

GCSE



CCEA GCSE

Mathematics

Progression of Subject Content



For first teaching from September 2017

Progression of subject content: GCSE Mathematics for first teaching September 2017

	Number	M1	M2	M3	M4
1	Structure and Calculation	Use the four operations, including efficient written methods, applied to positive and negative integers			
2		Order positive and negative integers, decimals and fractions Use symbols = , ≠ , < , > , ≤ , ≥			
3		Use calculators effectively and efficiently			
4		Understand and use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals			
5		Recognise and use relationships between operations including inverse operations			
6	Indices	Use index notation for squares, cubes and powers of 10	Use index notation and index laws for positive, whole number powers		
7	Definitions and Terms	Use the concepts and vocabulary of factor, multiple, common factor, common multiple and prime	Use the concepts and vocabulary of divisor, highest common factor, least (lowest) common multiple and prime factor decomposition	Find the LCM and HCF of numbers written as the product of their prime factors	

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	Number	M1	M2	M3	M4
8	Definitions and Terms (cont.)	Use the terms square, positive and negative square root, cube and cube root			
9	Decimals	Understand place value and decimal places			
10		Read, write and compare decimals up to three decimal places			
11		Add, subtract, multiply and divide decimals up to 3 decimal places	Add, subtract, multiply and divide decimals of any size		
12		Round to a specified or appropriate degree of accuracy, including a given power of 10, number of decimal places or 1 significant figure	Round to a specified or appropriate number of significant figures		
13		Use correct decimal notation when working with money			
14	Fractions	Understand and use equivalent fractions			
15		Write a simple fraction as a terminating decimal	Recognise that recurring decimals are exact fractions and that some exact fractions are recurring decimals		

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	Number	M1	M2	M3	M4
16	Fractions (cont.)	Add and subtract simple fractions and simple mixed numbers	Add, subtract, multiply and divide fractions, including mixed numbers		
17		Calculate a fraction of a quantity			
18		Express one quantity as a fraction of another			
19	Percentages	Understand that percentage means 'number of parts per 100'			
20		Calculate a percentage of a quantity	Use percentage and repeated proportional change	Find the original quantity given the result of a proportional change	
21		Express one quantity as a percentage of another			
22		Calculate percentage increase/decrease			
23	Equivalences	Use equivalences between fractions, decimals and percentages in a variety of contexts			

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	Number	M1	M2	M3	M4
24	Financial Capability	Calculate with money and solve simple problems in the context of finance (for example: profit and loss, discount, wages and salaries, bank accounts, simple interest, budgeting, debt, APR and AER)	Calculate with money and solve problems in the context of finance (for example: compound interest, insurance, taxation, mortgages, investments)		
25	Upper and Lower Bounds			Calculate the upper and lower bounds in calculations involving addition and multiplication of numbers expressed to a given degree of accuracy	Calculate the upper and lower bounds in calculations involving subtraction and division of numbers expressed to a given degree of accuracy

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	Number	M5	M6	M7	M8
26	Structure and Calculation	Use non-calculator methods to solve problems involving whole numbers, fractions, decimals and percentages		Use surds and π in exact calculations	Distinguish between rational and irrational numbers
27					Change a recurring decimal to a fraction
28	Number Systems		Understand the principles of number systems		
29			Convert numbers from Decimal to Binary (base 2) and vice versa		
30	Indices			Use index notation and index laws for zero, positive and negative powers	Use index notation and index laws for integer, fractional and negative powers
31				Interpret, order and calculate with numbers written in standard index form	Set up, solve and interpret the answers in growth and decay problems, e.g. use the formula for compound interest
32	Surds				Simplify numerical expressions involving surds, including the rationalisation of the denominator of a fraction such as: $\frac{5}{3\sqrt{2}}$

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	Number	M5	M6	M7	M8
33	Estimation	Estimate answers; check calculations using approximation and estimation			
34	Ratio	Use ratio notation, including reduction to its simplest form and its various links to fraction notation			
35		Divide a quantity in a given ratio			
36		Apply ratio and proportion to real life contexts and problems (such as those involving conversion, best buy, comparison, scaling, mixing, concentrations, exchange rates)			

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	Algebra	M1	M2	M3	M4
37	Algebraic expressions	Distinguish the different roles played by letter symbols in algebra, using the correct notation			
38		Understand and use the concepts and vocabulary of expressions, equations, formulae, inequalities, terms and factors		Know the difference between an equation and an identity	
39		Interpret simple expressions as functions with inputs and outputs			
40		Simplify and manipulate algebraic expressions by collecting like terms and multiplying a constant over a bracket	Simplify and manipulate algebraic expressions by multiplying a single term over a bracket	Multiply two linear expressions	
41		Manipulate algebraic expressions by taking out common factors which are constants	Manipulate algebraic expressions by taking out common factors which are terms	Factorise quadratic expressions of the form $x^2 + bx + c$	Factorise quadratic expressions of the form $ax^2 + bx + c$, including more complex expressions
42				Factorise using the difference of two squares	

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	Algebra	M1	M2	M3	M4
43	Algebraic Formulae	Write simple formulae and expressions from real life contexts			
44		Substitute numbers into formulae (which may be expressed in words or algebraically) and expressions			
45		Use standard formulae			
46	Algebraic Fractions			Add or subtract algebraic fractions e.g. simplify $\frac{4x+3}{10} + \frac{6x-5}{5}$	Add or subtract algebraic fractions with linear denominators e.g. simplify $\frac{2}{x+2} + \frac{3}{2x-1}$
47				Simplify, multiply and divide algebraic fractions with linear or quadratic numerators and denominators	
48	Algebraic Equations	Set up and solve linear equations in one unknown	Set up and solve linear equations in one unknown, including those with the unknown on both sides of the equation and equations of the form: $\frac{x}{4} + 3 = 7$	Set up and solve linear equations of the form: $\frac{4x+3}{10} + \frac{6x-5}{5} = \frac{13}{2}$	Solve equations such as: $\frac{2}{x+2} + \frac{3}{2x-1} = 1$

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	Algebra	M1	M2	M3	M4
49	Algebraic Equations (cont.)			Set up and solve quadratic equations using factors	Set up and solve quadratic equations using factors and the formula; where the coefficient of $x^2 \neq 1$ and more complex equations
50	Coordinates	Work with coordinates in all four quadrants			
51	Graphs	Recognise and plot equations that correspond to straight line graphs in the coordinate plane;		Understand that the form $y = mx + c$ represents a straight line and that m is the gradient of the line and c is the value of the y – intercept	
52			Find the mid-point and length of a line given in 2D co-ordinates	Find the equation of a line through two given points or through one point with a given gradient	
53				Understand and use the gradients of parallel lines	Understand and use the gradients of perpendicular lines
54		Construct and interpret linear graphs in real world contexts	Find and interpret gradients and intercepts of linear graphs e.g. plot and interpret the graph of the cost of hiring a car at £40 per day plus 20p per mile		

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	Algebra	M5	M6	M7	M8
55	Indices		Use index laws in algebra for positive powers	Use index laws in algebra for integer powers	Use index laws in algebra for integer, fractional and negative powers
56	Algebraic Equations		Use systematic trial and improvement to find approximate solutions of equations where there is no simple analytical method of solving them		
57				Set up and solve two linear simultaneous equations algebraically	Set up and solve two simultaneous equations, 1 linear and 1 non linear
58	Algebraic Inequalities		Solve linear inequalities in one variable, and represent the solution set on a number line	Solve linear inequalities in two variables representing the solution set on a graph	
59	Algebraic Formulae		Change the subject of a simple formula	Change the subject of a formula, including cases where a power or root of the subject appears and including cases where the subject appears in more than one term	
60	Sequences	Recognise and use sequences of e.g. triangular, square and cube numbers			

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	Algebra	M5	M6	M7	M8
61	Sequences (cont.)	Generate terms of a sequence using term to term or a position-to-term rule	Find the n^{th} term of a sequence where the rule is linear	Find the n^{th} term of non-linear sequences	
62	Graphs	Plot and interpret graphs modelling real situations e.g. conversion graphs, distance/time graphs and intersecting travel graphs		Recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function $y = \frac{a}{x}$ with $x \neq 0$	Recognise, sketch and interpret graphs of exponential functions $y = k^x$ for positive values of k e.g. growth and decay rates
63			Solve two linear simultaneous equations graphically		
64			Generate points and plot graphs of simple quadratic functions, and use these to find approximate solutions for points of intersection lines of the form $y = \pm a$ only	Generate points and plot graphs of simple quadratic functions, and use these to find approximate solutions for points of intersection with lines of the form $y = mx + c$	Find the intersection points of the graphs of a linear and quadratic function, knowing that these are the approximate solutions of the corresponding simultaneous equations representing the linear and quadratic functions where algebraic manipulation may be required
65					Interpret the gradient at a point on a curve as the instantaneous rate of change.
66	Circle				Recognise and use the equation of a circle, centre the origin, radius r

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	Algebra	M5	M6	M7	M8
67	Circle (cont.)				Find the equation of a tangent to a circle at a given point on the circle
68	Variation			Set up equations and solve problems involving direct proportion, including graphical and algebraic representations	Set up equations and solve problems involving indirect proportion, including graphical and algebraic representations

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	Geometry and Measures	M1	M2	M3	M4
69	Properties and constructions	Use conventional terms and notations such as: points, lines, vertices, edges, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries			
70		Use the standard conventions for labelling and referring to the sides and angles of shapes			
71		Draw diagrams from written description			
72		Apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles			
73		Understand and use alternate and corresponding angles on parallel lines			
74		Identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference		Identify and apply circle definitions and properties, including: tangent, arc, sector and segment	

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	Geometry and Measures	M1	M2	M3	M4
75	Properties and constructions (cont.)	Apply the properties and definitions of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus; and triangles			
76		Identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres			
77		Draw and interpret 2D representations of 3D shapes, for example nets, plans and elevations			
78	Units and Measurement	Understand and use metric units of measurement			
79		Make sensible estimates of a range of measures			
80		Convert metric measurements from one unit to another			
81		Solve problems involving length, area, volume/ capacity, mass, time, and temperature			

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	Geometry and Measures	M1	M2	M3	M4
82	Units and Measurement (cont.)	Measure line segments and angles in geometric figures			
83		Use compound units such as speed, heart beats per minute, miles per gallon	Use compound units such as density	Use compound units such as pressure	
84	Perimeter, Area and Volume	Calculate perimeters and areas of triangles and rectangles and simple compound shapes made from rectangles and triangles	Calculate perimeters and areas of kite, parallelogram, rhombus and trapezium		
85		Calculate circumferences and areas of circles	Calculate perimeters and areas of composite shapes		
86		Calculate surface area and volumes of cubes and cuboids	Calculate volumes of right prisms	Solve mensuration problems that involve arc length and area of sector; surface area and volume of a cylinder, cone and sphere	Solve more complex mensuration problems (example frustums)
87	Triangle Mensuration		Use Pythagoras' theorem in 2D problems;	Understand and use the trigonometric ratios of sine, cosine and tangent to solve 2D problems; including those involving angles of elevation and depression	
88	Circle Theorems				Understand and use circle theorems

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	Geometry and Measures	M5	M6	M7	M8
89	Units and Measurement	Interpret scales on a range of measuring instruments and recognise the continuous nature of measure and approximate nature of measurement			
90		Know and use imperial measures still in common use and their approximate metric equivalents			
91	Maps and Scale Drawings	Use and interpret maps, scale factors and scale drawings	Understand and use bearings		
92	Polygons	Use the sum of angles in a triangle for example, to deduce the angle sum in any polygon	Calculate and use the sums of the interior and exterior angles of polygons		
93	Triangle Mensuration				Understand and use the sine and cosine rules
94					Calculate the area of a triangle using $A = \frac{1}{2}ab \sin C$
95					Use Pythagoras' theorem and trigonometry to solve 2D and 3D problems

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	Geometry and Measures	M5	M6	M7	M8
96	Transformations	Describe and transform 2D shapes using single transformations	Distinguish properties that are preserved under particular transformations	Describe and transform 2D shapes using combined transformations	
97		Describe and transform 2D shapes using reflections about the x and y axes	Describe and transform 2D shapes using reflections in lines parallel to the x or y axis	Describe and transform 2D shapes using reflections in the lines $y = \pm x$	
98		Describe and transform 2D shapes using single rotations about the origin	Describe and transform 2D shapes using rotations about any point		
99		Describe and transform 2D shapes using translations	Describe and transform 2D shapes using translations to include use of vector notation		
100		Describe and transform 2D shapes using enlargements by a positive whole number scale factor		Describe and transform 2D shapes using enlargements by a fractional scale factor	Describe and transform 2D shapes using enlargements by a negative scale factor
101			Understand and use the effect of enlargement on perimeter, area of shapes	Understand and use the effect of enlargement on volume of solids	
102	Similarity and Congruence		Understand the term congruent	Use the relationship between the ratios of lengths and areas of similar 2-D shapes	Use the relationship between the ratios of lengths, areas and volumes of similar 3-D shapes

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	Geometry and Measures	M5	M6	M7	M8
103	Constructions	Draw triangles and other 2D shapes using a ruler and protractor	Use the standard ruler and compass constructions		
104	Loci		Identify the loci of points, to include real life problems		

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	Statistics	M1	M2	M3	M4
105	Handling Data Cycle	Understand the handling data cycle to solve problems			
106	Planning and Collecting Data	Understand what is meant by a sample and a population			
107		Understand simple random sampling and the effect of sample size on the reliability of conclusions			Understand and use stratified sampling techniques
108		Design an experiment or survey to test hypotheses			
109		Design data-collection sheets, distinguishing between different types of data			
110		Identify possible sources of bias			
111		Sort, classify and tabulate qualitative (categorical) data and discrete or continuous quantitative data; including the use of 2 circle Venn diagrams to sort data	Use 3 circle Venn diagrams to sort data		
112		Extract data from printed tables and lists			
113		Design and use two-way tables for discrete and grouped data			

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	Statistics	M1	M2	M3	M4
114	Analysing Data	Find mean, median, mode and range for ungrouped data and understand their uses		Calculate quartiles and inter-quartile range from ungrouped data and understand their uses	
115		Calculate mean from an ungrouped frequency table and identify the mode and median	Estimate mean from a grouped frequency distribution, identify the modal class and the class in which the median lies		
116	Presenting and Interpreting Data	Construct and interpret a wide range of graphs and diagrams including frequency tables and diagrams, pictograms, bar charts, pie charts, line graphs, frequency trees and flow charts; recognising that graphs may be misleading		Construct and interpret cumulative frequency tables and the cumulative frequency curve	Construct and interpret histograms for grouped continuous data with unequal class intervals
117				Estimate the median, quartiles and interquartile range; display information using box plots	
118		Look at data to find patterns and exceptions		Infer properties of populations or distributions from a sample, whilst knowing the limitations of doing so	
119		Compare distributions and make inferences			
120	Bivariate data	Plot and interpret scatter diagrams; recognise correlation	Draw and/or use lines of best fit by eye, understanding what these lines represent		

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	Statistics	M1	M2	M3	M4
121	Bivariate data (cont.)		Draw conclusions from scatter diagrams		
122			Use terms such as positive correlation, negative correlation, little or no correlation		
123			Interpolate and extrapolate from data whilst knowing the dangers of doing so		
124			Identify outliers		
125			Appreciate that correlation does not imply causality		

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	Probability	M5	M6	M7	M8
126	Vocabulary of probability	Understand and use the vocabulary of probability, including notions of uncertainty and risk			
127		Use the terms 'fair', 'random', 'evens', 'certain', 'likely', 'unlikely' and 'impossible'			
128	Probability scale	Understand and use the probability scale from 0 to 1			
129	Sample spaces	List all outcomes for single events, and for two successive events	List all outcomes for single events, and for two successive events, in a systematic way		
130	Enumeration	Apply systematic listing strategies		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 $m \times n$)	
131	Calculating probabilities	Work out probabilities expressed as fractions or decimals from simple experiments with equally likely outcomes and simple combined events			Use the most appropriate method when solving complex problems

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	Probability	M5	M6	M7	M8
132	Calculating probabilities (cont.)	Identify different mutually exclusive outcomes and know that the sum of the probabilities of all these outcomes is 1			
133		Understand the probability of an event not occurring is one minus the probability that it occurs		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 $P(A) \times P(B)$	
134	Expectation	Use probabilities to calculate expectation			
135	Relative frequency		Understand and use estimates or measures of probability from relative frequency		
136			Compare experimental data and theoretical probabilities		
137			Understand that increasing sample size generally leads to better estimates of probability		
138	Tree diagrams			Use tree diagrams to represent successive events which are independent	Use tree diagrams to represent successive events which are not independent