

# 9-1 GCSE Maths

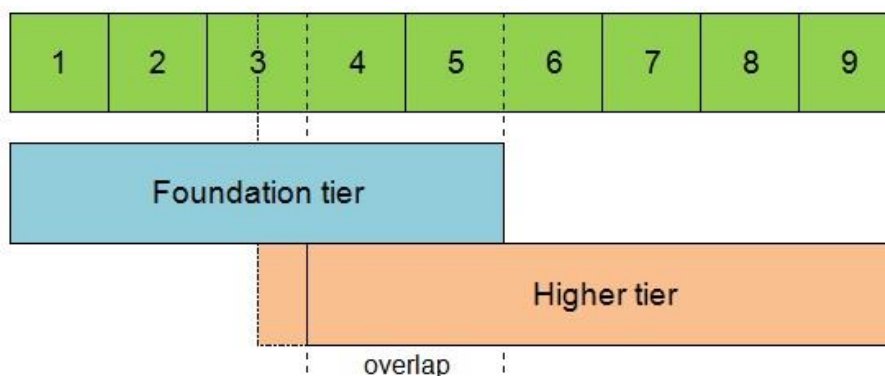
GCSE Mathematics has a Foundation tier (Grades 1 – 5) and a Higher tier (Grades 4 – 9).

In each tier, there are three exams taken at the end of Year 11. Any topic may be assessed on each of the paper. Each paper is a mixture of short, single mark questions to multi-step problems. There is no coursework or controlled assessment.

Paper 1	Non-calculator	1 hour 30 min
Paper 2	Calculator allowed	1 hour 30 min
Paper 3	Calculator allowed	1 hour 30 min

Approximate equivalence between new 9-1 GCSE grades and old A\* - G grades:

New 9-1 GCSE	Old GCSE A* - G
Grades 1, 2 and 3	Grades G, F, E and D
Grades 4, 5 and 6	Grades C and B
Grades 7, 8 and 9	Grades B, A and A*



## Grade Descriptors

“It is question papers, not individual questions, which carry grades” (AQA). Basic foundation content can be used to set challenging questions, and so it is not possible to assign grades to specific topics.

The following grade descriptors have been written to give an indication of the topics that students achieving different grades are likely to be successful with. Students achieving a particular grade will be expected to know, understand and be able to apply the majority of topics up to and including those topics listed for a particular grade descriptor.

## Grades 8 - 9

Number	<ul style="list-style-type: none"><li>• Fractions, Decimals and Percentages - convert recurring decimals into fractions and vice versa</li><li>• Indices and Surds - calculate values using fractional indices</li><li>• Measures and Accuracy - combine upper or lower bounds appropriately to achieve an overall maximum or minimum for a situation.</li></ul>
Algebra	<ul style="list-style-type: none"><li>• Expressions, equations and formulas - solve equations that use function notation; understand, interpret and use composite function <math>fg(x)</math> and the inverse function <math>f^{-1}(x)</math>; solve simultaneous equations when one is linear and the other quadratic; solve quadratic inequalities</li><li>• Graphs - estimate the gradient at a point on a curve by drawing a tangent at that point and working out its gradient; interpret the meaning of the gradient as the rate of change of the variable on the vertical axis compared to the horizontal axis</li><li>• Sequences - use suffix notation in recursive formulae; find approximate solutions using recursive formulae; solve growth and decay problems, for example using multipliers or iterative processes; understand that some iterations may have a limiting value</li></ul>
Geometry	<ul style="list-style-type: none"><li>• Trigonometry –use trigonometric ratios in 3D contexts, including finding the angles between a line and a plane.</li><li>• Circle Geometry – work out coordinates of points of intersection of a given circle and a given straight line; use the fact that the angle between the tangent and radius is <math>90^\circ</math> to work out the gradient of a tangent and hence the equation of a tangent at a given point</li><li>• Vectors - recognise when three or more points are collinear using vectors; use vectors to show three or more points are collinear.</li></ul>

## Grades 6 - 7

<b>Number</b>	<ul style="list-style-type: none"> <li>• Fractions, Decimals and Percentages - convert recurring decimals into fractions and vice versa</li> <li>• Indices and Surds - use index laws for multiplication and division of positive, negative and fractional indices; simplify surds; rationalise a denominator</li> <li>• Measures and Accuracy - write down the maximum or minimum figure for a value rounded to a given accuracy; work with practical problems involving bounds</li> </ul>
<b>Ratio and Proportion</b>	<ul style="list-style-type: none"> <li>• Ratio and proportion - understand that an equation of the form <math>y = kx</math> represents direct proportion and that an equation of the form <math>y = \frac{k}{x}</math> represents inverse proportion, where <math>k</math> is the constant of proportionality.</li> </ul>
<b>Algebra</b>	<ul style="list-style-type: none"> <li>• Expressions, equations and formulas - solve quadratic equations by factorising, completing the square or using the quadratic formula; simplify by factorising and cancelling algebra fractions; complete the square; use a systematic method to find approximate solutions of equations</li> <li>• Graphs - work out the gradients of lines that are parallel and perpendicular to a given line; deduce turning points by completing the square; know the shapes of the graphs of functions <math>y = \sin x</math>, <math>y = \cos x</math> and <math>y = \tan x</math>; transform the graph of any function; draw an exponential graph; calculate the area under a graph consisting of straight lines</li> <li>• Sequences - work out the value of the <math>n</math>th term of a sequence for any given value of <math>n</math>; work out a formula for the <math>n</math>th term of a sequence, which may contain linear or quadratic parts</li> </ul>
<b>Geometry</b>	<ul style="list-style-type: none"> <li>• Transformations - construct enlargements with negative scale factors; describe and transform 2D shapes using combined rotations, reflections, translations, or enlargements; understand and use the term 'invariance' for points, lines and shapes achieved by single or combined transformations</li> <li>• Similarity - compare the areas or volumes of similar shapes or solids, knowing that if <math>a : b</math> is the ratio of lengths, then <math>a^2 : b^2</math> is the ratio of areas and <math>a^3 : b^3</math> is the ratio of volumes</li> <li>• Trigonometry - understand, recall and use Pythagoras' theorem in 3D problems; use the sine and cosine rules to solve 2D and 3D problems; calculate the area of a triangle using <math>\frac{1}{2}ab \sin C</math></li> <li>• Circle Geometry – understand, use and prove the circle theorems;</li> <li>• Vectors - solve simple geometrical problems in 2D using vector methods; apply vector methods for simple geometric proofs; recognise when lines are parallel using vectors</li> </ul>
<b>Statistics</b>	<ul style="list-style-type: none"> <li>• Probability - understand conditional probability and use a tree diagram or Venn diagram as a method for calculating conditional probabilities</li> <li>• Statistics – construct suitable diagrams for grouped discrete and continuous data; read off lower quartile, median and upper quartile from a cumulative frequency diagram or a box plot and calculate inter-quartile range; find an estimate of the median or other information from a histogram</li> </ul>

## Grade 5

<b>Number</b>	<ul style="list-style-type: none"> <li>• Calculations - convert mixed numbers to improper fractions and add and subtract mixed numbers</li> <li>• Measures and Accuracy - give answers in terms of <math>\pi</math> and use values given in terms of <math>\pi</math> in calculations; use inequality notation to specify error intervals due to truncation or rounding</li> </ul>
<b>Ratio and Proportion</b>	<ul style="list-style-type: none"> <li>• Fractions, decimal and percentages - solve compound interest problems</li> <li>• Ratio and proportion - match direct and inverse proportion graphs to their equations and vice versa; draw graphs to represent direct and inverse proportion; solve problems involving repeated proportional change; use calculators to explore exponential growth and decay using a multiplier and the power</li> <li>• Measures and scale drawings - understand and use compound measures and compound units including density and pressure</li> </ul>
<b>Algebra</b>	<ul style="list-style-type: none"> <li>• Expressions, equations and formulas - multiply two linear expressions, such as <math>(2x + 3)(3x + 4)</math>; factorise quadratics of the form <math>x^2 + bx + c</math>; solve quadratic equations by factorising; set up a pair of simultaneous linear equations to solve problems</li> <li>• Graphs - recognise that equations of the form <math>y = mx + c</math> correspond to straight-line graphs in the coordinate plane; interpret quadratic graphs by finding roots, intercepts and turning points; draw, sketch, recognise and interpret graphs of the form <math>y = x^3 + k</math> where <math>k</math> is an integer and the graph <math>y = x^{-1}</math> with <math>x \neq 0</math>; interpret non-linear graphs showing real-life situations</li> <li>• Sequences - work with Fibonacci-type sequences; know how to continue the terms of a quadratic sequence; work out the value of a term in a geometrical progression of the form <math>r^n</math> where <math>n</math> is a positive integer</li> </ul>
<b>Geometry</b>	<ul style="list-style-type: none"> <li>• 3D shapes - work out the surface area and volume of spheres, pyramids and cones; work out the surface area and volume of compound solids constructed from cubes, cuboids, cones, pyramids, cylinders, spheres and hemispheres</li> <li>• Area and Perimeter - work out the perimeter and area of semicircles, quarter circles or other fractions of a circle</li> <li>• Transformations - construct enlargements with fractional scale factors; understand and use vector notation; calculate the resultant of two vectors</li> <li>• Constructions - use a straight edge and a pair of compasses to do standard constructions; construct loci and describe regions satisfying several conditions.</li> <li>• Similarity and Congruence - understand congruence and identify shapes that are congruent; understand and use conditions for congruent triangles: SSS, SAS, ASA and RHS; understand similarity; work out the side of one shape that is similar to another shape given the ratio or scale factor of lengths</li> <li>• Trigonometry - understand, recall and use Pythagoras' theorem in 2D problems; recall exact values of sine, cosine and tangent for <math>0^\circ</math>, <math>30^\circ</math>, <math>45^\circ</math> and <math>60^\circ</math>; solve right-angled triangles with angles of <math>30^\circ</math>, <math>45^\circ</math> or <math>60^\circ</math> without using a calculator</li> </ul>
<b>Statistics</b>	<ul style="list-style-type: none"> <li>• Probability - use a tree diagram as a method for calculating probabilities for independent or dependent events</li> <li>• Statistics – understand that samples may or may not be representative of a population; plot and interpret time-series graphs</li> </ul>

## Grades 3 - 4

<b>Number</b>	<ul style="list-style-type: none"> <li>• Calculations - apply the four rules to fractions with and without a calculator; use brackets and the hierarchy of operations</li> <li>• Properties of Integers - write a number as the product of its prime factors and use methods to identify highest common factors (HCF) and lowest common multiples (LCM); understand standard form</li> <li>• Fractions, Decimals and Percentages - compare fractions; convert between fractions and decimals using place value</li> <li>• Measures and Accuracy - know and use standard metric and imperial measures; know and use compound measures such as area, volume and speed; use approximation to estimate the value of a calculation</li> </ul>
<b>Ratio and Proportion</b>	<ul style="list-style-type: none"> <li>• Fractions, decimal and percentages - use a fraction of a quantity to compare proportions; calculate a percentage increase or decrease; work out one quantity as a percentage of another quantity</li> <li>• Ratio and proportion - understand the meaning of ratio notation and use direct proportion to solve geometrical problems; solve best-buy problems using informal strategies or using the unitary method of solution; calculate an unknown quantity from quantities that vary in direct proportion or inverse proportion</li> <li>• Measures and scale drawings - work out a scale from a scale drawing given additional information.</li> </ul>
<b>Algebra</b>	<ul style="list-style-type: none"> <li>• Expressions, equations and formulas - factorise algebraic expressions by taking out common factors; simplify algebraic expressions, for example by cancelling common factors in fractions or using index laws; change the subject of a formula.</li> <li>• Graphs - draw graphs of functions in which <math>y</math> is given explicitly or implicitly in terms of <math>x</math>; recognise that equations of the form <math>y = mx + c</math> correspond to straight-line graphs in the coordinate plane with gradient <math>m</math> and <math>y</math> - intercept at <math>(0, c)</math></li> <li>• Sequences - work out the value of the <math>n</math>th term of a linear sequence for any given value of <math>n</math>; generate a sequence where the <math>n</math>th term is given</li> </ul>
<b>Geometry</b>	<ul style="list-style-type: none"> <li>• Angles and Polygons - calculate and use the sums of interior and exterior angles of polygons; understand and use three-figure bearings</li> <li>• Symmetry - draw or complete a diagram with a given number of lines of symmetry; draw or complete a diagram with rotational symmetry</li> <li>• 3D shapes - analyse 3D shapes through 2D projections and cross sections, including plans and elevations; recall and use the formula for the volume of a cube, cuboid, cylinder or prism</li> <li>• Area and Perimeter - work out the area and perimeter of a triangle, parallelogram, trapezium or of a compound shape made from triangles and rectangles; recall and use the formula for the circumference and area of a circle</li> <li>• Transformations - describe and transform 2D shapes using rotations, reflections, translations and enlargements</li> </ul>
<b>Statistics</b>	<ul style="list-style-type: none"> <li>• Probability - understand and use the term relative frequency; use a frequency tree to compare frequencies of outcomes</li> <li>• Statistics – use lists, tables or diagrams to find the mean, median, mode and range; understand and interpret scatter graphs and correlation</li> </ul>

## Grades 1 - 2

<b>Number</b>	<ul style="list-style-type: none"> <li>• Calculations - add, subtract, multiply and divide integers, decimals and positive and negative numbers using both mental and written methods</li> <li>• Properties of Integers - recall all multiplication facts to 12 x 12 and use them to derive the corresponding division facts</li> <li>• Fractions, Decimals and Percentages - simplify a fraction by cancelling all common factors and convert between mixed numbers and improper fractions</li> <li>• Measures and Accuracy - make sensible estimates of a range of measures in everyday settings and round numbers to the nearest whole number, 10, 100 or 1000</li> </ul>
<b>Ratio and Proportion</b>	<ul style="list-style-type: none"> <li>• Fractions, decimal and percentages - calculate a fraction or percentage of a quantity</li> <li>• Ratio and proportion - understand the meaning of ratio notation and use direct proportion to solve geometrical problems</li> <li>• Measures and scale drawings - convert between metric measures and construct scale drawings</li> </ul>
<b>Algebra</b>	<ul style="list-style-type: none"> <li>• Expression, equations and formulas - substitute numbers into a formula, write expressions, collect like terms, expand single brackets and solve simple equations</li> <li>• Graphs - plot points in all four quadrants</li> <li>• Sequences - generate linear sequences with a given term-to-term rule and describe how a sequence continues</li> </ul>
<b>Geometry</b>	<ul style="list-style-type: none"> <li>• Angles and Polygons - work out the size of missing angles at a point and on a straight line; recognise and name regular polygons: pentagons, hexagons, octagons and decagons</li> <li>• Symmetry - understand line and rotational symmetry</li> <li>• 3D shapes - identify and name common solids, for example cube, cuboid, prism, cylinder, pyramid, cone and sphere; draw nets and show how they fold to make a 3D solid</li> <li>• Area and Perimeter - work out the area and perimeter of a rectangle; calculate the area and perimeter of shapes drawn on a grid</li> </ul>
<b>Statistics</b>	<ul style="list-style-type: none"> <li>• Probability - design and use two-way tables; list all the outcomes for a single event in a systematic way</li> <li>• Statistics - draw bar charts including composite bar charts, dual bar charts and multiple bar charts</li> </ul>