**MATHEMATICS Key Stage 4 Foundation**

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| **Topic title:**  Unit 2 Algebra | **Year: 10 Term: Autumn 1** | **Why we teach this:**  Algebra is a universal language that has been used for centuries in countries all over the world. | **Why we teach this here:**  Algebra forms the building block upon which many more topic are built. | |
| **Big questions:**   * Describe the key features of a formula/ identity/expression/ equation. * Explain the rules for simplifying various types of expressions. * Explain the difference in method between multiplying two terms and multiplying an expression by a term * What are the similarities between cancelling a numerical fraction and cancelling a simple algebraic fraction? * Explain the difference between partial and full factorisation. * When writing an expression, which words indicate the need to add/subtract/multiply/divide? | | **Builds on previous topics:**  The ability to use negative numbers with the four operations and recall and use hierarchy of operations and understand inverse operations; dealing with decimals and negatives on a calculator;  using index laws numerically. | **Links to future topics:**  Unit 5: Equations, Inequalities and Sequences  Unit 9: Graphs  Unit 16: Quadratic Equations and Graphs  Unit 20: More Algebra | |
| **Key knowledge:**   * Algebraic Expressions * Simplifying Expressions * Substitution * Using Formulae * Expanding Brackets * Factorising * Using Expressions and Formulae |  | |
| **Skills developed:**   * Use of correct algebraic notation. * Simplify algebraic expressions * Use of index rules to simplify expressions. * Substitute numbers into a formula. * Expand brackets and simplify * Factorise algebraic expressions * Form equations to solve a problem. | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  December | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Expression  Equation  Identity  Formula  Simplify  Index  Power  Expand  Factorise  Substitution | **Key vocabulary**  Terms  Like Terms  Common Factor  Linear  BIDMAS  Evaluate  Identity  Positive  Negative  Base |
| **Cultural capital opportunities:**  Formulae are widely used in Science, Mathematics and Engineering. They are used in everyday life to calculate the cost of tickets, phone charges, electricity bills etc. Real life graphs can be used to identify trends in data and to predict future behaviour. | | **Whole school Curricular Concept links:**  Money Matters and Nature's Wonders |

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| **Topic title:**  Unit 3 Graphs, Tables and Charts | **Year: 10 Term: Autumn 1** | **Why we teach this:**  Statistical diagrams are a useful way of representing data which makes it easier to interpret and make decisions based on that data. | **Why we teach this here:**  Consolidation of KS3 knowledge which helps prepare students for data handling in other subjects at GCSE, such as Science and Geography. | |
| **Big questions:**   * What information can you find out from a frequency table? * What are the advantages of using a two way table? * How do dual and composite bar charts allow you to make comparisons between data? * Under which circumstances would you choose to construct a histogram? * Describe the key features of a time series graph * What key information do you need in order to construct a pie chart? * What are the advantages of extracting data from a scatter graph? | | **Builds on previous topics:**  Students should be able to use inequality signs between numbers.  Students should be able to use negative numbers with the four operations, recall and use the hierarchy of operations and understand inverse operations.  Students should be able to deal with decimals and negatives on a calculator.  Students should be able to use index laws numerically.  Students should be able to draw a number line. | **Links to future topics:**  Unit 7: Averages and Range | |
| **Key knowledge:**   * Frequency Tables * Two way tables * Representing Data * Time Series * Stem and Leaf Diagrams * Pie Charts * Scatter Diagrams * Line of Best Fit |  | |
| **Skills developed:**   * Reading data from tables * Draw and interpret a series of statistical diagrams. * Draw conclusions based on data read from a number of statistical methods. | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  December | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Data  Mean  Median  Mode  Range  Outlier  Frequency  Bar Chart  Pie Chart | **Key vocabulary**  Pictogram  Compound  Comparative  Correlation  Variable  Continuous  Discrete  Time-Series  Interpret |
| **Cultural capital opportunities:**  Techniques for graphical presentation are used throughout the sciences, social sciences, finance etc. Most companies produce an annual report containing statistical diagrams, the media reports the results of polls and survey, and scientists report their findings in diagrammatical form. | | **Whole school Curricular Concept links:**  Technical Progress and Nature’s wonders. |

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| **Topic title:**  Unit 5 Equations, Inequalities and Sequences | **Year: 10 Term: Autumn 2** | **Why we teach this:**  Compare quantities and be able to use formulae to generalise patterns. | **Why we teach this here:**  Build confidence in generating and using formulae which are needed in future topics. | |
| **Big questions:**   * How can we recognise patters and use mathematics to use these patterns to solve problems in the real world? * Can you use a formula? * Can you use a function machine? * Can you solve an equation? * Can you solve a problem to calculate an unknown? * Can you find the next few terms of a sequence? * Can you generalise a sequence as a formulae? * Can you predict future terms in a sequence? * Can you determine if a term lies in a given sequence? | | **Builds on previous topics:**  Students should be able to use inequality signs between numbers. Students should be able to use negative numbers with the four operations, recall and use the hierarchy of operations and understand inverse operations. Students should be able to deal with decimals and negatives on a calculator.  Students should be able to use index laws numerically. Students should be able to draw a number line. | **Links to future topics:**  Unit 9: Graphs  Unit 16: Quadratic Equations and Graphs  Unit 20: More Algebra | |
| **Key knowledge:**   * Solving Equations * Solving Equations with brackets * Inequalities * Generating sequences * Using the nth term of a sequence |  | |
| **Skills developed:**   * Use equations for calculate quantities in science. * Able to solve an equation to find an unknown. * Compare quantities using inequalities. * Use a formula to calculate real world values in context. * Able to generalise a pattern and use it to predict future values with a high degree of confidence. | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  December | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Solve  Equation  Formula  Substitution  Inequality  Number Line  Sequence  Nth term  Fibonacci  Linear | **Key vocabulary**  Geometric  Functions  Subject of Formula  Rearrange  Expression  Identity |
| **Cultural capital opportunities:**  Nurses often use mathematical formula when they are administering drugs, for example, in converting from one unit to another, calculating the amount of a drug based on somebody's weight, or working out concentrations from solutions. Working with the formula is a topic within algebra comma and is a good example of the practical use of mathematics. | | **Whole school Curricular Concept links:**  Nature’s Wonders and Money Matters |

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| **Topic title:**  Unit 7 Averages and Range | **Year: 10 Term: Autumn 2** | **Why we teach this:**  To develop the ability to summarise data to enable comparisons and decisions to be made. | **Why we teach this here:**  Develop confidence in using mathematics to analyise large data sets. | |
| **Big questions:**   * Give two different examples to show when you would use the mean or median to represent your collected data. * What is the difference between discrete and continuous data? * How could you compare two sets of data? * What is different when showing discrete or continuous data in a table? | | **Builds on previous topics:**  Students should be able to calculate the midpoint of two numbers. Students will have drawn the statistical diagrams in unit 3. Students will have used inequality notation. | **Links to future topics:**  Advanced level study. | |
| **Key knowledge:**   * Mean and Range. * Mode, Median and Mean. * Types of Average. * Estimating the Mean. * Sampling. |  | |
| **Skills developed:**   * Calculate model group, median and mean from a Frequency Table. * Compare data sets using measures of location and dispersion. * Use a variety of statistical diagrams to represent data sets and the ability to interpret them in context. * Understand the concept of sampling and how to avoid bias. * Describe what is meant by ‘biased’? * With what data would you use an estimate? * When would you choose to collect primary or secondary data? | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  December | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Qualitative  Quantitative  Continuous  Discrete  Primary  Secondary  Date  Mean  Frequency Table | **Key vocabulary**  Sample  Census  Median  Mode  Range  Modal group  Outlier  Population  Random |
| **Cultural capital opportunities:**  In the modern world there is an ever-increasing volume of data being continually collected, analysed, interpreted and stored. It was estimated that in 2007, there was 295 exabytes of data being stored around the world. It has increased significantly since then. Statistics is the branch of mathematics that deals with the handling of data. | | **Whole school Curricular Concept links:**  Human Health |

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| **Topic title:**  Unit 8 Perimeter, Area and Volume. | **Year: 10 Term: Autumn 2** | **Why we teach this:**  Use of mathematics to measure shape and space in the real world. | **Why we teach this here:**  Confidence in the use of mathematical formula is high after studying previous units and students now have the opportunity to consolidate this knowledge in context. | |
| **Big questions:**   * What strategies and applications are important in computing for area, perimeter and volume? * Which formulae must be considered to calculate the area and perimeter of 3D shapes? * How is the volume of a 3D shape and the area of a 2D shape related? * How the area of a rectangle can helps to find the area of a triangle? * What similarities exist with finding the area of a parallelogram and a trapezium? * What are the names and characteristics of some 2D and 3D shapes? | | **Builds on previous topics:**  Students should be able to measure lines and recall the names of 2D shapes. Students should be able to use strategies for multiplying and dividing by powers of 10. Students should be able to find areas by counting squares and volumes by counting cubes. Students should be able to interpret scales on a range of measuring instruments. | **Links to future topics:**  Unit 10: Transformations  Unit 12: Right Angled Triangles  Unit 14: Constructions, Loci and Bearings  Unit 17: Perimeter, Area and Volume 2  Unit 19: Congruency, Similarity and Vectors | |
| **Key knowledge:**   * Rectangles, Parallelograms and Triangles. * Trapezia and Changing Units. * Area of Compound Shapes * Surface Area of 3D Solids. * Volume of Prisms. | | |
| **Skills developed:**   * Calculate the perimeter and area of shapes. * Calculate missing lengths given the area. * Conversion between units of area. * Calculate the surface area of 3D shapes. * Calculate the volume of 3D shapes. * Conversion between units of volume. | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  December | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Shape  Space  Volume  Area  Prism  Perimeter  Cuboid  Parallelogram  Triangle  Trapezium  Compound Shape | **Key vocabulary**  Cross Section  Depth  Width  Height  Cylinder  Estimations  Characteristics  Metric Units  Imperial Units  Conversion |
| **Cultural capital opportunities:**  Self-similarity is the property whereby an entire shape is mathematically similar to a part of itself. What this means is that you zoom in on a small corner of the shape, you get an exact replica of the original shape itself. Self-similarity is used in fractal images, it has real world use in the describing the structure of coastlines comma as well as the natural growth of plants such as ferns comma and the formation of crystals and snowflakes from | | **Whole school Curricular Concept links:**  Technological Progress |

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| **Topic title:**  Unit 9 Graphs | **Year: 10 Term: Spring 1** | **Why we teach this:**  Pupils need to be able to represent relationships graphically to understand and interpret. | **Why we teach this here:**  Once confidence has been built up in basic numeracy and algebra, we now look at using them to understand wider contexts. | |
| **Big questions:**   * What information can be represented on a graph? * What is the difference between an input and an output of a given function? * What are the key points to remember when drawing a graph> * How can you interpret information presented on a linear graph? | | **Builds on previous topics:**  Students should be able to plot coordinates and read scales  Students should be able to substitute into a formula. | **Links to future topics:**  Unit 16: Quadratic Equations and Graphs.  Unit 20: More Algebra | |
| **Key knowledge:**   * Coordinates * Linear Graphs * Graphs * Real-life graphs * Distance-time graphs * More real-life graphs |  | |
| **Skills developed:**   * Find the midpoint of a line segment * Generate and plot coordinates from a rule * Draw graphs to represent relationships * Understand what m and c refer to in * Find the equation of a straight line * Find the solution to straight line graphs. * Draw distance-time graphs * Interpret rates of change on a graph * Draw and interpret graphs from real data * Draw and interpret a range of graphs * Understand when predictions are valid. | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  March | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Linear  Graph  Distance  Time  Coordinate  Quadrant  Real-life graph | **Key vocabulary**  Gradient  Intercept  Function  Solution  Parallel |
| **Cultural capital opportunities:**  Kinematics the topic within maths that deals with motion. By writing equations and drawing graphs that describe the relationship between distance, speed and acceleration, it is possible to calculate things such as the speed of a vehicle a particular time during its journey. | | **Whole school Curricular Concept links:**  Technological Progress |

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| **Topic title:**  Unit 10 Transformations | **Year: 10 Term: Spring 1** | **Why we teach this:**  Pupils gain the ability to manipulate shape and space | **Why we teach this here:**  Once pupils are confident manipulating number and algebra, we look at manipulation of 2D and 3D space. | |
| **Big questions:**   * What are the four types of transformations? * What technique can change the size or position of a shape? * Can you describe a translation? * Can you describe a rotation? * Can you describe an enlargement? * Can you find the scale factor of an enlargement? * Can you find the centre of a rotation? * Can you describe the difference between congruent and similar shapes? | | **Builds on previous topics:**  Students should recall basic shapes. Students should be able to plot points in all four quadrants. Students should have an understanding of the concept of rotation. Students should be able to draw and recognise lines parallel to axes and y = x, y = -x. Students will have encountered the terms clockwise and anticlockwise previously. | **Links to future topics:**  Unit 12: Right angled triangles  Unit 15: Constructions, Loci and Bearing  Unit 17: Perimeter, Area and Volume 2  Unit 19: Congruence, Similarity and Vectors | |
| **Key knowledge:**   * Translation * Reflection * Rotation * Enlargement * Describing Enlargements * Combining Transformations |  | |
| **Skills developed:**   * Translate a shape on a coordinate grid * Use of a column vector to describe a translation * Draw a reflection of a shape in a mirror line and on a grid. * Rotate a shape on a coordinate grid * Describe a rotation * Enlarge a shape by a scale factor * Enlarge a shape using a centre of enlargement * Find the centre of enlargement * Describe combined transformations on a gird. | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  March | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Transformation  Rotation  Reflection  Enlargement  Translation  Single  Combination  Scale Factor  Mirror Line  Centre of Rotation  Column Vector | **Key vocabulary**  Centre of Enlargement  Similarity  Congruent  Angle  Direction  Coordinate  Describe |
| **Cultural capital opportunities:**  Transformations have many applications in real life. Graphic designers use transformations to create patterns, sushi bars use conveyers to translate dishes in front of customers and web designers using larger if the transform images. Observation wheels such as the London Eye rotate around a central axis but the individual capsules rotate in the opposite direction around their own axis of rotation. As a result the people inside the capsules remain upright. | | **Whole school Curricular Concept links:**  Technological Progress |

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| **Topic title:**  Unit 11 Ratio and Proportion | **Year: 10 Term: Spring 2** | **Why we teach this:**  To give pupils the ability to compare quantities and to change amounts in proportion accurately. | **Why we teach this here:**  Use previous knowledge in a practical context and solve problems. | |
| **Big questions:**   * How can I use ratio and proportion to express related ideas and relationships? * How do I write a ratio in its simplest form? * How can I divide a quantity into a given ratio? * How can I use a ratio to find one quantity when the other is know? * How do I write a ratio in the form 1:n? * What is the unitary method? | | **Builds on previous topics:**  Students should know the four operations of number. Students should have a basic understanding of fractions as being ‘parts of a whole’. | **Links to future topics:**  Unit 14: Multiplicative Reasoning | |
| **Key knowledge:**   * Writing ratios * Using ratios * Ratios and Measures * Comparing using ratios * Using proportion * Proportion and graphs * Proportion problems |  | |
| **Skills developed:**   * Use ratio notation * Write a ratio in its simplest form * Solve problems using ratio * Use ratios to convert between units * Divide a quantity into 2 and 3 parts in a given ratio * Use rations involving decimals * Compare ratios * Solve problems using ratio and proportion. * Work out ‘best buys’ * Recognise and use direct proportion on a graph * Understand the link between ratio and gradient * Solve problems involving indirect proportion. | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  March | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Ratio  Proportion  Share  Parts  Fraction  function | **Key vocabulary**  Direct proportion  inverse proportion  graphical  linear  compare |
| **Cultural capital opportunities:**  Colour theory is based on the idea that all possible colours can be created from 3 primary colours. Video screens use the additive colours red, green and blue. Artist often uses red, yellow and blue as the basis for mixing paints. Whilst the printing industry uses subtractive colours of cyan, magenta and yellow. The ratio in which the primary colours are mixed determines the colour of the result. | | **Whole school Curricular Concept links:**  Human Health |

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| **Topic title:**  Unit 12 Right Angles Triangles | **Year: 10 Term: Spring 2** | **Why we teach this:**  To enable pupil to solve problems in a real world context using right-angled triangles | **Why we teach this here:**  Use of formulae and algebraic manipulation are now sound. Their use within a more real-world context in now explored. | |
| **Big questions:**   * How could you use Pythagoras theorem to discover if a triangle is right-angled? * How could you find the missing length of a triangle that is drawn on a coordinate grid? * How might you find the length of a line segment? * How could you use Pythagoras to work out the missing side of a triangle? * How could you use Pythagoras to work out a missing angle of a triangle? * How can we use the sine, cos and tan ratio to calculate missing sides in a triangle? | | **Builds on previous topics:**  Students should be able to rearrange simple formulae and equations, as preparation for rearranging trigonometric formulae. Students should recall basic angle facts. Students should understand when to leave an answer in surd form. Students can plot coordinates in all four quadrants and draw axes. | **Links to future topics:**  Unit 15: Constructions, Loci and Bearings  Unit 17: Perimeter, Area and Volume 2  Unit 19: Congruence, Similarity and Vectors | |
| **Key knowledge:**   * Pythagoras’ theorem * Trigonometry: the sine ratio * Trigonometry: the cosine ratio * Trigonometry: the tangent ratio * Finding lengths and angles using trigonometry | | |
| **Skills developed:**   * Understand Pythagoras’ theorem * Calculate missing lengths in a right-angled triangle * Solve problem using Pythagoras’ theorem * Use trigonometric ratios to find missing lengths. * Use trigonometric ratios to find missing angles. * Solve problems involving right-angled triangles in context | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  March | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Triangle  Right-angle  angle  Pythagoras’ Theorem  Sine  Cosine  Tangent  Trigonometry  opposite  hypotenuse  adjacent | **Key vocabulary**  Ratio  Elevation  Depression  Length  accuracy |
| **Cultural capital opportunities:**  The highest mountain in the world is Mount Everest, located the Himalayas. Its peak is now measured to be 8848 metres above sea level. The mountain was first climbed in 1953, by Edmund Hillary and Sherpa Tenzing, almost 100 years after its height was first measured as part of the great trigonometrical survey of India in 1856. The original surveyors, who included George Everest, obtained the height of 8840 metres by measuring the distance and the angle of elevation between Mount Everest and a fixed location. | | **Whole school Curricular Concept links:**  Technological Progress |

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| **Topic title:**  Unit 14 Multiplicative Reasoning | **Year: 10 Term: Summer 1** | **Why we teach this:**  To allow pupils to use their multiplication and division skills to solve real world problems | **Why we teach this here:**  Confidence using numeracy is now secure and this unit gives the opportunity to explore its use in context. | |
| **Big questions:**   * How can you apply multiplication and division skills to solve real life problems? * Can you write different formulae to show how you calculate speed, density or pressure? * Describe how to convert from percentages to decimals? Can you include percentages greater than 100% * Draw a graph to show the current relationship between pounds (£) and Yen (¥) * Fill in the gaps with your own information and calculate, A car is bought for £\_\_\_\_\_\_\_\_\_. It increases in value by \_\_\_\_% every month. How much is it worth after 2 years? | | **Builds on previous topics:**  Students should be able to interpret scales on a range of measuring instruments. Students should be able to find a percentage of an amount and relate percentages to decimals.  Students should be able to rearrange equations and use these to solve problems. Students should know speed = distance/time, density = mass/volume. | **Links to future topics:**  n/a | |
| **Key knowledge:**   * Percentages * Growth and decay * Compound measures * Distance, speed and time * Direct and inverse proportion |  | |
| **Skills developed:**   * Calculate percentage profit/loss * Express one number as a percentage of another * Solve problems involving compound measures * Convert between speed measures * Calculate average speed * Use ratio and proportion in measure of conversion * Use inverse proportion | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  June | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Ratio  Proportion  best value  proportional change  compound measure  density  mass  volume  speed | **Key vocabulary**  Distance  Time  Density  Mass  Volume  Pressure  Acceleration  Velocity  Inverse  direct |
| **Cultural capital opportunities:**  The half-life of a radioactive isotope is the time taken for half its radioactive atoms to decay. The number of radioactive isotopes remaining after each half life forms a geometric sequence. Comparing the proportion of remaining radioactive isotopes to the geometric sequence, allows you to estimate the age of an artefact. Even something that is millions of years old. Scientists can estimate the age of a Dinosaur fossil by analysing the proportion of radioactive uranium atoms in the surrounding layers of volcanic rock. The oldest Dinosaur fossils are thought to be more than 240 million years old. | | **Whole school Curricular Concept links:**  Nature’s Wonders |

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| **Topic title:**  Unit 15 Constructions, Loci and Bearings | **Year: 10 Term: Summer 1** | **Why we teach this:**  To gain an understanding of shape and space | | **Why we teach this here:**  Scales and ratio are embedded by now so attention turns to considering the use of shape and space in context. | |
| **Big questions:**   * How would you identify a perpendicular bisector? * What is the ratio 7 : 14 written as 1 : * What will you use to draw a 60°angle accurately? * How do you check your answer after constructing a perpendicular bisector of a line? * What angle does the compass move through if it turns anticlockwise from north to south-west? * Where can we see loci used in real life? | | | **Builds on previous topics:**  Students should be able to measure and draw lines. | **Links to future topics:**  Unit 17: Perimeter, Area and Volume 2  Unit 19: Congruence, Similarity and Vectors | | |
| **Key knowledge:**   * Plans and elevations * Accurate drawing * Scale drawing and maps * Constructions * Loci and regions * Bearings |  | | |
| **Skills developed:**   * Identify and sketch planes of symmetry * Understand plans and elevations * Make accurate drawing of triangles and identify congruency * Draw diagrams to scale * Accurately draw angles and 2D shapes using mathematical instruments. * Draw a loci of points that follow a given rule. * Solve problems involving bearings and scale diagrams. | | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  June | | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Construct  Circle  Arc  Sector  Face  Edge  Vertex  two-dimensional  three-dimensional  solid  map  scale | **Key vocabulary**  Elevations  Congruent  Angles  Regular  Irregular  Bearing  Degree  Bisect  Perpendicular  Loci  Plan  region | |
| **Cultural capital opportunities:**  The invention of the wheel was most definitely a landmark event in human technological development, giving people the ability to travel and speed. However it was the use of gears and cogs on a massive scale during the industrial revolution that really accelerated advancement, not just in technology but also in social and economic development in full stop | | | **Whole school Curricular Concept links:**  Technological Progress |

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| **Topic title:**  Unit 16 Quadratics Equations and Graphs | **Year: 10 Term: Summer 2** | **Why we teach this:**  There are many applications of quadratic equations which the pupils will need to be able to use. | **Why we teach this here:**  By this stage a lot of algebra has been covered and now is the time to use more advanced algebra in context. | |
| **Big questions:**   * How do you determine the best strategy for solving quadratic equations? * Why do you need to factorise quadratic expressions for the form x2 +bx +c? * Which is the most suitable method to multiply two algebraic expressions with brackets? * How can ‘quadratic’ expressions be defined? * Explain what it means to find the root of quadratic functions? | | **Builds on previous topics:**  Students should be able to square negative numbers. Students should be able to substitute into formulae.  Students should be able to plot points on a coordinate grid. Students should be able to expand single brackets and collect ‘like’ terms. | **Links to future topics:**  Unit 20: More Algebra | |
| **Key knowledge:**   * Expanding double brackets * Plotting quadratic graphs * Using quadratic graphs * Factorising quadratic graphs * Solving quadratic equations graphically | | |
| **Skills developed:**   * Multiply double brackets * Square single brackets * Plot graphs of quadratic functions * Use quadratic graphs to solve problems * Solve quadratic equations using a graph * Factorise quadratic expressions * Solve quadratic functions algebraically | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  June | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Quadratic  Function  Solve  Expand  Factorise  Simplify  expression | **Key vocabulary**  Graph  Curve  Factor  Coefficient  bracket |
| **Cultural capital opportunities:**  When you look at a balls flight, you already know certain things about its path, or trajectory. It will travel in a smooth curve. It will reach a maximum point. Its downward path will tend to be a mirror image of the upwards path. In football, a goalkeeper knows this well so a striker may put spin on the ball to make its flight less predictable. The path of the ball could be modelled mathematically by a type of equation called a quadratic equation. | | **Whole school Curricular Concept links:**  Nature’s Wonders |

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| **Topic title:**  Unit 17 Perimeter, Area and Volume 2 | **Year: 10 Term: Summer 2** | **Why we teach this:**  Calculation of perimeter, area and volume of common 3D objects | **Why we teach this here:**  Algebra and shape/space at an advanced stage so attention now turns to application in context. | |
| **Big questions:**   * What is the most exact way to calculate with pi? * How can we use estimation to check our answers? * How do we decide on an appropriate degree of accuracy when rounding answers? * How can a formula be rearranged to help us? * How does area help us to calculate volume? * How does a circle relate to a sphere? * How can we calculate sectors of a circle if we know its area? | | **Builds on previous topics:**  Students should know the formula for calculating the area of a rectangle. Students should know how to use the four operations on a calculator. | **Links to future topics:**  Uni 19: Congruence, Similarity and Vectors | |
| **Key knowledge:**   * Circumference of a circle * Area of a circle * Semicircles and sectors * Composite 2D shapes and cylinders * Pyramids and cones | | |
| **Skills developed:**   * Calculate the circumference and radius of a circle. * Calculate the area of a circle. * Solve problems in circles and semi-circles. * Work out volume and surface area of 3D shapes involving circles. * Work out the volume and surface area of a pyramid and a cone. | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  June | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Area  Perimeter  Formula  Length  Width  Measurement  Volume  Circle  Segment  Arc  sector | **Key vocabulary**  Cylinder  Circumference  Radius  Diameter  Pi  Sphere  Cone  Hemisphere  Segment  Accuracy  surface area |
| **Cultural capital opportunities:**  In the cave of crystal giants in Mexico, vast crystals of selenite grow up to lengths of 11 metres, weighing up to 55 tonnes, the largest crystals have yet been discovered. The Cave was only discovered because there was a mine nearby, it is highly likely that there are even more awesome geological structures lying somewhere undiscovered beneath our feet! | | **Whole school Curricular Concept links:**  Artistic Creativity |

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| **Topic title:**  Unit 19 Congruence, Similarity and Vectors | **Year: 11 Term: Autumn 1** | **Why we teach this:**  To recognise patterns in shape and space to enable generalisations and predictions in shape and space. | | **Why we teach this here:**  Application of previous topics in context at an advanced stage of the course. | |
| **Big questions:**   * How can similarity, congruence and vectors be used to describe relationships between shapes/points/figures? * What criteria can you use to find out whether triangles are congruent? * How can you find out whether shapes are similar? * How can you use your knowledge of similarity to solve missing angle/side problems? * Can you explain what column notation means? * Can you represent vectors graphically? | | | **Builds on previous topics:**  Students will have used column vectors when dealing with translations. Students can recall and apply Pythagoras’ Theorem on a coordinate grid. Students should be able to recognise and enlarge shapes and calculate scale factors. Students know how to calculate area and volume in various metric measures. Students should be able to measure lines and angles and using compasses, ruler and protractor, and construct standard constructions. | **Links to future topics:**  n/a | | |
| **Key knowledge:**   * Similarity and enlargement * More similarity * Using similarity * Congruence * Vectors |  | | |
| **Skills developed:**   * Understand similarity. * Use similarity to solve problems. * Find the scale factor of an enlargement. * Understand similarity of regular polygons. * Use congruence to calculate unknown angles. * Add and subtract vectors. * Find multiples of a vector. | | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  December | | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Vector  Direction  Magnitude  Scalar  Multiple  Parallel  Collinear  Ratio  column vector congruence  side | **Key vocabulary**  Angle  Compass  Construction  Shape  Volume  Length  Area  Volume  scale factor  enlargement  similar  perimeter | |
| **Cultural capital opportunities:**  Using scale diagrams, including bearings and maps, provides a rich source of real-life examples and links to other areas of mathematics. Investigations involving vectors around 2D shapes such as a square can be extended to include considering the area enclosed in the same shapes. | | | **Whole school Curricular Concept links:**  Technological Progress |

**MATHEMATICS Key Stage 4 Foundation**

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| **Topic title:**  Unit 20 More Algebra | **Year: 11 Term: Autumn 2** | **Why we teach this:**  To allow students to explore more advanced application of algebra following on from previous units. | **Why we teach this here:**  Application of previous topics in context at an advanced stage of the course. | |
| **Big questions:**   * What are the practical uses of simultaneous equations? * How can you describe the difference between an equation and an identity? * What do you need to remember when you change the subject of a formula involving the use of square roots and squares? * How can you prove that a number is even using algebraic methods? * How can you eliminate a variable in a set of simultaneous equations? | | **Builds on previous topics:**  Students should be able to draw linear graphs. Students should be able to plot coordinates and sketch simple functions with a table of values. Students should be able to substitute into and solve equations.  Students should have experience of using formulae. Students should recall and use the hierarchy of operations and use of inequality symbols. | **Links to future topics:**  n/a | |
| **Key knowledge:**   * Graphs of cubic and reciprocal functions * Non-linear graphs * Solving simultaneous equations graphically * Solving simultaneous equations algebraically * Rearranging formulae * Proof | | |
| Skills developed:   * Know the difference between an equation and an identity and use and understand the ≠ symbol; * Change the subject of a formula involving the use of square roots and squares; * Answer ‘show that’ questions using consecutive integers (, + 1), squares 2, 2, even numbers 2, and odd numbers 2 +1; * Solve problems involving inverse proportion using graphs, and read values from graphs; * Find the equation of the line through two given points; * Recognise, sketch and interpret graphs of simple cubic functions; * Recognise, sketch and interpret graphs of the reciprocal function with ≠ 0; * Use graphical representations of inverse proportion to solve problems in context; * identify and interpret the gradient from an equation + = ; * Write simultaneous equations to represent a situation; * Solve simultaneous equations (linear/linear) algebraically and graphically; | |
| **Mini/Interim assessments:**  Quick 5s/End of topic mini-tests **Termly summative assessment:**  December | | **Independent study tasks/resources:**  KAO | **Key vocabulary**  Reciprocal  Linear  Gradient  Functions  Direct  Indirect  Estimate | **Key vocabulary**  Cubic  Subject  rearrange simultaneous  substitution elimination  proof |
| **Cultural capital opportunities:**  Simple simultaneous equations can be formed and solved from real life scenarios, such as 2 adult and 2 child tickets cost £18, and 1 adult and 3 child tickets costs £17. What is the cost of 1 adult ticket? | | **Whole school Curricular Concept links:**  Technological Progress |