

Section D

Syllabuses

To make this outline of content into a workable specification for teaching and examining purposes, more detail and exemplification would be provided to ensure clarity about what is in which GCSE and in which tier of that GCSE.

Outline Content: GCSE 1

	Paper1, Paper 2 and Paper 3
Using and Applying Mathematics GCSE 1	<p>Use appropriate strategies and methods to solve a problem</p> <p>Break down complex problems into a series of tasks</p> <p>Interpret and discuss information presented in a variety of forms</p> <p>Communicate mathematically by presenting and organising results in an appropriate form</p> <p>Estimate and check answers</p> <p>Recognise the importance of assumptions when applying mathematics</p> <p>Use mathematical reasoning</p> <p>Explore connections in mathematics</p> <p>Present and interpret solutions in the context of the original problem</p> <p>Understanding and using the data handling cycle</p> <p>Look for relationships between variables when analysing data</p> <p>Interpret and discuss data</p>

Paper1, Paper 2 and Paper 3	
Number GCSE 1	<p>Multiples, factors, common factors, primes, squares, cubes, square roots and cube roots, odd and even numbers</p> <p>Add, subtract, multiply and divide positive whole numbers and decimals and be able to select the right operation in context; be able to work without a calculator for addition, subtraction, multiplication and division</p> <p>Round to the nearest integer, to one significant figure, to a given power of ten; use rounding to estimate answers to problems</p> <p>Give solutions to an appropriate degree of accuracy</p> <p>Use positive and negative numbers in context, including addition, subtraction, multiplication and division of directed numbers in context</p> <p>Use equivalences between fractions, decimals and percentages</p> <p>Find a percentage or fraction of a number</p> <p>Express a number as a percentage or fraction of another number</p> <p>Increase and decrease by a percentage</p> <p>Ordering fractions, decimals and integers, equivalent fractions, mixed numbers</p> <p>Using ratio, including reduction to simplest form and division in a given ratio</p> <p>Multiplication and division of fractions; reciprocals</p> <p>Addition and subtraction of fractions</p> <p>Integer powers and expressing numbers in standard form</p> <p>Unitary method for ratio and proportion in context</p> <p>Understanding the order of operations and that some calculators use this while others do not</p> <p>Use a calculator efficiently, including standard form calculations; interpret the calculator display correctly</p>

Paper 3 only	
Number GCSE 1	<p>Compound interest</p> <p>Multiplying factors for percentage increase and decrease</p> <p>Reverse percentage problems</p> <p>Calculations with numbers in standard form without a calculator</p>

	Paper1, Paper 2 and Paper 3
Algebra GCSE 1	<p>Distinguish the different roles played by letter symbols in algebra: definite unknown numbers, variables, general unspecified numbers</p> <p>Understand that the transformation of algebraic expressions obeys and generalises the rules of arithmetic</p> <p>Use algebraic formulae</p> <p>Change the subject of a formula where the required variable appears once</p> <p>Solving linear equations in context</p> <p>Sequences in context eg the sequences of hydrocarbons in chemistry</p> <p>Using coordinates</p> <p>Using the form $y=mx+c$ for straight line graphs, draw a line of best fit through a set of points, understanding when it is appropriate to force it through the origin, finding the equation of a line of best fit</p> <p>Construct linear functions and plot the corresponding graphs arising from real-life problems</p> <p>Drawing straight line graphs in form $ax+by=c$</p> <p>Using intersecting straight line graphs to solve simultaneous equations</p> <p>Interpret graphs modelling real situations</p> <p>Using simple quadratic graphs in context</p> <p>Use systematic trial and improvement to find approximate solutions of equations which cannot be solved otherwise</p>
	Paper 3 only
Algebra GCSE 1	Solving linear inequalities in context

Paper1, Paper 2 and Paper 3	
Shape, Space and Measures GCSE 1	<p>Use angle properties of intersecting and parallel lines and triangles, quadrilaterals and other polygons in context</p> <p>Acute, obtuse and reflex angles, estimating angles in degrees</p> <p>Knowing names of special quadrilaterals and their properties</p> <p>Area of rectangle, parallelogram and triangle</p> <p>Perimeter and area of shapes made of rectangles and triangles</p> <p>Circumference and area of circles</p> <p>Surface areas and volumes of cuboids, prisms and cylinders</p> <p>Converting between units of area and volume</p> <p>Using Pythagoras's theorem in context</p> <p>Definition of a circle and the meaning of related terms, including centre, radius, chord, diameter, circumference, tangent, arc, sector and segment</p> <p>2-D representations of 3-D shapes including 2-D projections and cross-sections, including plan and elevation</p> <p>Reflections, rotations, translations and enlargements with positive scale factors; ideas of symmetry, congruence and similarity</p> <p>The implications of enlargement for perimeter, area, volume; recognise that angles are preserved</p> <p>Use vectors for translations</p> <p>Use coordinates in all four quadrants</p> <p>Maps and scale drawings</p> <p>Bearings to specify direction</p> <p>Interpret scales on a range of measuring instruments, including those for time and mass; convert measurements from one unit to another; know rough metric equivalents of pounds, feet, miles, pints and gallons; make sensible estimates of a range of measures in everyday settings</p> <p>Use compound measures including speed and density</p> <p>Know that a measurement given to the nearest unit can be half a unit out in either direction</p> <p>Accurate construction of triangles and ruler and compass constructions of angle and perpendicular bisectors</p> <p>Understand that inscribed regular polygons can be constructed by equal division of a circle</p> <p>Loci</p>

	Paper 3 only
Shape, Space and Measures GCSE 1	Calculate upper and lower bounds of areas and volumes Areas and volumes of similar shapes in context Distinguishing between formulae for length, area and volume by using dimensions

	Paper1, Paper 2 and Paper 3
Data Handling GCSE 1	<p>Realise that random processes are unpredictable</p> <p>Identify questions that can be addressed by statistical methods</p> <p>Design data collection sheets, experiments, questionnaires and surveys to collect primary data</p> <p>Decide on appropriate class intervals for grouping data</p> <p>Identify possible sources of bias and decide how they can be minimised</p> <p>Use data from secondary sources</p> <p>Look at data to find patterns and exceptions</p> <p>Relating data to the original question</p> <p>Two way tables for discrete and grouped data</p> <p>Using pie charts, frequency diagrams, stem and leaf diagrams, scatter diagrams, line graphs for time series and understanding how to draw them by hand and using ICT and which diagram is appropriate</p> <p>Interpret statistical graphs and diagrams</p> <p>Draw a line of best fit by eye and use it; positive negative and zero correlation</p> <p>Appreciate that zero correlation doesn't mean no relationship but no linear relationship</p> <p>Mean, median, mode and range for lists and ungrouped frequency tables</p> <p>Estimate of mean, modal class for grouped data</p> <p>Compare distributions using an average and range</p> <p>Use the probability scale</p> <p>Measure and estimate probability using equally likely outcomes and relative frequency</p> <p>List outcomes for one event (NB 2 events are in GCSE 2)</p> <p>Know the sum of probabilities of mutually exclusive events is 1</p> <p>Compare experimental and theoretical probabilities, knowing that repeating the experiment more gives a better estimate</p>

Outline Content: GCSE 2

In addition to the content listed below, all of GCSE 1 is assumed knowledge and may be used as part of questions that also include new content OR in more abstract questions than would have been asked in GCSE 1

Questions in GCSE 2 are intended to assess increasingly abstract understanding and may be set in context, or not.

Paper1, Paper 2 and Paper 3	
Using and Applying Mathematics GCSE 2	<ul style="list-style-type: none">Use algebra in context to solve a problemSelect and use appropriate techniques to solve a problemUnderstand the difference between checking and proving a resultExplain mathematical reasoningUse a variety of strategies and be able to represent a situation in different mathematical ways eg algebra, tables, diagramsDefine and use consistent algebraic symbolismUse precise formal languageDerive simple proofs; understand the importance of a counter-exampleExplore connections in mathematics and show step-by-step deduction in solving problemsUnderstand constraints and conditions for solutions to remain validUnderstand and use the data handling cycleIdentify exceptional or unexpected cases when solving statistical problems

Paper1, Paper 2 and Paper 3	
Number GCSE 2	<p>Arithmetic of directed numbers</p> <p>HCF, LCM, prime factor decomposition of positive integers</p> <p>Addition, subtraction, multiplication and division of mixed numbers</p> <p>Efficient methods for calculating with fractions including cancelling before multiplying</p> <p>Reciprocal as multiplicative inverse</p> <p>Know that terminating and recurring decimals can be expressed as exact fractions</p> <p>Fractional, zero and negative powers</p> <p>Understanding inverse operations</p> <p>Round to a given number of significant figures</p> <p>Long division without a calculator</p> <p>Direct and inverse proportion</p> <p>Use surds and π in exact calculations without a calculator</p> <p>Select and justify an appropriate degree of accuracy</p>

Paper 3 only	
Number GCSE 2	<p>Change a recurring decimal to a fraction</p> <p>Represent repeated proportional change by a multiplier raised to a power</p> <p>Explore exponential growth and decay using multipliers and powers</p> <p>Rationalise a denominator such as $1/\sqrt{3}=\sqrt{3}/3$</p> <p>Calculate upper and lower bounds of speeds and other calculations</p>

Paper 1, Paper 2 and Paper 3	
Algebra GCSE 2	<p>Equations, formulae, functions, expressions and identities and the different roles that letter symbols have in them</p> <p>Manipulation of algebraic expressions including collection of like terms and multiplying out brackets up to level of difficulty $(2x+1)(3x-2)$</p> <p>Common factors</p> <p>Common integer sequences: squares, triangular number, powers of 2, powers of 10</p> <p>Term to term and position to term rules for sequences</p> <p>Finding the formula for the nth term of a linear sequence</p> <p>Index notation for simple integer powers; substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$</p> <p>Solve linear inequalities in one variable, and represent the solution set on a number line</p> <p>Solve linear equations, including ones where the variable appears on each side, simplification is needed or the solution is negative, and use them in appropriate situations</p> <p>Generate a formula</p> <p>Set up equations to solve problems involving direct and inverse proportion</p> <p>Solve 2 linear simultaneous equations in two unknowns by elimination and relate the solution to the point of intersection of 2 straight lines</p> <p>Explore gradients of parallel and perpendicular lines</p> <p>Drawing quadratic graphs and using them to solve quadratic equations</p> <p>Find intersections of linear and quadratic graphs and know these correspond to the solution of simultaneous linear and quadratic equations</p> <p>Plot cubic and reciprocal graphs</p> <p>Graph of a circle as $x^2 + y^2 = r^2$; find graphically the intersection points of a given straight line with this circle and know that this corresponds to solving the simultaneous equations representing the line and the circle</p>

Paper 3 only	
Algebra GCSE 2	<p>Factorising quadratics including difference of 2 squares</p> <p>Cancelling factors in rational expressions</p> <p>Solve several linear inequalities in two variables and find the solution set</p> <p>Change the subject of a formula where the variable appears twice</p> <p>Solve quadratic equations by factorisation, completing the square and using the formula</p> <p>Solve simultaneous equations where one is linear and the other quadratic or represents a circle</p> <p>Plot exponential graphs $y = k^x$ for k a positive integer and graphs $y = \sin x$, $y = \cos x$</p> <p>Apply to the graph of $y=f(x)$ the transformations $y=f(x) +a$, $y=f(ax)$, $y=f(x+a)$, $y=af(x)$ for linear, quadratic, sine and cosine functions</p>

Paper1, Paper 2 and Paper 3	
Shape, Space and Measures GCSE 2	<p>Distinguish between lines and line segments</p> <p>Angle properties of triangles, parallel lines, quadrilaterals and other polygons</p> <p>Understand simple proofs of angle properties eg angles of triangle add up to 180°</p> <p>Understand similarity in triangles and other plane figures and use this to make geometrical inferences</p> <p>Understand that the tangent at any point on a circle is perpendicular to the radius at that point; understand and use the fact that tangents from an external point are equal in length; explain why the perpendicular from the centre to a chord bisects the chord; understand that inscribed regular polygons can be constructed by equal division of a circle;</p> <p>Pythagoras in 2-D</p> <p>Trigonometry in right angled triangles including solving problems</p> <p>Area of triangle = $\frac{1}{2}ab\sin C$</p> <p>Surface areas and volumes of prisms, pyramids, cylinders, cones and spheres; solve problems involving more complex shapes and solids, including segments of circles and frustums of cones</p> <p>Length of arc and area of sector</p> <p>Combinations of transformations; enlargements with positive, negative and fractional scale factors</p> <p>Effect of enlargement on angle, length, area and volume</p> <p>Find the coordinates of the midpoint of a line segment, given the coordinates of the endpoints and also its length</p> <p>Understand and use vector notation; calculate, and represent graphically the sum of two vectors, the difference of two vectors and a scalar multiple of a vector; calculate the resultant of two vectors; understand and use the commutative and associative properties of vector addition</p> <p>Construct specified cubes, regular tetrahedra, square-based pyramids and other 3-D shapes</p> <p>Ruler and compass construction of a perpendicular from a point to a line and from a point on a line</p>

Paper 3 only	
Shape, Space and Measures GCSE 2	<p>SSS, SAS, ASA and RHS conditions to prove the congruence of triangles using formal arguments, and to verify standard ruler and compass constructions</p> <p>Pythagoras in 3-D</p> <p>Angle between a line and a plane</p> <p>Trig graphs for angles of any size and stretches of them parallel to x and y axes</p> <p>Sine and cosine rules to solve 2D and 3D problems</p> <p>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 subtended at the circumference by a semicircle is a right angle, that angles in the same segment are equal, and that opposite angles of a cyclic quadrilateral sum to 180°; prove and use the alternate segment theorem</p> <p>Solve simple geometrical problems in 2D using vector methods</p>

	Paper1, Paper 2 and Paper 3
Data Handling GCSE 2	<p>Random and stratified sampling</p> <p>Appreciate that increasing sample size generally leads to more reliable results</p> <p>Identify sources of bias and plan to minimise it; dealing with non-response and missing data</p> <p>Cumulative frequency tables and diagrams; finding median, quartiles and interquartile range</p> <p>Box plots</p> <p>Compare distributions using an average and measure of spread</p> <p>Calculate appropriate moving averages for time series; identify seasonal factors and trends</p> <p>List outcomes of 2 events in a systematic way (NB – this will not be tested in GCSE 1)</p> <p>Know when to add or multiply two probabilities: if A and B are mutually exclusive, then the probability of A or B occurring is $P(A) + P(B)$, whereas if A and B are independent events, the probability of A and B occurring is $P(A) \times P(B)$</p> <p>Use tree diagrams to represent outcomes of compound events, recognising when events are independent</p>
	Paper 3 only
Data Handling GCSE 2	Histograms and frequency density