Marshalls Park Academy - Curriculum Overview

Subject: Mathematics Year Group: 9 Higher

In Year 9, Students start the three year KS4 mathematics curriculum.

The aim of the curriculum is to become fluent in the fundamentals of mathematics, reason mathematically and solve problems.

TERM 1	TERM 2	TERM 3
CONTENT/SKILLS	CONTENT/SKILLS	CONTENT/SKILLS
Number • Add, subtract, multiply and divide decimals, whole numbers including any number between 0 and 1; • Put digits in the correct place in a decimal calculation and use one calculation to find the answer to another; • Use the product rule for counting (i.e. if there are m ways of doing one task and for each of these, there are n ways of doing another task, then the total number of ways the two tasks can be done is $m \times n$ ways); • Round numbers to the nearest 10, 100, 1000, the nearest integer, to a given number of decimal places and to a given number of significant figures; • Estimate answers to one- or two-step calculations, including use of rounding numbers and formal estimation to 1 significant figure: mainly whole numbers and then decimals. • Use index notation for integer powers of 10, including negative powers; • Recognise powers of 2, 3, 4, 5; • Use the square, cube and power keys on a calculator and estimate powers and roots of any given positive number, by considering the values it must lie between, e.g. the square root of 42 must be between 6 and 7;	**Fractions, ratios and percentages** • Express a given number as a fraction of another; • Find equivalent fractions and compare the size of fractions; • Write a fraction in its simplest form, including using it to simplify a calculation, e.g. 50 ÷ 20 = $\frac{50}{20} = \frac{5}{2}$ = **2.5**; • Find a fraction of a quantity or measurement, including within a context; • Convert a fraction to a decimal to make a calculation easier; • Convert between mixed numbers and improper fractions; • Add and subtract fractions, including mixed numbers; • Multiply and divide fractions, including mixed numbers and whole numbers and vice versa; • Understand and use unit fractions as multiplicative inverses; • By writing the denominator in terms of its prime factors, decide whether fractions can be converted to recurring or terminating decimals; • Convert a fraction to a recurring decimal and vice versa; • Find the reciprocal of an integer, decimal or fraction; • Convert between fractions, decimals and percentages;	**Graphs** • Identify and plot points in all four quadrants; • Draw and interpret straight-line graphs for real-life situations, including ready reckoner graphs, conversion graphs, fuel bills, fixed charge and cost per item; • Draw distance-time and velocity-time graphs; • Use graphs to calculate various measures (of individual sections), including: unit price (gradient), average speed, distance, time, acceleration; including using enclosed areas by counting squares or using areas of trapezia, rectangles and triangles; • Find the coordinates of the midpoint of a line segment with a diagram given and coordinates; • Find the coordinates of the midpoint of a line segment from coordinates; • Calculate the length of a line segment given the coordinates of the end points; • Find the coordinates of points identified by geometrical information. • Find the equation of the line through two given points. • Plot and draw graphs of $y = a$, $x = a$, $y = x$ and $y = -x$, drawing and recognising lines parallel to axes, plus $y = x$ and $y = -x$; • Identify and interpret the gradient of a line segment;

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- Find the value of calculations using indices including positive, fractional and negative indices;
- Recall that $n^0 = 1$ and $n^{-1} = \frac{1}{n}$ for positive integers n as well as, $n^{\frac{1}{2}} = \sqrt{n}$ and $n^{\frac{1}{3}} = \sqrt[3]{n}$ for any positive number n;
- Understand that the inverse operation of raising a positive number to a power n is raising the result of this operation to the power $\frac{1}{n}$;
- Use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of integer powers, fractional and negative powers, and powers of a power;
- Solve problems using index laws;
- Use brackets and the hierarchy of operations up to and including with powers and roots inside the brackets, or raising brackets to powers or taking roots of brackets;
- Use an extended range of calculator functions, including +, -, ×, ÷, x^2, $\sqrt{x}$, memory, x^y, $x^{\frac{1}{y}}$, brackets;
- Use calculators for all calculations: positive and negative numbers, brackets, powers and roots, four operations.
- 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;
- Understand surd notation, e.g. calculator gives answer to $\sqrt{8}$ as $2\sqrt{2}$;
- Simplify surd expressions involving squares (e.g. $\sqrt{12} = \sqrt{(4 \times 3)} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}$).

- Express a given number as a percentage of another number;
- Express one quantity as a percentage of another where the percentage is greater than 100%
- Find a percentage of a quantity;
- Find the new amount after a percentage increase or decrease;
- Work out a percentage increase or decrease, including: simple interest, income tax calculations, value of profit or loss, percentage profit or loss;
- Compare two quantities using percentages, including a range of calculations and contexts such as those involving time or money;
- Find a percentage of a quantity using a multiplier and use a multiplier to increase or decrease by a percentage in any scenario where percentages are used;
- Find the original amount given the final amount after a percentage increase or decrease (reverse percentages), including VAT;
- Use calculators for reverse percentage calculations by doing an appropriate division;
- Use percentages in real-life situations, including percentages greater than 100%;
- Describe percentage increase/decrease with fractions, e.g. 150% increase means $2\frac{1}{2}$ times as big;
- Understand that fractions are more accurate in calculations than rounded percentage or decimal equivalents, and choose fractions, decimals or percentages appropriately for calculations.
- Express the division of a quantity into a number parts as a ratio;
- Write ratios in form 1 : m or m : 1 and to describe a situation;

- Recognise that equations of the form $y = mx + c$ correspond to straight-line graphs in the coordinate plane;
- Identify and interpret the gradient and y-intercept of a linear graph given by equations of the form $y = mx + c$;
- Find the equation of a straight line from a graph in the form $y = mx + c$;
- Plot and draw graphs of straight lines of the form $y = mx + c$ with and without a table of values;
- Sketch a graph of a linear function, using the gradient and y-intercept (i.e. without a table of values);
- Find the equation of the line through one point with a given gradient;
- Identify and interpret gradient from an equation $ax + by = c$;
- Find the equation of a straight line from a graph in the form $ax + by = c$;
- Plot and draw graphs of straight lines in the form $ax + by = c$;
- Interpret and analyse information presented in a range of linear graphs:
  - use gradients to interpret how one variable changes in relation to another;
  - find approximate solutions to a linear equation from a graph;
  - identify direct proportion from a graph;
  - find the equation of a line of best fit (scatter graphs) to model the relationship between quantities;
- Explore the gradients of parallel lines and lines perpendicular to each other;
- Interpret and analyse a straight-line graph and generate equations of lines parallel and perpendicular to the given line;

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Algebra

- Use algebraic notation and symbols correctly;
- Know the difference between a term, expression, equation, formula and an identity;
- Write and manipulate an expression by collecting like terms;
- Substitute positive and negative numbers into expressions such as $3x + 4$ and $2x^3$ and then into expressions involving brackets and powers;
- Substitute numbers into formulae from mathematics and other subject using simple linear formulae, e.g. $l \times w$, $v = u + at$;
- Simplify expressions by cancelling, e.g. $\frac{4x}{2} = 2x$;
- Use instances of index laws for positive integer powers including when multiplying or dividing algebraic terms;
- Use instances of index laws, including use of zero, fractional and negative powers;
- Multiply a single term over a bracket and recognise factors of algebraic terms involving single brackets and simplify expressions by factorising, including subsequently collecting like terms;
- Expand the product of two linear expressions, i.e. double brackets working up to negatives in both brackets and also similar to $(2x + 3y)(3x - y)$;
- Know that squaring a linear expression is the same as expanding double brackets;
- Factorise quadratic expressions of the form $ax^2 + bx + c$;
- Factorise quadratic expressions using the difference of two squares.
- Set up simple equations from word problems and derive simple formulae;
- Write ratios in their simplest form, including three-part ratios;
- Divide a given quantity into two or more parts in a given part : part or part : whole ratio;
- Use a ratio to find one quantity when the other is known;
- Write a ratio as a fraction and as a linear function;
- Identify direct proportion from a table of values, by comparing ratios of values;
- Use a ratio to compare a scale model to real-life object;
- Use a ratio to convert between measures and currencies, e.g. £1.00 = €1.36;
- Scale up recipes;
- Convert between currencies.

Angles and trigonometry

- Classify quadrilaterals by their geometric properties and distinguish between scalene, isosceles and equilateral triangles;
- Understand 'regular' and 'irregular' as applied to polygons;
- Understand the proof that the angle sum of a triangle is 180°, and derive and use the sum of angles in a triangle;
- Use symmetry property of an isosceles triangle to show that base angles are equal;
- Find missing angles in a triangle using the angle sum in a triangle AND the properties of an isosceles triangle;
- Understand a proof of, and use the fact that, the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices;
- Explain why the angle sum of a quadrilateral is 360°; use the angle properties of quadrilaterals and the fact that the angle sum of a quadrilateral is 360°;
- Select and use the fact that when $y = mx + c$ is the equation of a straight line, then the gradient of a line parallel to it will have a gradient of m and a line perpendicular to this line will have a gradient of $-\frac{1}{m}$.
- Recognise a linear, quadratic, cubic, reciprocal and circle graph from its shape;
- Generate points and plot graphs of simple quadratic functions, then more general quadratic functions;
- Find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function;
- Interpret graphs of quadratic functions from real-life problems;
- Draw graphs of simple cubic functions using tables of values;
- Interpret graphs of simple cubic functions, including finding solutions to cubic equations;
- Draw graphs of the reciprocal function $y = \frac{1}{x}$ with $x \neq 0$ using tables of values;
- Draw circles, centre the origin, equation $x^2 + y^2 = r^2$.

Area and volume

- Recall and use the formulae for the area of a triangle, rectangle, trapezium and parallelogram using a variety of metric measures;
- Calculate the area of compound shapes made from triangles, rectangles, trapezia and parallelograms using a variety of metric measures;
- Find the perimeter of a rectangle, trapezium and parallelogram using a variety of metric measures;
- Calculate the perimeter of compound shapes made from triangles and rectangles;
- Estimate area and perimeter by rounding measurements to 1 significant figure to check reasonableness of answers;

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• Understand the ≠ symbol (not equal), e.g. $6x + 4 \neq 3(x + 2)$, and introduce identity ≡ sign; • Solve linear equations, with integer coefficients, in which the unknown appears on either side or on both sides of the equation; • Solve linear equations which contain brackets, including those that have negative signs occurring anywhere in the equation, and those with a negative solution; • Solve linear equations in one unknown, with integer or fractional coefficients; • Set up and solve linear equations to solve a problem; • Derive a formula and set up simple equations from word problems, then solve these equations, interpreting the solution in the context of the problem; • Substitute positive and negative numbers into a formula, solve the resulting equation including brackets, powers or standard form; • Use and substitute formulae from mathematics and other subjects, including the kinematics formulae $v = u + at$, $v^2 - u^2 = 2as$, and $s = ut + \frac{1}{2}at^2$; • Change the subject of a simple formula, i.e. linear one-step, such as $x = 4y$; • Change the subject of a formula, including cases where the subject is on both sides of the original formula, or involving fractions and small powers of the subject; • Simple proofs and use of ≡ in "show that" style questions; know the difference between an equation and an identity;	• Understand and use the angle properties of parallel lines and find missing angles using the properties of corresponding and alternate angles, giving reasons; • Use the angle sums of irregular polygons; • Calculate and use the sums of the interior angles of polygons; use the sum of angles in a triangle and use the angle sum in any polygon to derive the properties of regular polygons; • Use the sum of the exterior angles of any polygon is 360°; • Use the sum of the interior angles of an n-sided polygon; • Use the sum of the interior angle and the exterior angle is 180°; • Find the size of each interior angle, or the size of each exterior angle, or the number of sides of a regular polygon, and use the sum of angles of irregular polygons; • Calculate the angles of regular polygons and use these to solve problems; • Use the side/angle properties of compound shapes made up of triangles, lines and quadrilaterals, including solving angle and symmetry problems for shapes in the first quadrant, more complex problems and using algebra; • Use angle facts to demonstrate how shapes would 'fit together', and work out interior angles of shapes in a pattern. • Understand, recall and use Pythagoras' Theorem in 2D; • Given three sides of a triangle, justify if it is right-angled or not; • Calculate the length of the hypotenuse in a right-angled triangle (including decimal lengths and a range of units);	• Recall the definition of a circle and name and draw parts of a circle; • Recall and use formulae for the circumference of a circle and the area enclosed by a circle (using circumference = $2\pi r = \pi d$ and area of a circle = πr^2) using a variety of metric measures; • Use $\pi \approx 3.142$ or use the π button on a calculator; • Calculate perimeters and areas of composite shapes made from circles and parts of circles (including semicircles, quarter-circles, combinations of these and also incorporating other polygons); • Calculate arc lengths, angles and areas of sectors of circles; • Find radius or diameter, given area or circumference of circles in a variety of metric measures; • Give answers to an appropriate degree of accuracy or in terms of π; • Form equations involving more complex shapes and solve these equations. • Find the surface area of prisms using the formulae for triangles and rectangles, and other (simple) shapes with and without a diagram; • Draw sketches of 3D solids and identify planes of symmetry of 3D solids, and sketch planes of symmetry; • Recall and use the formula for the volume of a cuboid or prism made from composite 3D solids using a variety of metric measures; • Convert between metric measures of volume and capacity, e.g. 1 ml = 1 cm^3; • Use volume to solve problems; • Estimating surface area, perimeter and volume by rounding measurements to 1 significant figure to check reasonableness of answers; • Use $\pi \approx 3.142$ or use the π button on a calculator; • Find the volume and surface area of a cylinder;

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• Use iteration to find approximate solutions to equations, for simple equations in the first instance, then quadratic and cubic equations. • Recognise simple sequences including at the most basic level odd, even, triangular, square and cube numbers and Fibonacci-type sequences (including those involving numbers in standard form or index form); • Generate sequences of numbers, squared integers and sequences derived from diagrams; • Describe in words a term-to-term sequence and identify which terms cannot be in a sequence; • Generate specific terms in a sequence using the position-to-term rule and term-to-term rule; • Find and use (to generate terms) the nth term of an arithmetic sequence; • Use the nth term of an arithmetic sequence to decide if a given number is a term in the sequence, or find the first term above or below a given number; • Identify which terms cannot be in a sequence by finding the nth term; • Continue a quadratic sequence and use the nth term to generate terms; • Find the nth term of quadratic sequences; • Distinguish between arithmetic and geometric sequences; • Use finite/infinite and ascending/descending to describe sequences; • Recognise and use simple geometric progressions (rn where n is an integer, and r is a rational number > 0 or a surd);	• Find the length of a shorter side in a right-angled triangle; • Calculate the length of a line segment AB given pairs of points; • Give an answer to the use of Pythagoras' Theorem in surd form; • 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; • Find angles of elevation and depression; • Know the exact values of sin θ and cos θ for θ = 0°, 30°, 45°, 60° and 90°; know the exact value of tan θ for θ = 0°, 30°, 45° and 60°.	• Recall and use the formula for volume of pyramid; • Find the surface area of a pyramid; • Use the formulae for volume and surface area of spheres and cones; • Solve problems involving more complex shapes and solids, including segments of circles and frustums of cones; • Find the surface area and volumes of compound solids constructed from cubes, cuboids, cones, pyramids, spheres, hemispheres, cylinders; • Give answers to an appropriate degree of accuracy or in terms of π; • Form equations involving more complex shapes and solve these equations. • Calculate the upper and lowers bounds of numbers given to varying degrees of accuracy; • Calculate the upper and lower bounds of an expression involving the four operations; • Find the upper and lower bounds in real-life situations using measurements given to appropriate degrees of accuracy; • Find the upper and lower bounds of calculations involving perimeters, areas and volumes of 2D and 3D shapes; • Calculate the upper and lower bounds of calculations, particularly when working with measurements; • Use inequality notation to specify an error interval due to truncation or rounding.

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• Continue geometric progression and find term to term rule, including negative, fraction and decimal terms; • Solve problems involving sequences from real life situations. **Interpreting and representing data** • Know which charts to use for different types of data sets; • Produce and interpret composite bar charts; • Produce and interpret comparative and dual bar charts; • Produce and interpret pie charts: – find the mode and the frequency represented by each sector; – compare data from pie charts that represent different-sized samples; • Produce and interpret frequency polygons for grouped data: – from frequency polygons, read off frequency values, compare distributions, calculate total population, mean, estimate greatest and least possible values (and range); • Produce frequency diagrams for grouped discrete data: – read off frequency values, calculate total population, find greatest and least values; • Produce histograms with equal class intervals: – estimate the median from a histogram with equal class width or any other information, such as the number of people in a given interval; • Produce line graphs:		

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– read off frequency values, calculate total population, find greatest and least values; • Construct and interpret time-series graphs, comment on trends; • Compare the mean and range of two distributions, or median or mode as appropriate; • Recognise simple patterns, characteristics relationships in bar charts, line graphs and frequency polygons; • Draw and interpret scatter graphs in terms of the relationship between two variables; • Draw lines of best fit by eye, understanding what these represent; • Identify outliers and ignore them on scatter graphs; • Use a line of best fit, or otherwise, to predict values of a variable given values of the other variable; • Distinguish between positive, negative and zero correlation using lines of best fit, and interpret correlation in terms of the problem; • Understand that correlation does not imply causality, and appreciate that correlation is a measure of the strength of the association between two variables and that zero correlation does not necessarily imply 'no relationship' but merely 'no linear correlation'; • Explain an isolated point on a scatter graph; • Use the line of best fit make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing.		

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KEY ASSESSMENTS	KEY ASSESSMENTS	KEY ASSESSMENTS
HALF TERM 1 Unit assessment HALF TERM 2 End of Term 1 assessment	HALF TERM 3 Unit assessment HALF TERM 4 End of Term 2 assessment	HALF TERM 5 Unit assessment HALF TERM 6 End of Year assessment

Students have access to Mathswatch revision resources and supporting video clips https://vle.mathswatch.co.uk/vle/

Edexcel Maths GCSE Higher revision guides are available to support learning.

Students can obtain further revision resources from www.mathsgenie.co.uk and www.corbettmaths.com