Marshalls Park Academy - Curriculum Overview

Subject: Mathematics Year Group: 10 Higher

In Year 10, Students study the second year of a three year GCSE 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
Transformations • Distinguish properties that are preserved under particular transformations; • Recognise and describe rotations – know that they are specified by a centre and an angle; • Rotate 2D shapes using the origin or any other point (not necessarily on a coordinate grid); • Identify the equation of a line of symmetry; • Recognise and describe reflections on a coordinate grid – know to include the mirror line as a simple algebraic equation, $x = a$, $y = a$, $y = x$, $y = -x$ and lines not parallel to the axes; • Reflect 2D shapes using specified mirror lines including lines parallel to the axes and also $y = x$ and $y = -x$; • Recognise and describe single translations using column vectors on a coordinate grid; • Translate a given shape by a vector; • Understand the effect of one translation followed by another, in terms of column vectors (to introduce vectors in a concrete way); • Enlarge a shape on a grid without a centre specified; • Describe and transform 2D shapes using enlargements by a positive integer, positive fractional, and negative scale factor;	**Probability** • Write probabilities using fractions, percentages or decimals; • Understand and use experimental and theoretical measures of probability, including relative frequency to include outcomes using dice, spinners, coins, etc; • Estimate the number of times an event will occur, given the probability and the number of trials; • Find the probability of successive events, such as several throws of a single dice; • List all outcomes for single events, and combined events, systematically; • Draw sample space diagrams and use them for adding simple probabilities; • Know that the sum of the probabilities of all outcomes is 1; • Use $1 - p$ as the probability of an event not occurring where p is the probability of the event occurring; • Work out probabilities from Venn diagrams to represent real-life situations and also 'abstract' sets of numbers/values; • Use union and intersection notation; • Find a missing probability from a list or two-way table, including algebraic terms;	**Further statistics** • Specify the problem and plan: – decide what data to collect and what analysis is needed; – understand primary and secondary data sources; – consider fairness; • Understand what is meant by a sample and a population; • Understand how different sample sizes may affect the reliability of conclusions drawn; • Identify possible sources of bias and plan to minimise it; • Write questions to eliminate bias, and understand how the timing and location of a survey can ensure a sample is representative (see note); • Use statistics found in all graphs/charts in this unit to describe a population; • Know the appropriate uses of cumulative frequency diagrams; • Construct and interpret cumulative frequency tables, cumulative frequency graphs/diagrams and from the graph: – estimate frequency greater/less than a given value; – find the median and quartile values and interquartile range;

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- Know that an enlargement on a grid is specified by a centre and a scale factor;
- Identify the scale factor of an enlargement of a shape;
- Enlarge a given shape using a given centre as the centre of enlargement by counting distances from centre, and find the centre of enlargement by drawing;
- Find areas after enlargement and compare with before enlargement, to deduce multiplicative relationship (area scale factor); given the areas of two shapes, one an enlargement of the other, find the scale factor of the enlargement (whole number values only);
- Use congruence to show that translations, rotations and reflections preserve length and angle, so that any figure is congruent to its image under any of these transformations;
- Describe and transform 2D shapes using combined rotations, reflections, translations, or enlargements;
- Describe the changes and invariance achieved by combinations of rotations, reflections and translations.
- 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;
- Use and interpret maps and scale drawings, using a variety of scales and units;
- Read and construct scale drawings, drawing lines and shapes to scale;
- Estimate lengths using a scale diagram;
- Understand, draw and measure bearings;

- Understand conditional probabilities and decide if two events are independent;
- Draw a probability tree diagram based on given information, and use this to find probability and expected number of outcome;
- Understand selection with or without replacement;
- Calculate the probability of independent and dependent combined events;
- Use a two-way table to calculate conditional probability;
- Use a tree diagram to calculate conditional probability;
- Use a Venn diagram to calculate conditional probability;
- Compare experimental data and theoretical probabilities;
- Compare relative frequencies from samples of different sizes.

Multiplicative reasoning

- Express a multiplicative relationship between two quantities as a ratio or a fraction, e.g. when A:B are in the ratio 3:5, A is $\frac{3}{5}B$. When $4a = 7b$, then $a = \frac{7b}{4}$ or a:b is 7:4;
- Solve proportion problems using the unitary method;
- Work out which product offers best value and consider rates of pay;
- Work out the multiplier for repeated proportional change as a single decimal number;
- Represent repeated proportional change using a multiplier raised to a power, use this to solve problems involving compound interest and depreciation;
- Understand and use compound measures and:
  - convert between metric speed measures;
  - convert between density measures;
  - convert between pressure measures;

- Compare the mean and range of two distributions, or median and interquartile range, as appropriate;
- Interpret box plots to find median, quartiles, range and interquartile range and draw conclusions;
- Produce box plots from raw data and when given quartiles, median and identify any outliers;
- Know the appropriate uses of histograms;
- Construct and interpret histograms from class intervals with unequal width;
- Use and understand frequency density;
- From histograms:
  - complete a grouped frequency table;
  - understand and define frequency density;
- Estimate the mean and median from a histogram with unequal class widths or any other information from a histogram, such as the number of people in a given interval.

Equations and graphs

- Sketch a graph of a quadratic function, by factorising or by using the formula, identifying roots, y-intercept and turning point by completing the square;
- Be able to identify from a graph if a quadratic equation has any real roots;
- Find approximate solutions to quadratic equations using a graph;
- Expand the product of more than two linear expressions;
- Sketch a graph of a quadratic function and a linear function, identifying intersection points;
- Sketch graphs of simple cubic functions, given as three linear expressions;
- Solve simultaneous equations graphically:
  - find approximate solutions to simultaneous equations formed from one linear function and

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- Calculate bearings and solve bearings problems, including on scaled maps, and find/mark and measure bearings
- Use the standard ruler and compass constructions:
  - bisect a given angle;
  - construct a perpendicular to a given line from/at a given point;
  - construct angles of 90°, 45°;
  - perpendicular bisector of a line segment;
- Construct:
  - a region bounded by a circle and an intersecting line;
  - a given distance from a point and a given distance from a line;
  - equal distances from two points or two line segments;
  - regions which may be defined by 'nearer to' or 'greater than';
- Find and describe regions satisfying a combination of loci, including in 3D;
- Use constructions to solve loci problems including with bearings;
- Know that the perpendicular distance from a point to a line is the shortest distance to the line.

Equations and inequalities

- Factorise quadratic expressions in the form $ax^2 + bx + c$;
- Set up and solve quadratic equations;
- Solve quadratic equations by factorisation and completing the square;
- Solve quadratic equations that need rearranging;
- Solve quadratic equations by using the quadratic formula;
- Use kinematics formulae from the formulae sheet to calculate speed, acceleration, etc (with variables defined in the question);
- Calculate an unknown quantity from quantities that vary in direct or inverse proportion;
- Recognise when values are in direct proportion by reference to the graph form, and use a graph to find the value of k in $y = kx$;
- Set up and use equations to solve word and other problems involving direct proportion (this is covered in more detail in unit 19);
- Relate algebraic solutions to graphical representation of the equations;
- Recognise when values are in inverse proportion by reference to the graph form;
- Set up and use equations to solve word and other problems involving inverse proportion, and relate algebraic solutions to graphical representation of the equations.

Similarity and congruence

- Understand and use SSS, SAS, ASA and RHS conditions to prove the congruence of triangles using formal arguments, and to verify standard ruler and pair of compasses constructions;
- Solve angle problems by first proving congruence;
- Understand similarity of triangles and of other plane shapes, and use this to make geometric inferences;
- Prove that two shapes are similar by showing that all corresponding angles are equal in size and/or lengths of sides are in the same ratio/one is an enlargement of the other, giving the scale factor;
- Use formal geometric proof for the similarity of two given triangles;
  - one quadratic function using a graphical approach;
  - find graphically the intersection points of a given straight line with a circle;
  - solve simultaneous equations representing a real-life situation graphically, and interpret the solution in the context of the problem;
- Solve quadratic inequalities in one variable, by factorising and sketching the graph to find critical values;
- Represent the solution set for inequalities using set notation, i.e. curly brackets and 'is an element of' notation;
  - for problems identifying the solutions to two different inequalities, show this as the intersection of the two solution sets, i.e. solution of $x^2 - 3x - 10 < 0$ as $\{x: -3 < x < 5\}$;
- Solve linear inequalities in two variables graphically;
- Show the solution set of several inequalities in two variables on a graph;
- Use iteration with simple converging sequences.
- Recall the definition of a circle and identify (name) and draw parts of a circle, including sector, tangent, chord, segment;
- Prove and use the facts that:
  - the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference;
  - the angle in a semicircle is a right angle;
  - the perpendicular from the centre of a circle to a chord bisects the chord;
  - angles in the same segment are equal;
  - alternate segment theorem;
  - opposite angles of a cyclic quadrilateral sum to 180°;

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- Find the exact solutions of two simultaneous equations in two unknowns;
- Use elimination or substitution to solve simultaneous equations;
- Solve exactly, by elimination of an unknown, two simultaneous equations in two unknowns:
  - linear / linear, including where both need multiplying;
  - linear / quadratic;
  - linear / $x^2 + y^2 = r^2$;
- Set up and solve a pair of simultaneous equations in two variables for each of the above scenarios, including to represent a situation;
- Interpret the solution in the context of the problem;
- Show inequalities on number lines;
- Write down whole number values that satisfy an inequality;
- Solve simple linear inequalities in one variable, and represent the solution set on a number line;
- Solve two linear inequalities in x, find the solution sets and compare them to see which value of x satisfies both solve linear inequalities in two variables algebraically;
- Use the correct notation to show inclusive and exclusive inequalities.

- Understand the effect of enlargement on angles, perimeter, area and volume of shapes and solids;
- Identify the scale factor of an enlargement of a similar shape as the ratio of the lengths of two corresponding sides, using integer or fraction scale factors;
- Write the lengths, areas and volumes of two shapes as ratios in their simplest form;
- Find missing lengths, areas and volumes in similar 3D solids;
- Know the relationships between linear, area and volume scale factors of mathematically similar shapes and solids;
- Use the relationship between enlargement and areas and volumes of simple shapes and solids;
- Solve problems involving frustums of cones where you have to find missing lengths first using similar triangles.

More trigonometry

- Recognise, sketch and interpret graphs of the trigonometric functions (in degrees) y = sin x, y = cos x and y = tan x for angles of any size.
- Know the exact values of sin θ and cos θ for θ = 0°, 30°, 45° , 60° and 90° and exact value of tan θ for θ = 0°, 30°, 45° and 60° and find them from graphs.
- Apply to the graph of y = f(x) the transformations y = −f(x), y = f($-x$) for sine, cosine and tan functions f(x).
- Apply to the graph of y = f(x) the transformations y = f(x) + a, y = f($x + a$) for sine, cosine and tan functions f(x).
- Know and apply Area = $\frac{1}{2}ab \sin C$ to calculate the area, sides or angles of any triangle.
- Know the sine and cosine rules, and use to solve 2D problems (including involving bearings).
- Use the sine and cosine rules to solve 3D problems.

- Understand and use the fact that the tangent at any point on a circle is perpendicular to the radius at that point;
- Find and give reasons for missing angles on diagrams using:
  - circle theorems;
  - isosceles triangles (radius properties) in circles;
  - the fact that the angle between a tangent and radius is 90°;
  - the fact that tangents from an external point are equal in length.

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	• Understand the language of planes, and recognise the diagonals of a cuboid. • Solve geometrical problems on coordinate axes. • Understand, recall and use trigonometric relationships and Pythagoras' Theorem in right-angled triangles, and use these to solve problems in 3D configurations. • Calculate the length of a diagonal of a cuboid. • Find the angle between a line and a plane.	
KEY ASSESSMENTS HALF TERM 1 Unit assessment HALF TERM 2 End of Term 1 assessment	KEY ASSESSMENTS HALF TERM 3 Unit assessment HALF TERM 4 End of Term 2 assessment	KEY ASSESSMENTS HALF TERM 5 Unit assessment HALF TERM 6 End of Year assessment/PPEs

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