ARNOLD LODGE
4 - 18 yrs Co-educational Independent Day School

Key Stage 4 Foundation Mathematics: Curriculum Map

Year 10: Cycle of Topics Per Year

1. Number, Algebra, Graphs, Tables and Charts

2. Fractions and Percentages and Equations, Inequalities and Sequences

3. Angles, Averages and Range, Perimeter, Area and Volume

4. Graphs and Transformations

5. Ratio and Proportion, Right-Angled Triangles and Probability

6. Multiplicative Reasoning, Constructions Loci and Bearings

Year 10 Mathematics (Foundation Tier)

Pupils will be working towards the Edexcel GCSE Foundation qualification. Pupils will continue to build on the fundamental mathematical skills developed in KS3, focusing on their depth of mathematical knowledge and their ability to prove and accurately demonstrate their mathematical skills. The Edexcel GCSE specification focuses on six core sub-topics of mathematics: Number, Algebra, Ratio, Geometry, Probability and Statistics, in varying proportions. The amount of time dedicated to each sub-topic in class is proportional to the percentage incorporated into the examination. Pupils will have continual exposure to exam-style questions with consistent modelling and reference to the mark schemes to ensure that pupils are aware of the requirements of each question.

Topic of Learning	Half-Termly Overview: Knowledge and Skills
HT1 **Unit 1: Number** • Integers and Place Value • Decimals • Indices, Powers and Roots • Factors, Multiples and Primes	**By the end of the unit, pupils should be able to:** **Integers and Place Value** • Use and order positive and negative numbers (integers) and decimals. • Add, subtract, multiply and divide positive and negative numbers (integers and decimals). • Multiply or divide any number by powers of 10. • Use brackets and the hierarchy of operations (not including powers). **Decimals** • Identify the value of digits in a decimal or whole number. • Compare and order decimal numbers using the symbols <, >, ≠. • Round to the nearest integer, to powers of 10, to a given number of decimal places and significant figures. • Estimate answers to calculations by rounding numbers to 1 significant figure and using inverse operations. **Indices Powers and Roots** • Recall square and cube numbers and their associated roots. • 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.

Factors, Multiples and Primes
- 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 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.
- Solve simple problems using HCF, LCM and prime numbers.

Unit 2: Algebra • The Basics • Expressions and Substitution into Formulae	**By the end of the unit, pupils should be able to:** **The Basics** • 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. **Expressions and Substitution into Formulae** • Expand and simplify single and double brackets. • Argue mathematically to show algebraic expressions are equivalent and understand the identity $\equiv$ sign. • Factorise algebraic expressions by taking out common factors. • Substitute both positive and negative numbers into simple algebraic expressions and expressions involving brackets and powers.
Unit 3: Graphs, Tables and Charts • Tables, Graphs, Charts	**By the end of the unit, pupils should be able to:** **Tables, Graphs, Charts** • Design and criticise questionnaires and other data collection techniques. • Construct tables for time-series data. • 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); pie charts; scatter graphs. • Identify the mode from a frequency table and the modal class from grouped frequency tables. • For scatter graphs, identify outliers, draw lines of best fit, use the line of best fit to make predictions and understand the correlation does not imply causation.
HT2	**Unit 4: Fractions and Percentages** • Fractions • Percentages	**By the end of the unit, pupils should be able to:** **Fractions** • Find equivalent fractions; order and compare fractions. • Add and subtract fractions, including improper fractions and mixed numbers. • Multiply and divide fractions, including improper fractions and mixed numbers. • Recognise recurring decimals and convert fractions such as 3/7 into recurring decimals. • Express a given number as a percentage of another. • Convert between fractions, decimals and percentages. **Percentages** • Find a percentage of a quantity. • Calculate percentage increase/decrease, including in the context of profit and loss. • Calculate percentage increase/decrease, using multipliers.

| **Unit 5: Equations, Inequalities and Sequences**
• Equations and Inequalities
• Sequences | **By the end of the unit, pupils should be able to:**

Equations and Inequalities
• Use function machines.
• Solve one and step equations, including equations in which the unknown appears on both sides of the equation.
• Solve angle and perimeter problems using algebra.
• Show inequalities on number lines.
• Solve inequalities (both two-part and three-part) and show the solution set on a number line.
• Use inequality notation to specify simple error intervals due to truncation or rounding.

Sequences
• Recognise sequences of odd and even numbers, and other sequences including Fibonacci sequences.
• Write the term-to-term definition of a sequence in words.
• Find the nth term for a pattern sequence, a linear sequence and of an arithmetic sequence.
• Use the nth term to generate terms; decide if a given number is in a sequence.
• Continue a geometric progression and find the term-to-term rule. |

HT3	**Unit 6: Angles** • Properties of Shapes, Parallel Lines and Angle Facts • Interior and Exterior Angles of Polygons	**By the end of the unit, pupils should be able to:** **Properties of Shapes, Parallel Lines and Angle Facts** • Estimate the size of angles. • Measure angles using a protractor. • Use notation for lines and angles. • Recall and apply basic angle facts, including that angles on a straight line sum to 180°, angles around a point sum to 360° and vertically opposite angles are equal. • Use the fact that the angle sum of a quadrilateral is 360°. • Distinguish between scalene, equilateral, isosceles and right-angled triangles. • Recall and apply the idea that the angle sum of a triangle is 180° **Interior and Exterior Angles of Polygons** • Recognise pentagons, hexagons, heptagons, octagons and decagons. • Understand 'regular' and 'irregular' as applied to polygons. • Calculate and use the sums of the interior angles of polygons. • 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°. • Explain why some polygons fit together and others do not.
	Unit 7: Averages and Range • Averages • Range	**By the end of the unit, pupils should be able to:** **Averages and Range** • 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. (NB: Pupils may have touched on this briefly during Unit 3: Tables, Graphs and Charts).

	Unit 8: Perimeter, Area and Volume • Perimeter • Area • Volume	**By the end of the unit, pupils should be able to:** **Perimeter, Area and Volume** • Identify and name common solids: cube, cuboid, cylinder, prism, pyramid, sphere and cone. • Convert between units of measure, including time and metric units to metric units of length, area, volume and capacity. • Calculate the perimeter of 2D shapes, including compound shapes. • Recall and use the formulae for the area of a triangle, rectangle, trapezium, parallelogram and compound shapes. • Sketch nets of cuboids and prisms. • Calculate the surface area of a prism • Find the volume of a prism, including a triangular prism, cube and cuboid.
HT4	**Unit 9: Graphs** • Real Life Graphs • Straight-Line Graphs	**By the end of the unit, pupils should be able to:** **Real Life Graphs** • Use axes and coordinates to specify points in all four quadrants in 2D. • Find the coordinates of the midpoint of a line segment. • Draw straight-line graphs for real-life situations e.g. conversion graphs. • Draw distance-time and velocity-time graphs. • Interpret distance-time graphs e.g. speed of individual sections, total distance and total time. • Find the gradient of a straight line from real-life graphs. **Straight-Line Graphs** • Plot and draw graphs of parallel to the axis and those of $y = a$, $x = a$, $y = x$ and $y = -x$. • Recognise that equations in the form $y = mx + c$ correspond to straight-line graphs in the coordinate plane. • Plot and draw graphs in the form $y = mx + c$ using a table of values. • Sketch the graph of a linear function, using the gradient and the y-intercept. • Identify parallel lines from their equations. • Find the equation of the line through one point with a given gradient. • Find approximate solutions to a linear equation from a graph.

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	Unit 10: Transformations	**By the end of the unit, pupils should be able to:** **Transformations** • Enlarge a given shape using positive integer scale factors and fractional scale factor and identify the centre of enlargement of a transformation already carried out. • Reflect a given shape
HT5	**Unit 11: Ratio and Proportion** • Ratio • Proportion	**By the end of the unit, pupils should be able to:** **Ratio** • Write ratios in their simplest form. • 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. • Compare ratios. • Write ratios in the form 1:m or m: 1. • Write a ratio as a fraction. • Write a ratio as a linear function. **Proportion** • Solve word problems using direct and inverse proportion. • Work out which product is the better buy. • Scale up recipes. • Recognise the graph of direct proportion. • Understand inverse proportion (graphs later). • Understand the direct proportion relationship as $y = kx$.

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Unit 12: Right-angled Triangles
   • Pythagoras
   • Trigonometry
		By the end of the unit, pupils should be able to:
		
		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.
		   • 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.
		   • Know the exact trigonometric values.

Unit 13: Probability
   • Probability
		By the end of the unit, pupils should be able to:
		
		Probability
		   • Mark events and/or probabilities on a scale of 0 to 1; describing them as impossible, unlikely, even chance, likely and certain to occur.
		   • Write probabilities in words or in fraction, decimal and percentage form.
		   • Find the probability of an event happening using theoretical probability.
		   • List all outcomes for single events systemically.
		   • Work out probability from frequency tables, frequency trees and two way tables.
		   • Identify different mutually exclusive outcomes and know that the sum of the probabilities of all outcomes is 1.
		   • Know and all the idea that probabilities sum to 1.
		   • Find the probability of an event happening using relative frequency.
		   • Understand experimental probabilities.
		   • Estimate the number of times an event will occur.
		   • Use and draw sample space diagrams.
		   • Work out probabilities from Venn Diagrams.
		   • Use union and intersection notation.
		   • Find the probability of successive events.
		   • Use tree diagrams to calculate the probability of two independent and dependent events.

	Unit 14: Multiplicative Reasoning • Compound Measures	**By the end of the unit, pupils should be able to:** **Compound Measures** • Understand and use compound measures, including density, pressure and speed. • Make calculations involving repeated percentage change. • Find the original amount given the final amount after a percentage increase or decrease. • Use compound interest. • Set up, solve and interpret the answers in growth and decay problems. • Interpret equations that describe direct and inverse proportion.
HT6	**Unit 15: Constructions Loci and Bearings** • Plans and Elevations • Constructions, Loci and Bearings	**By the end of the unit, pupils should be able to:** **Plans and Elevations** • Measure and draw lines, to the nearest mm. • Measure and draw angles, to the nearest degree. • Know and use compass direction. • Know the terms face, edge and vertex. • 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. **Constructions, Loci and Bearings** • Understand congruence. • Understand and know the conditions for similarity in triangles (SSS, SAS, ASA, RHS) • Use straight edge and a pair of compasses to do standard constructions: perpendicular bisector of a given line, the perpendicular from a point to a line, the bisector of a given angle, construct angles of 90° and 45°. • Find and describe regions satisfying a combination of loci. • Use and interpret maps and scale diagrams. • Use and calculate bearings.

Year 11: Cycle of Topics Per Year

1. Algebra;
Perimeter, Area and
Volume 2; Fractions,
Reciprocals,
Standard Form,
Zero and Negative
Indices

2. Congruence,
Similarities and Vectors;
Rearranging Equations,
Graphs of Cubic and
Reciprocal Functions and
Simultaneous Equations.

3. Application to Exam
Questions

4. Application to Exam
Questions and Revision

Year 11 Mathematics (Foundation Tier)

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	Topic of Learning	Half-Termly Overview: Knowledge and Skills
HT1	**Unit 16: Algebra (Quadratic Equations and Graphs)** • Quadratic Equations: Expanding and Factorising • Quadratic Equations: Graphs	**By the end of the unit, pupils should be able to:** **Quadratic Equations: Expanding and Factorising** • Define a 'quadratic' expression. • Multiply together two algebraic expressions with brackets; • Square a linear expression, e.g. $(x + 1)^2$; • Factorise quadratic expressions of the form $x^2 + bx + c$; • Factorise a quadratic expression $x^2 - a^2$ using the difference of two squares. • Solve quadratic equations by factorising. • Find the roots of a quadratic function algebraically. **Quadratic Equations: Graphs** • Generate points and plot graphs of simple quadratic functions, then more general quadratic functions.

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- Identify the line of symmetry of a quadratic graph.
- Find approximate solutions to quadratic equations using a graph.
- Interpret graphs of quadratic functions from real-life problems.
- Identify and interpret roots, intercepts and turning points of quadratic graphs.
- Solve simple problems using HCF, LCM and prime numbers.

Unit 17: Perimeter, Area and Volume 2 • Circles • Cylinders • Further 3D Shapes	**By the end of the unit, pupils should be able to:** • Recall the definition of a circle and identify, name and draw parts of a circle including tangent, chord and segment. • Recall and use formulae for the circumference of a circle and the area enclosed by a circle circumference of a circle = $2\pi r$ = πd, area of a circle = πr^2 • Use $\pi \approx 3.142$ or use the π button on a calculator. • Give an answer to a question involving the circumference or area of a circle in terms of π. • Find radius or diameter, given area or perimeter of a circle; • Find the perimeters and areas of semicircles and quarter-circles; • Calculate perimeters and areas of composite shapes made from circles and parts of circles. • Calculate arc lengths, angles and areas of sectors of circles. • Find the surface area and volume of a cylinder. • Find the surface area and volume of spheres, pyramids, cones and composite solids. • Round answers to a given degree of accuracy.
Unit 18: More Fractions, Reciprocals, Standard Form, Zero and Negative Indices • Fractions	**By the end of the unit, pupils should be able to:** **Fractions** • Add and subtract mixed number fractions.

	• Indices and Standard Form	• Multiply mixed number fractions.
		• Divide mixed numbers by whole numbers and vice versa.
		• Find the reciprocal of an integer, decimal or fraction.
		• Understand 'reciprocal' as multiplicative inverse, knowing that any non-zero number multiplied by its reciprocal is 1 (and that zero has no reciprocal because division by zero is not defined).
		Indices and Standard Form
		• Use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of integer powers, fractions and powers of a power.
		• Use numbers raised to the power zero, including the zero power of 10.
		• Convert large and small numbers into standard form and vice versa.
		• Add, subtract, multiply and divide numbers in standard form.
		• Interpret a calculator display using standard form and know how to enter numbers in standard form.
HT2	**Unit 19: Congruence, Similarity and Vectors** • Similarity and Congruency in 2D • Vectors	**By the end of the unit, pupils should be able to:** **Similarity and Congruency in 2D** • Use the basic congruence criteria for triangles (SSS, SAS, ASA and RHS). • Solve angle problems involving congruence. • Identify shapes which are similar; including all circles or all regular polygons with equal number of sides. • Understand similarity of triangles and of other plane shapes, use this to make geometric inferences, and solve angle problems using similarity. • Identify the scale factor of an enlargement of a shape as the ratio of the lengths of two corresponding sides. • Understand the effect of enlargement on perimeter of shapes. • Solve problems to find missing lengths in similar shapes. • Know that scale diagrams, including bearings and maps are 'similar' to the real-life examples. **Vectors** • Understand and use column notation in relation to vectors. • Be able to represent information graphically given column vectors. • Identify two column vectors which are parallel. • Calculate using column vectors, and represent graphically, the sum of two vectors, the difference of two vectors and a scalar multiple of a vector.

Unit 20: Rearranging Equations, Graphs of Cubic and Reciprocal Functions and Simultaneous Equations. • Rearranging Equations • Further Graphs • Simultaneous Equations	**By the end of the unit, pupils should be able to:** • Know the difference between an equation and an identity and use and understand the $\equiv$ symbol. • Change the subject of a formula involving the use of square roots and squares. • Answer 'show that' questions using consecutive integers (n, $n + 1$), squares a^2, b^2, even numbers $2n$, and odd numbers $2n +1$. • 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 $y \square \frac{1}{x}$ with $x \neq 0$; x • Use graphical representations of inverse proportion to solve problems in context. • Identify and interpret the gradient from an equation $ax + by = c$. • Write simultaneous equations to represent a situation. • Solve simultaneous equations (linear/linear) algebraically and graphically. • Solve simultaneous equations representing a real-life situation, graphically and algebraically, and interpret the solution in the context of the problem;

HT3	**Application to Exam Questions**
HT4	**Application to Exam Questions and Revision**

HT5	**Application to Exam Questions and Revision**