# AQA GCSE Maths 8300 Topic List - HIGHER

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|  | **NUMBER** |
| N1 | Order numbers | * Put in order of size, integers (whole numbers), decimals and fractions
* use the symbols =, ≠, <, >, ≤, and ≥
* Understand and use positive and negative numbers on a number line
 |
| N2 | Add, subtract, multiply, divide | * Add, subtract, multiply, and divide integers (whole numbers), decimals, simple fractions (including mixed numbers and improper fractions), both positive and negative
* Understand and use place value
* Understand the terms profit, loss, cost price, selling price, debit, credit, income tax, VAT and interest rate.
 |
| N3 | Operations | * Understand inverse (opposite) operations; x and ÷, + and −
* Use correct order of operations (BIDMAS)
* Be able to understand and use brackets, powers, roots and reciprocals
 |
| N4 | Factors, multiples and primes | Understand the terms;* + Prime number
	+ Factor
	+ Multiple
	+ Common factor
	+ Highest common factor
	+ Least (lowest) common multiple
* Express a number as a product of prime factors (factor tree) in index form and understand that this is unique for every number
 |
| N5 | Listing and counting | * List things in a systematic way
* **Use the product rule for counting**
 |
| N6 | Powers and roots | * Use positive integer powers and roots of numbers
* Recognise powers of 2, 3, 4 and 5
* Know square numbers up to 152
* Know that 103 = 1000 and that 106 = 1 million
* **Estimate powers and roots of any positive number**
 |
| N7 | Powers and roots and fractional indices | * Calculate with roots and with whole number indices
* **Calculate with fractional indices**
 |
| N8 | Exact calculations | * Calculate exactly with fractions
* Calculate exactly with multiples of π
* **Calculate exactly with surds**
* **Simplify surds (eg.** $\sqrt{50} =5\sqrt{2}$ **)**
* **Rationalise demoninators with surds**
 |
| N9 | Standard form | * Understand numbers written in standard form
* Calculate with numbers in standard form
 |
| N10 | Fractions and decimals | * Convert between fractions and decimals
* Be able to put fractions and decimals in order of size
* **Convert between recurring decimals and fractions**
 |
| N11 | Fractions and ratios | * Be able to work with fractions in ratio problems
 |
| N12 | Fractions and percentages | * Find a fraction of a quantity
* Find a percentage of a quantity
* Use a multiplier to increase of decrease a quantity (eg. use x 1.05 to increase by 5%, or 0.88 to decrease by 12%))
 |
| N13 | Units of measurement | * Be able to use units of mass, length, time, money and other measures, including using decimal amounts
* Convert between metric measurements of length
* Convert between metric measurements of area
* Convert between metric measurements of volume and capacity
* NB. Imperial (old) units to metric units do not need to be known, and conversions will be given in the question if required
 |
| N14 | Estimation | * Estimate answers (by rounding)
* Check calculations using approximation and estimation
 |
| N15 | Rounding | * Round to an appropriate degree of accuracy
* Round to a number of decimal places
* Round to a number of significant figures
* Use inequality signs to show an error interval due to rounding, eg. 8.5 $\leq $ a $<$ 9.5
* Know not to round in the middle of a calculation, but just to round the final answer
 |
| N16 |  | * Understand and use limits of accuracy
* **Understand and use upper and lower bounds**
 |
|  | **ALGEBRA** |
| A1 | Basic notation | Understand and use algebraic notation, including* + ab,
	+ 3a
	+ a2, a3, a2b, etc.
	+ $\frac{a}{b}$
* Use fractions in algebra work instead of decimals
* Use brackets

NB. Answers are expected to be given in their simplest form even when not asked to do so. |
| A2 | Substitution | * Substitute numbers into formulas, and expressions, including scientific formulas which may not have been seen before
 |
| A3 | Algebraic terms | Understand and use the terms;* + Expression
	+ Equation
	+ Formula
	+ Inequality
	+ Term
	+ Factor
	+ Identity
 |
| A4 | Manipulate algebra | * Simplify by collecting like terms
* Multiply out a single bracket
* Factorise a single bracket by taking out common factors
* Expand two brackets
* Factorise quadratics (with a single x2) into two brackets
* Factorise quadratics using the difference of two squares, eg. a2 – 9 = (a + 3)(a – 3)
* Simplify algebraic expressions by adding, subtracting and multiplying
* Use index laws
* **Expand three brackets**
* **Factorise quadratics with 3x2, 10x2 etc. into two brackets**
* **Manipulate algebraic expressions involving surds**
* **Manipulate algebraic expressions involving algebraic fractions**
 |
| A5 | Formulae | * Understand and use mathematical formulae
* Rearrange a formula to change the subject
 |
| A6 | Expressions | * Know the difference between an equation, like 2x + 3 = 17, and an identity, like 2x $≡$ x + x
* Be able to show that two expressions are equal
* **Use algebra in proofs**
 |
| A7 | Functions | * Understand functions with inputs and outputs
* **Understand inverse functions**
* **Understand composite functions (two functions)**
* **Understand and use function notation, eg. f(x), gf(x) etc.**
 |
| A8 | Graphs | * Work with graphs in all four quadrants (ie. with negative values as well as positive)
 |
| A9 | Straight line graphs | * Plot straight line graphs
* Use y = mx + c to find parallel graphs
* Find the equation of a line when given the gradient and one point
* Find the equation of a line when given two points
* **Use y = mx + c to find perpendicular graphs**
 |
| A10 | Gradients and intercepts | * Find and use gradients and intercepts of graphs
 |
| A11 | Key features of graphs | Look at a quadratic graph and identify from it* Roots (where a graph crosses the x axis)
* Intercept (where it crosses the y axis)
* Turning points
* Find the roots of a quadratic using algebra
* **Find the turning points of a graph by completing the square**
* Understand the symmetry of a quadratic graph
 |
| A12 | Other graphs | Recognise, sketch or interpret other graphs, including* + Cubic functions (x3, etc.)
	+ Reciprocal functions ($\frac{1}{x}$, etc.)
	+ **Exponential functions (y = 5x, etc.)**
	+ **y = sin x**
	+ **y = cos x**
	+ **y = tan x**
 |
| A13 | **Transformations of graphs** | * **Sketch translations and reflections of functions**
 |
| A14 | Real life graphs | * Plot and interpret graphs of speed, distance and time
* Use graphs to find solutions with problems of speed, distance and acceleration
* Understand and use reciprocal graphs
* **Understand and use exponential graphs**
 |
| A15 | **Distance-time graphs and speed-time graphs** | * **Find gradients of distance-time graphs to estimate speed**
* **Find gradients of speed-time graphs to estimate acceleration**
* **Find area under a distance-time graph to estimate distance**
 |
| A16 | **Graph of a circle** | * **Recognise and use the equation of the graph of a circle (with centre at the origin only)**
* **Find the equation of a tangent to a circle**
 |
| A17 | Linear equations | * Solve linear equations
* Solve equations with x on both sides
* Solve equations with brackets
* Find a solution to a linear equation by reading it from a graph
 |
| A18 | Quadratic equations | * Solve quadratic equations by factorising into 2 brackets
* Find solutions to a quadratic equation by reading them from a graph
* **Solve quadratic equations that need rearranging first**
* **Solve quadratic equations using the quadratic formula**
* **Solve quadratic equations by completing the square**
 |
| A19 | Simultaneous equations | * Solve simultaneous linear equations
* Find solutions simultaneous equations by reading them from a graph
* **Solve simultaneous equations when one is linear and the other is quadratic**
 |
| A20 | **Iteration** | * **Find approximate solutions to equations by using iteration**
 |
| A21 | Creating expressions and equations | * Create an expression from a word or shape problem
* Create an equation from a word or shape problem and solve it
 |
| A22 | Inequalities | * Solve linear inequalities
* Represent solutions to linear inequalities on a number line
* **Solve linear inequalities with two variables**
* **Solve quadratic inequalities**
* **Represent solutions to inequalities on a number line, using set notation, or on a graph**

NB. On a number line, open circles and closed circles must be used correctly, and on a graph, dashed lines and solid lines must be used correctly. |
| A23 | Sequences | * Generate a sequence from a term-to-term rule or an nth term expression
* Generate a sequence from patterns
 |
| A24 | Sequences | Recognise and use sequences, including* + Square numbers
	+ Cube numbers
	+ Triangular numbers
	+ Arithmetic (linear) sequences
	+ Fibonacci sequences
	+ Simple geometric sequences (eg. doubling or multiplying each term by 3)
	+ **Other sequences**
	+ **Sequences involving surds**
 |
| A25 | Nth term of a sequence | * Find the nth term of a linear sequence
* **Find the nth term of a quadratic sequence**
 |
|  | **RATIO, PROPORTION AND RATES OF CHANGE** |
| R1 | Units | Change between units for * + Time
	+ Length
	+ Area
	+ Volume/capacity
	+ Mass

Change between units for compound measures of* + Speed
	+ Rates of pay
	+ Density
	+ Pressure
 |
| R2 | Scale | * Use scale factors, scale diagrams and maps
 |
| R3 | Finding a fraction | * Express one quantity as a fraction of another

NB. The result may also be greater than one or a top-heavy fraction. |
| R4 | Simple ratios | * Use ratio notation
* Simplify a ratio
 |
| R5 | Using ratios | * Dividing a quantity into a given ratio
* Make a division into two parts into a ratio
* Use ratio in problems, including mixing substances, conversions, scale problems, and best value for money, etc.
 |
| R6 | Writing as a ratio | * Express two amounts as a ratio or fraction
 |
| R7 | Proportion | * Understand and use proportion
 |
| R8 | Ratio and fractions | * Understand the relationship between ratio and a fraction or a linear function
 |
| R9 | Percentages | * Understand the meaning of percentage
* Change percentages to fractions or decimals and the other way round
* Use percentages, fractions and decimals to multiply
* Express one amount as a percentage of another
* Compare two quantities by using percentages
* Use percentages greater than 100%
* Solve problems using percentage change
* Work with percentage increase and decrease
* Calculate an original value (reverse percentages)
* Find simple interest
 |
| R10 | Proportion | * Solve problems involving direct proportion
* Solve problems involving inverse proportion
* Understand graphs of direct and inverse proportion
 |
| R11 | Compound units | Use units for compound measures of* + Speed
	+ Rates of pay
	+ Density
	+ Price per item/amount
	+ Pressure
 |
| R12 | Comparisons | * Compare lengths, areas and volumes using ratio notation
* Apply ratio comparisons in similar shapes or in trigonometry ratios
 |
| R13 | Direct and inverse proportion | * Understand that x inversely proportional to y means x is proportional to $\frac{1}{y}$
* Use equations for direct and inverse proportion
* **Construct and use equations for direct and inverse proportion**
 |
| R14 | Graphs and proportion | * Understand and use the gradient of a straight line graph as a rate of change
* Recognise and use graphs that show direct or inverse proportion
 |
| R15 | **Graphs and proportion** | * **Understand and use the gradient at a point on a curve as an instantaneos rate of change**
* **Understand average rate of change (gradient of a chord) and instantaneous rate of change (gradient of a tangent)**
 |
| R16 | Growth and decay | * Set up and solve problems of growth and decay
* Set up and solve problems of compound interest
* **Work with iterative processes**
 |
|  | **GEOMETRY AND MEASURE** |
| G1 | Understanding terms | * Understand and use the terms points, lines, vertices and planes
* Understand and use the terms parallel, perpendicular and right angle
* Understand and use the terms polygon and regular polygon
* Understand symmetry and rotational symmetry of polygons
* Understand labelling of sides and angles on shapes
* Draw a diagram from a description
 |
| G2 | Constructions | Use ruler and compasses to construct* + Perpendicular bisector of a line
	+ Perpendicular at a point on a line
	+ Perpendicular from a separate point to a line
	+ Angle bisector
	+ An angle of 60°
* Use constructions in loci problems
* Know that the perpendicular from a point to a line is the shortest distance from the point to the line
 |
| G3 | Basic angle facts | Know and use * + Angles at a point add up to 360⁰
	+ Angles at a point on a straight line add up to 180⁰
	+ Vertically opposite angles are equal
	+ In parallel lines, alternate angles are equal
	+ In parallel lines, corresponding angles are equal
	+ Angles in a triangle add up to 180⁰
* Be able to find the sum of angles in any polygon
* Be able to find exterior and interior angles of any regular polygon

NB. In parallel lines, “Z angles” and “F angles” are not allowed as reasons |
| G4 | Triangles, quadrilaterals and other polygons | Know and use the special properties of quadrilaterals:* + Square
	+ Rectangle
	+ Parallelogram
	+ Trapezium
	+ Kite
	+ Rhombus

Know and use the special properties of triangles:* + Isosceles triangle
	+ Equilateral triangle
	+ Scalene triangle
	+ Right-angled triangle
	+ Acute angled triangle
	+ Obtuse angled triangle

Know and use the names of polygons:* + Pentagon
	+ Hexagon
	+ Octagon
	+ Decagon
 |
| G5 | Congruent triangles | * Know and use the criteria for congruent triangles: SSS, SAS, ASA and RHS
 |
| G6 | Applying angle facts and other properties | * Apply angle facts and facts about congruence and similar shapes to find angles and sides
* Use Pythagoras’ theorem
* Use base angles in an isosceles triangle are equal
* Use angle facts and other properties for simple proofs
 |
| G7 | Transformations | * Identify, describe or draw similar shapes
* Identify, describe or draw congruent shapes

Describe and use transformations:* + Rotation
	+ Reflection
	+ Translation (including using vectors)
	+ Enlargement
* Describe and use enlargements with fractional scale factors
* **Describe and use enlargements with negative scale factors**
 |
| G8 | **Combinations of transformations** | * **Describe and use combinations of rotations, reflections and translations**
* **Identify invariant points from transformations**
 |
| G9 | The circle | Know and use definitions and properties of circle parts: * + Centre
	+ Radius
	+ Chord
	+ Diameter
	+ Circumference
	+ Tangent
	+ Arc
	+ Sector
	+ Segment
 |
| G10 | **Circle theorems** | **Apply and prove circle theorems:*** + **Angle at the centre is double the angle at the circumference**
	+ **Angle in a semicircle is 90⁰**
	+ **Angles in the same segment are equal**
	+ **Opposite angles in a cyclic quadrilateral add up to 180⁰**
	+ **Angle between a tangent and a radius is 90⁰**
	+ **Tangents from an external point are equal in length**
	+ **The perpendicular from the centre to a chord bisects the chord**
	+ **Alternate segment theorem**
 |
| G11 | Geometry on a grid | * Solve geometrical problems on a coordinate grid
 |
| G12 | Solid shapes | Know properties of the faces, surfaces, edges and vertices of * + Cubes
	+ Cuboids
	+ Prisms
	+ Cylinders
	+ Pyramids
	+ Cones
	+ Spheres
 |
| G13 | Plans and elevations | * Draw and interpret plans and elevations of 3D shapes
 |
| G14 | Units of measure | * Use standard units of measure for length, area, volume/capacity, mass, time, money, etc.
 |
| G15 | Maps and scale drawings | * Measure and use lines and angles in diagrams
* Use maps and scale drawings
* Use bearings, including the 8 compass points and 3-figure angles for bearings
 |
| G16 | Area and volume | Know and use formulas to calculate* + Area of a triangle
	+ Area of a parallelogram
	+ Area of a trapezium
	+ Volume of a cuboid
	+ Volume of a prism
	+ Volume of a cylinder
 |
| G17 | Circles and other shapes | * Know and use the formula for circumference of a circle
* Know and use the formula for area of a circle
* Calculate perimeters of 2D shapes
* Calculate areas of compound shapes

Find the surface area and volume of * + Sphere
	+ Pyramid
	+ Cone
	+ Frustum
	+ Composite solids

NB. Answers may be asked for in terms of $π$ |
| G18 | Sectors and arcs | * Calculate length of an arc
* Calculate area of a sector
* Calculate the angle of a sector
 |
| G19 | Congruence and similarity | * Understand congruent shapes
* Understand similar shapes
* Calculate lengths in similar shapes
* **Understand the relationship between lengths, areas and volumes of similar shapes**
* **Calculate lengths, areas and volumes in similar shapes**
 |
| G20 |  | * Know and use the formula for Pythagoras’ Theorem to find a length
* Know and use the sin, cos and tan ratios to find a length
* Know and use the sin, cos and tan ratios to find an angle
* **Use Pythagoras and sin, cos and tan in three dimensional shapes**
 |
| G21 | Exact values of sin, cos and tan | * Know the exact values of sin and cos for angles of 0⁰, 30⁰, 45⁰, 60⁰ and 90⁰
* Know the exact values of tan for angles of 0⁰, 30⁰, 45⁰, and 60⁰
 |
| G22 | **Sine and cosine rules** | * **Know and use the sine rule to find lengths and angles**
* **Know and use the cosine rule to find lengths and angles**
 |
| G23 | **Area of a triangle using sin** | * **Know and use the formula to find area of a triangle using sin**
* **Use the same formula to find a length or an angle**
 |
| G24 | Vectors for translations | * Use a vector to describe a translation
 |
| G25 | Using vectors | * Add and subtract vectors
* Multiply a vector by a number
* Use column vectors and vectors on diagrams
* **Use vectors in vector geometry problems and proofs**
 |
|  | **PROBABILITY**  |
| P1 | Basic probability | * Use tables and probability trees to show outcomes and probabilities

NB. Probabilities should be shown as fractions, decimals or percentages |
| P2 | Random, fair and equally likely events | * Understand and use ideas of random events, fairness, and equally likely events
* Use these ideas to calculate expected outcomes
 |
| P3 | Relative frequency | * Understand the relationship between relative frequency and probability
 |
| P4 | Exhaustive outcomes | * Understand and use the fact that the probabilities of exhaustive outcomes (all possible outcomes) add up to 1
 |
| P5 | Experimental probability | * Understand that the greater the sample size or number of events in experimental probability, the closer the results will be to the theoretical probability
 |
| P6 | Diagrams | Use diagrams for showing and calculating sets of data, including* + Tables and grids
	+ Venn diagrams
	+ Tree diagrams
 |
| P7 | Sample spaces | * Use sample spaces for single or combined events with equally likely outcomes
* Use sample spaces to calculate theoretical probabilities
 |
| P8 | Probability trees | * Use tree diagrams to represent independent events
* Use tree diagrams to represent dependent events
* Use adding and multiplying correctly for combined probabilities
 |
| P9 | **Conditional probabilities** | * **Understand and calculate conditional probabilities, using two-way tables, tree diagrams and Venn diagrams**
 |
|  | **STATISTICS** |
| S1 | Sample populations | * Understand how a sample of a population can be used to represent the whole population
 |
| S2 | Graphs and diagrams | Construct and use* + Frequency tables
	+ Bar charts
	+ Pie charts
	+ Pictograms
	+ Vertical line charts
	+ Tables and line graphs for time series data
 |
| S3 | **Grouped data** | * **Construct and use histograms**
* **Construct and use cumulative frequency graphs**
 |
| S4 | Measures of data | * Be able to represent data in graphs or diagrams
* **Use box plots to represent data**

Understand and use* + Median
	+ Mean
	+ Mode and modal class
	+ Range
	+ **Lower quartile and upper quartile**
	+ **Inter-quartile range**

Know and understand the terms* + Primary data
	+ Secondary data
	+ Discrete data
	+ Continuous data
 |
| S5 | Describing a population | * Describe a population, eg. using range, median, etc.
 |
| S6 | Scatter graphs | * Use and interpret scatter graphs
* Recognise correlation (positive or negative, and strong or weak, or no correlation)
* Understand that a correlation doesn’t mean that one variable is a cause of the other
* Draw a line of best fit
* Use a line of best fit to predict results
* Extrapolate data, but understand why this is not always advisable
 |