

Roundwood Park School



KS4 Maths (Pearson Edexcel Level 1/Level 2 GCSE (9–1)) (1MA1)

Mathematics is incredibly important in our lives and, without realising it, we use mathematical concepts, as well as the skills we learn from doing maths problems, every day. The laws of mathematics govern everything around us, and with a good understanding of them, we can accomplish some truly exceptional things.

We want all our students to see the beauty of maths, to be proud of their achievements and be supported by passionate staff through incorporating their ASPIRE learning habits in their mathematical endeavours.

All students will have the opportunity to benefit fully from a broad, balanced and challenging programme, which supports their studies across all subjects. Our overarching aim is to develop the mathematical knowledge of students through the application and study of mathematical concepts, terminology, notation, facts, generalisations, methods and techniques. We will support students to develop extensive subject-specific vocabulary and will ensure that, where appropriate, students are exposed to suitable extension material.

We will in addition ensure students are fully prepared to sit the GCSE and that the students are prepared with the skills needed for success in the next steps of their life be it in the workplace or further education. We want to continue to offer our students opportunities for enrichment and challenge through extra-curricular activities with a view inspire them enough to want to consider their maths further.

The aims and objectives of the Mathematics course are to enable students to:

- develop fluent knowledge, skills and understanding of mathematical methods and concepts
- acquire, select and apply mathematical techniques to solve problems
- reason mathematically, make deductions and inferences, and draw conclusions
- comprehend, interpret and communicate mathematical information in a variety of forms appropriate to the information and context.

Topics	Prior Knowledge	Foundation	Cross over	Higher
1. Standard Form <i>Standard form</i> <i>Significant figure</i> <i>Power</i> <i>Indices</i>	Writing numbers in standard form Convert a 'near miss' into standard form; e.g. 23×10^7	Multiplying and dividing in standard form, Ordering standard form	Quick methods for adding subtracting standard form	
2. Indices Negative and Fractional Indices Surds <i>Powers</i> <i>Indices</i> <i>Coefficients</i> <i>Roots</i>	Working with powers use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 Calculate with roots, and with integer indices	Indices positive and Negative Addition, subtraction and power rules with indices <ul style="list-style-type: none"> $a^0 = 1$ Know that $a^{-n} = 1/a^n$ Know that $a^{1/n} = \sqrt[n]{a}$ 	Fractional indices Include problems like $8^x = 2^{12}$	Surds Simplify surd expressions involving squares, calculate exactly with surds add, subtract, multiply and divide. rationalise denominators
3. Rearranging formulae <i>Power</i> <i>Indices</i> <i>Formula, Formulae</i> <i>Subject</i> <i>Change the subject</i>	Solving linear equations including brackets	rearranging non-linear formulae (involving powers and roots)		Rearranging equations involving linear factorisation
4. Enlargement and similarity <i>Ratio</i> <i>Similar</i> <i>Congruent</i> <i>Scale factor</i> <i>Conversion</i> <i>Transformation</i> <i>Invariance</i>	Enlargement with positive scale factors and any centre of enlargement	Enlargement (including fractional enlargements) Multiple Transformations and invariance Similarity – triangles missing sides	Enlargement with negative scale factors Similarity of length and area, including conversions between square and cube units compare lengths, areas and volumes using ratio notation	Similarity with algebra
5. Pythagoras and trigonometry Hypotenuse Elevation Depression Trigonometry	Pythagoras Theorem	Right angled Trig finding sides and angles know the exact values of $\sin \theta$ and $\cos \theta$ for $\theta = 0, 30, 45, 60$ and 90 ; know the exact value of $\tan \theta$ for $\theta = 0, 30, 45$ and 60	Non-calculator trigonometry problems Problems using bearings and angles of elevation and depression	Right angled trig exact values 3D problems Use Pythagoras' theorem to find the length a given diagonal in a cuboid Use Pythagoras' theorem to find lengths in three dimensional figures Use trigonometry to find the angle between a line and a plane Solve practical problems involving lengths and angles in three dimensional figures

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6. Quadratics Factorising, expanding and plotting <i>Product</i> <i>Variable</i> <i>Term</i> <i>Coefficient</i> <i>Common factor</i> <i>Factorise</i> <i>Algebra, algebraic, algebraically</i> <i>Unknown</i> <i>Equation</i> <i>Operation</i> <i>Solve</i> <i>Solution</i> <i>Brackets</i> <i>Symbol</i>	Expanding quadratics	Quadratics $a = 1$ Factorising and solving Plot quadratic graphs Relate quadratic equations to graphs Identify and interpret roots, intercepts, turning points of quadratic functions graphically	Factorising the difference of two squares Expanding more than two binomials Identify when it is necessary to remove factors to factorise a quadratic expression to simplify to $a = 1$ factorising a quadratic where $a > 1$	Expand the product of two binomials involving surds Complete the square Quadratic Formula Relate factorisation and completing the square to features of graph
7. $Y=mx+c$ Sketch plot Gradient y-intercept, x-intercept	$Y=mx+c$ Representing equations in the form $y = mx + c$ on a coordinate grid Read gradient using 1 across, 'm' up/down and find y-intercept from a given graph, use these to give the equation in the form $y = mx + c$. Sketch a graph given the gradient and y-intercept (without plotting a table of values) Calculate the gradient of a line using change in y/change in x Use the form $y = mx + c$ to identify parallel lines	Find the equation of a line through one point with a given gradient Find the equation of a line through two given points Interpret the gradient of a straight line graph as a rate of change Rearrange an equation into the form $y = mx + c$		Equation of Perpendicular lines Problem solving with perpendicular and parallel lines

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8. Simultaneous Equations Equation Simultaneous equation Variable Manipulate Eliminate Solve Derive Interpret			Find approximate solutions to simultaneous equations using a graph Solve simultaneous equations by elimination including multipliers for both equations Derive and solve two simultaneous equations Interpret the solution to a pair of simultaneous equations		Simultaneous equations one linear one quadratic Make an appropriate substitution when solving simultaneous equations in two variables where one is quadratic Manipulate and solve the resulting quadratic equation to find the values for one variable Find the values of the second variable by substitution Make connections between simultaneous equations and graphs
9. Inequalities Linear inequality Unknown Manipulate Solve Solution set Integer		Understand the meaning of the four inequality symbols Choose the correct inequality symbol for a particular situation order positive and negative integers, decimals and fractions; use the symbols Represent practical situations as inequalities Recognise a simple linear inequality Find the set of integers that are solutions to an inequality Know when to use an open circle or closed circle at the end of a range of values shown on a number line are true for two inequalities	Use set notation to list a set of integers Use a formal method to solve an inequality Know how to deal with negative number terms in an inequality Know how to show a range of values that solve an inequality on a number line	Graphing linear inequalities: solve linear inequalities in two variables Know when to use a dotted line as a boundary for an inequality on a graph Know when to use a solid line as a boundary for an inequality on a graph Construct and shade a graph to show a linear inequality of the form $y > ax + b$, $y < ax + b$, $y \geq ax + b$ or $y \leq ax + b$ Find the set of integer coordinates that are solutions to a set of inequalities in two variables Construct and shade a graph to show a linear inequality in two variables stated implicitly	Use set notation to represent the solution set to an inequality quadratic inequalities in one variable; represent the solution set using set notation and on a graph Use the graph to find, and state the solution to a quadratic inequality
10. Percentages Percent, Percentage Percentage change Original amount Multiplier (Simple) interest		Identify the multiplier for a percentage increase or decrease when the percentage is greater than 100%. Use calculators to increase an amount by a percentage greater than 100%	Solve problems involving percentage change Solve original value problems when working with percentages Solve financial problems including simple interest	Compound interest Calculate the result of a repeated percentage change,	Set up a growth or decay problem Solve problems involving growth and decay
11. Fractions Fraction Mixed number Top-heavy fraction Percentage	Decimal Proportion Terminating Recurring Simplify / Cancel	Fraction arithmetic including mixed numbers		Algebraic Fraction arithmetic simplifying algebraic fractions, including numerical factors, single letter factors	Algebraic fractions simplifying and solving Convert recurring decimals into their corresponding fractions and vice versa

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12. Area and volume Composite) solid Sphere, Pyramid, Cone Perpendicular (height), (slant height) Surface area Volume	Identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, <i>tangent, arc, sector and segment</i> identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres <i>construct and</i> interpret plans and elevations of 3D shapes.	know and apply formulae to calculate: area of triangles, parallelograms, trapezia; volume of cuboids and other right prisms (including cylinders) know the formulae: circumference of a circle = $2\pi r$, area of a circle = πr^2 ; calculate areas and perimeters of circles and composite shapes;	<i>calculate arc lengths, angles and areas of sectors of circles</i> Calculate the arc length of a sector when radius is given Calculate the area of a sector when radius is given Calculate the angle of a sector when the arc length and radius are known Know the vocabulary of circles	<i>surface area and volume of spheres, pyramids, cones and composite solids</i> Use Pythagoras' theorem to find lengths in a pyramid Solve practical problems involving length, area and volume in similar figures
13. Algebra sequences Term Term-to-term rule Position-to-term rule nth term Generate Linear Quadratic First (second) difference Fibonacci number Fibonacci sequence	Linear sequences using nth term and finding nth term $an + b$	Recognise Fibonacci numbers and sequence Generate Fibonacci type sequences Find the next three terms in any Fibonacci type sequence Substitute numbers into formulae including terms in x^2 Generate terms of a quadratic sequence from a written rule and nth term Identify quadratic sequences Find the next three terms in any quadratic sequence Establish the first and second differences of a quadratic sequence to find nth term	Deduce expressions to calculate the nth term of quadratic sequences $a > 1$	recognise and use simple geometric progressions (ar^n where n is an integer, and r could be a surd or a fraction) and other sequences
15. Angles Radius, radii Tangent Chord Theorem Conjecture Derive Prove, proof Segment	apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles; understand and use alternate and corresponding angles on parallel lines; derive and use the sum of angles in a triangle (e.g. to deduce and use the angle sum in any polygon, and to derive properties of regular polygons)	derive and apply the properties and definitions of: special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus; and triangles and other plane figures using appropriate language bearings	congruence criteria for triangles (SSS, SAS, ASA, RHS)	Circle theorems apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results Cyclic Quadrilateral: Radius and Tangent: Radius and chord: Angles in the Same Segment: The Angle in the Centre Two Tangents Alternate Segment Theorem:
16. Transformations Reflect Rotate Enlarge Scale factor Invariance	identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement <i>(including fractional scale factors)</i>		describe the changes and invariance achieved by combinations of rotations, reflections and translations	

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17. Rounding Inequality Truncate Round Minimum, Maximum Interval Decimal place Significant figure	Round to a given number of decimal places or significant figures Estimating solutions	rounding errors and error intervals (upper and lower bounds of a rounded number) using inequalities Truncating vs. rounding basic calculations with UB/LB on	Approximations to calculations Calculations with upper and lower bounds, percentage error of these calculations	
18. Ratio Direct proportion Inverse proportion Multiplier Linear Ratio Proportion Proportional Multiplier	Use ratio notation, including reduction to simplest form divide a given quantity into two parts in a given part:part or part:whole ratio; express the division of a quantity into two parts as a ratio; apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations)	GCSE problems and applications, including fractions in problems Equations in ratio (e.g. $x:x+5 = 4:5$)	GCSE problem solving ratio	
19. Proportion Direct proportion Inverse Multiplier Constant of proportionality	Know the difference between direct and inverse proportion	Recognise direct (inverse) proportion in a situation Know the features of a graph that represents a direct (inverse) proportion situation. Know the features of an expression (or formula) that represents a direct (inverse) proportion situation use compound units such as speed, rates of pay, unit pricing, <i>density</i> and <i>pressure</i>	Understand the connection between the multiplier, the expression and the graph construct equations that describe direct and inverse	Create a statement describing an identified proportional relationship (e.g. $y \propto x^2$) Create an initial equation describing an identified proportional relationship (e.g. $y = kx^2$) Use given facts to identify the value of the multiplier in a situation involving proportion Create an equation in two variables describing an identified proportional relationship (e.g. $y = 3x^2$)

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H1. Non right-angled trigonometry Adjacent				know and apply the sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$, and cosine rule, $a^2 = b^2 + c^2 - 2bc \cos A$, to find unknown lengths and angles know and apply $\text{Area} = \frac{1}{2} ab \sin C$ to calculate the area, sides or angles of any triangle. Solve problems involving bearings
20. Recognise graphs Speed Distance Acceleration Quadratic Cubic Reciprocal Exponential Trigonometric	Plot and interpret graphs (including reciprocal graphs) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration	Recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal $\frac{1}{x}$ function $y = \frac{1}{x}$ with $x \neq 0$	plot and interpret exponential graphs to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration	recognise, sketch and interpret graphs of exponential functions $y = k^x$ for positive values of k , and the trigonometric functions (with arguments in degrees) $y = \sin x$, $y = \cos x$ and $y = \tan x$ for angles of any size
H2. Functions Function Composite Inverse Translation Stretch Transformations				Understand the meaning of a function Know the notation for composite functions Find the inverse of a given function Solve problems involving inverse functions Solve problems involving composite functions sketch translations and reflections of a given function <ul style="list-style-type: none"> Know the effects of transforming the graph $y = f(x)$: $f(ax)$, $af(x)$, $f(x) + a$, $f(x + a)$, $y = f(-x)$ and $y = -f(x)$ Solve problems involving the transformation of graphs

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21 Probability Probability, Theoretical probability Event Outcome Impossible, Unlikely, Evens chance, Likely, Certain Equally likely	Relate relative expected frequencies to theoretical probability, using appropriate language and the 0 – 1 probability scale apply the property that the probabilities of an exhaustive set of outcomes sum to one; apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one	Recording outcomes and possibilities using frequency trees, two-way tables and simple Venn diagrams. Use these diagrams to calculate probabilities Draw and interpret tree diagrams and associated probabilities for independent events Use a tree diagram to calculate probabilities of independent combined events Understand that relative frequency tends towards theoretical probability as sample size increases	Label a tree diagram with probabilities when events are dependent Use a tree diagram to calculate probabilities of dependent combined events Use a Venn diagram to sort information in a probability problem Use a two-way table to sort information in a probability problem Use a Venn diagram to calculate theoretical probabilities Use a two-way table to calculate theoretical probabilities Calculate conditional probabilities using different representations	calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams. Algebraic questions
22. Statistics Calculating Mean Mode Median Cumulative frequency Inter quartile Box and whisker	(median, mean, mode and modal class) and spread (range, including consideration of outliers for ungrouped and grouped data		cumulative frequency graphs, and know their appropriate use IQR Construct box and Whisker diagrams and interpret	
23. Statistics sampling Sample Population Capture/recapture Bias	Infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling			Methods of sampling Capture/recapture

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24. Vectors Vector Translation Column vector Geometric argument	Describe translations as 2D vectors		Vector notation apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors	Use vectors to construct geometric arguments and proofs
25. Statistics Graphing Pie chart Frequency table Discrete Time series Interpolate Extrapolate Histogram Frequency density	Interpret, construct and analyse tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data, <i>tables and line graphs for time series data</i> and know their appropriate use	Use and interpret scatter graphs of bivariate data; recognise correlation <i>and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing</i>		Histograms construct and interpret diagrams for grouped discrete data and continuous data, Construct and use the horizontal axis of a histogram correctly Know that frequency density = frequency ÷ class width Identify when it is necessary to calculate the frequency density Construct histograms for grouped data with equal class intervals Construct histograms for grouped data with unequal class intervals Use a histogram to find missing values in a frequency table Use a partially completed histogram and frequency table to complete both
H3. Iteration				Find approximate solutions to equations numerically using iteration work with general iterative processes

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<p>26 Units & graphing Compound Units Velocity Density Pressure Speed Conversion Gradient Tangent</p>	<p>Compound units - density, pressure, speed, including conversions between compound units Real-life graphs (of all sorts, including distance-time and velocity-time)</p>		<p>Recognise (plot, interpret) exponential graphs Plot graphs of non-standard functions Use graphs of non-standard functions to solve simple kinematic problems</p>	<p>Recognise that the gradient of a curve is not constant Know that the gradient of a curve is the gradient of the tangent at that point Calculate (estimate) the gradient at a point on a curve Interpret the gradient at a point on a curve as the instantaneous rate of change Solve problems involving the gradients of graphs in context Know that the area under a speed-time graph gives the distance Calculate (estimate) the area under a graph Solve problems involving the area under graphs in context</p>
<p>H4. Algebraic proof</p>				<p>Algebraic Proof Odd/even proof</p>