independent and mutually exclusive events. To know how to produce systematic lists. To know how to find the number of possibilities for events using the product rule for counting. To know how to draw tree diagrams to represent and solve problems related to independent events. To know how to draw tree diagrams to represent and solve problems related to conditional events. To know how to apply the 'AND' and 'OR' rules to solve probability problems with and without the use of tree diagrams. To know how to form and solve equations to find unknowns in probability problems.	To know the different types of data: categorical, numerical, quantitative, primary, secondary. To know the difference between discrete and continuous data. To know how to represent categorical data in frequency table, bar charts, pictograms To know how to represent numerical data in grouped and ungrouped frequency tables. To know how represent discrete data in bar charts, line graphs, pictograms, pie charts, stem and leaf diagrams. To know how to find the mean, median, mode and quartiles of discrete data, including from an ungrouped frequency table. To know how to find the range and inter-quartile range of a data set. To know how to compare data sets using graphs, measures of average and measures of spread. To know the difference between a population and a sample. To know how to take simple random, systematic, and stratified sampling. To know how to draw a frequency polygon and estimate the mean from a frequency polygon.	To know how to represent bivariate data on a scatter graph. To know how to interpret relationships from a scatter graph. To know how to describe correlation from a scatter graph. To know how to draw a line of best fit. To know how to identify outliers. To know how to interpolate from a line of best fit, and the validity of interpolation. To know extrapolate and the validity of extrapolation. To know that correlation does not imply causation. To know how to draw and interpret graphs of time series. To know how to find the mean, median and mode of grouped data. To know how to find the median and quartiles of discrete data. To know how to represent data with a cumulative frequency curve. To know how to find the median, quartiles and IQR from a cumulative frequency curve. To know how to represent data with a box plot. To know how to compare two data sets from cumulative frequency curves or box plots. To know how to draw a histogram for continuous data. To know how to read and interpret a histogram. To know how to find estimate for the mean and median from a histogram.
Why are we doing this now? *How does it build on prior learning and prepare for knowledge and learning still to come?*	The areas studied so far are known as pure mathematics. It is essential that the distinction is drawn between pure and applied maths because people often confuse the two. Pure maths is always true, whereas we never know if applied maths is true. Probability is the study of the likeliness of events. However, knowing what should happen does not definitively tell us what will happen.	All skills linked to probability should be taught together so that students build a strong schema.	Statistical enquiry involves a process of data collection, analysis, interpretation and sharing. We will follow this process as we introduce the skills starting with data collection in sampling.	Scatter graphs is studied last because it analyses bivariate data as opposed to the univariate examples seen up until this point. Cumulative frequency is heavily linked to central tendency so those skills must be embedded first.