# 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. )** * **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 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. * 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 (, 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 * 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 |
| 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 |