GCSE Maths Revision Checklist

8300 Higher Tier

Number

N1	know and use the word integer and the equality and inequality symbols	
N1	recognise integers as positive or negative whole numbers, including zero	
N1	order positive and/or negative numbers given as integers, decimals and fractions, including improper fractions	
N2	add, subtract, multiply and divide integers using both mental and written methods	
N2	add, subtract, multiply and divide decimals using both mental and written methods	
N2	add, subtract, multiply and divide positive and negative numbers	
N2	interpret a remainder from a division problem	
N2	recall all positive number complements to 100	
N2	recall all multiplication facts to 12×12 and use them to derive the corresponding division facts	
N2	perform money and other calculations, writing answers using the correct notation	
N2	apply the four rules to fractions with and without a calculator	
N2	multiply and divide a fraction by an integer, by a unit fraction and by a general fraction	
N2	divide an integer by a fraction	
N3	add, subtract, multiply and divide using commutative, associative and distributive laws	
N3	understand and use inverse operations	
N3	use brackets and the hierarchy of operations	
N3	solve problems set in words	
N4	identify multiples, factors and prime numbers from lists of numbers	

N4	write out lists of multiples and factors to identify common multiples or common factors of two or more integers	
N4	write a number as the product of its prime factors and use formal (eg using Venn diagrams) and informal methods (eg trial and error) for identifying highest common factors (HCF) and lowest common multiples (LCM)	
N4	work out a root of a number from a product of prime factors	
N5	identify all permutations and combinations and represent them in a variety of formats	
N5h	know and understand why if there are x ways to do task 1 and y ways to do task 2, then there are xy ways to do both tasks in sequence.	
N6	recall squares of numbers up to 15×15 and the cubes of 1, 2, 3, 4, 5 and 10, also knowing the corresponding roots	
N6	calculate and recognise powers of 2, 3, 4, 5	
N6	calculate and recognise powers of 10	
N6	understand the notation and be able to work out the value of squares, cubes and powers of 10	
N6	recognise the notation $\sqrt{25}$	
N6	solve equations such as $x^2 = 25$, giving both the positive and negative roots	
N6h	estimate the value of a power of a given positive number	
N6h	estimate the value of the root of any given positive number	
N6h	identify between which two integers the square root of a positive number lies	
N6h	identify between which two integers the cube root of a positive number lies	
N7	use index laws for multiplication and division of integer powers	
N7	calculate with positive integer indices	
N7h	calculate values using fractional indices	
N7h	calculate with positive and negative integer indices	
N7h	use index laws for multiplication and division of positive, negative and fractional indices	

N8	identify equivalent fractions	
N8	write a fraction in its simplest form	
N8	simplify a fraction by cancelling all common factors, using a calculator where appropriate, for example, simplifying fractions that represent probabilities	
N8	convert between mixed numbers and improper fractions	
N8	compare fractions	
N8	compare fractions in statistics and geometry questions	
N8	add and subtract fractions by writing them with a common denominator	
N8	convert mixed numbers to improper fractions and add and subtract mixed numbers	
N8	give answers in terms of π and use values given in terms of π in calculations.	
N8h	simplify surds	
N8h	rationalise a denominator of the form $\sqrt{a}$ or $b\sqrt{a}$	
N8h	simplify expressions using the rules of surds	
N8h	expand brackets where the terms may be written in surd form	
N8h	solve equations which may be written in surd form	
N9	know, use and understand the term standard from	
N9	write an ordinary number in standard form	
N9	write a number written in standard form as an ordinary number	
N9	order and calculate with numbers written in standard form	
N9	solve simple equations where the numbers are written in standard form	
N9	interpret calculator displays	
N9	use a calculator effectively for standard form calculations	
N9	solve standard form problems with and without a calculator	
N10	convert between fractions and decimals using place value	

N10	compare the value of fractions and decimals	
N10h	convert recurring decimals into fractions	
N10h	convert fractions into recurring decimals	
N10h	use formal algebraic methods to convert recurring decimals into fractions	
N11	understand the meaning of ratio notation	
N11	interpret a ratio as a fraction	
N11	use fractions and ratios in the context of geometrical problems, for example similar shapes, scale drawings and problem solving involving scales and measures	
N11	understand that a line divided in the ratio 1 : 3 means that the smaller part is one-quarter of the whole	
N12	calculate a fraction of a quantity	
N12	calculate a percentage of a quantity	
N12	use fractions, decimals or percentages to find quantities	
N12	use fractions, decimals or percentages to calculate proportions of shapes that are shaded	
N12	use fractions, decimals or percentages to calculate lengths, areas or volumes	
N12	understand and use unit fractions as multiplicative inverses	
N12	multiply and divide a fraction by an integer, by a unit fraction and by a general fraction	
N12	interpret a fraction, decimal or percentage as a multiplier when solving problems	
N12	use fractions, decimals or percentages to interpret or compare statistical diagrams or data sets	
N12	convert between fractions, decimals and percentages to find the most appropriate method of calculation in a question; for example, 62% of £80 is 0.62 × £80 and 25% of £80 is £80 ÷ 4	
N13	know and use standard metric and imperial measures	
N13	know and use compound measures such as area, volume and speed	

N13	choose appropriate units for estimating measurements, for example a television mast would be measured in metres	
N14	make sensible estimates of a range of measures in everyday settings	
N14	make sensible estimates of a range of measures in real-life situations, for example estimate the height of a man	
N14	evaluate results obtained	
N14	use approximation to estimate the value of a calculation	
N14	work out the value of a calculation and check the answer using approximations	
N15	perform money calculations, writing answers using the correct notation	
N15	round numbers to the nearest whole number, 10, 100 or 1000	
N15	round numbers to a specified number of decimal places	
N15	round numbers to a specified number of significant figures	
N15	use inequality notation to specify error intervals due to truncation or rounding	
N16	recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction	
N16h	write down the maximum or minimum figure for a value rounded to a given accuracy	
N16h	combine upper or lower bounds appropriately to achieve an overall maximum or minimum for a situation	
N16h	work with practical problems involving bounds including in statistics. For example, finding the midpoint of a class interval, such as $10 < t \leqslant 20$, in order to estimate a mean	

Algebra

A1	use notation and symbols correctly	
A1	understand that letter symbols represent definite unknown numbers in equations, defined quantities or variables in formulae, and in functions they define new expressions or quantities by referring to known quantities	
A2	use formulae from mathematics and other subjects expressed initially in words and then using letters and symbols. For example, formula for area of a triangle, area of a parallelogram, area of a circle, volume of a prism, conversions between measures, wage earned = hours worked $\times$ hourly rate + bonus	
A2	substitute numbers into a formula	
A3	understand phrases such as 'form an equation', 'use a formula', 'write down a term', 'write an expression' and 'prove an identity' when answering a question	
A3	recognise that, for example, $5x + 1 = 16$ is an equation	
A3	recognise that, for example, $V = IR$ is a formula	
A3	recognise that $x + 3$ is an expression	
A3	recognise that $(x + 2)^2 \equiv x^2 + 4x + 4$ is an identity	
A3	recognise that $2x + 5 < 16$ is an inequality	
A3	write an expression	
A3	know the meaning of the word 'factor' for both numerical work and algebraic work	
A4	understand that algebra can be used to generalise the laws of arithmetic	
A4	manipulate an expression by collecting like terms	
A4	write expressions to solve problems	
A4	write expressions using squares and cubes	
A4	factorise algebraic expressions by taking out common factors	
A4	multiply two linear expressions, such as $(x \pm a)(x \pm b)$ and $(cx \pm a)(dx \pm b)$, for example $(2x + 3)(3x - 4)$	
A4	multiply a single term over a bracket, for example, $a(b + c) = ab + ac$	

A4	know the meaning of and be able to simplify, for example $3x - 2 + 4(x + 5)$	
A4	know the meaning of and be able to factorise, for example $3x^2y - 9y$ or $4x^2 + 6xy$	
A4	factorise quadratic expressions using the sum and product method, or by inspection (FOIL)	
A4	factorise quadratics of the form $x^2 + bx + c$	
A4	factorise expressions written as the difference of two squares of the form $x^2 - a^2$	
A4	use the index laws for multiplication and division of integer powers	
A4	simplify algebraic expressions, for example by cancelling common factors in fractions or using index laws	
A4h	multiply two or more binomial expressions	
A4h	factorise quadratic expressions of the form $ax^2 + bx + c$	
A4h	simplify by factorising and cancelling expressions of the form $\frac{ax^2 + bx + c}{dx^2 + ex + f}$	
A5	understand and use formulae from maths and other subjects expressed initially in words and then using letters and symbols. For example formula for area of a triangle, area of a parallelogram, area of a circle, volume of a prism, conversions between measures, wage earned = hours worked $\times$ hourly rate + bonus	
A5	change the subject of a formula	
A6	recognise that, for example, $5x + 5 = 16$ is an equation, but $5x + 5 \equiv 5(x + 1)$ is an identity	
A6	show that two expressions are equivalent	
A6	use identities including equating coefficients	
A6	use algebraic expressions to support an argument or verify a statement	
A6h	construct rigorous proofs to validate a given result	
A7	understand and use number machines	
A7	interpret an expression diagrammatically using a number machine	

A7	interpret the operations in a number machine as an expression or function	
A7h	understand that a function is a relationship between two sets of values	
A7h	understand and use function notation, for example f(x)	
A7h	substitute values into a function, knowing that, for example f(2) is the value of the function when $x = 2$	
A7h	solve equations that use function notation	
A7h	understand, interpret and use composite function fg(x)	
A7h	understand, interpret and use inverse function $f^{-1}(x)$	
A8	plot points in all four quadrants	
A8	find and use coordinates of points identified by geometrical information, for example the fourth vertex of a rectangle given the other three vertices	
A8	find coordinates of a midpoint, for example on the diagonal of a rhombus	
A8	identify and use cells in 2D contexts, relating coordinates to applications such as Battleships and Connect 4	
A9	recognise that equations of the form $y = mx + c$ correspond to straight-line graphs in the coordinate plane	
A9	draw graphs of functions in which y is given explicitly or implicitly in terms of x	
A9	complete tables of values for straight-line graphs	
A9	calculate the gradient of a given straight-line given two points or from an equation	
A9	manipulate the equations of straight lines so that it is possible to tell whether lines are parallel or not	
A9	work out the equation of a line, given two points on the line or given one point and the gradient	
A9h	work out the gradients of lines that are parallel and perpendicular to a given line	
A9h	show that two lines are parallel or perpendicular using gradients	
A9h	manipulate the equations of straight lines so that it is possible to tell whether or not lines are perpendicular	

A9h	know that the gradients of perpendicular lines are the negative reciprocal of each other	
A10	recognise that equations of the form $y = mx + c$ correspond to straight-line graphs in the coordinate plane with gradient m and y-intercept at $(0, c)$	
A10	work out the gradient and the intersection with the axes	
A11	interpret quadratic graphs by finding roots, intercepts and turning points	
A11h	complete the square	
A11h	deduce turning points by completing the square	
A12	draw, sketch, recognise and interpret linear functions	
A12	calculate values for a quadratic and draw the graph	
A12	draw, sketch, recognise and interpret quadratic graphs	
A12	draw, sketch, recognise and interpret graphs of the form $y = x^3 + k$ where k is an integer	
A12	draw, sketch, recognise and interpret the graph $y = \frac{1}{x}$ with $x \neq 0$	
A12	find an approximate value of y for a given value of x, or the approximate values of x for a given value of y	
A12h	draw, sketch, recognise and interpret graphs of the form $y = k^x$ for positive values of k	
A12h	know the shapes of the graphs of functions $y = \sin x$, $y = \cos x$ and $y = \tan x$	
A13h	transform the graph of any function $f(x)$ including: $f(x) + a$, $f(x + b)$, $-f(x)$ and $f(-x)$ where a and b are integers	
A13h	recognise transformations of functions and be able to write down the function of a transformation given the original function	
A14	plot a graph representing a real-life problem from information given in words, in a table or as a formula	
A14	identify the correct equation of a real-life graph from a drawing of the graph	

A14	read from graphs representing real-life situations; for example, work out the cost of a bill for so many units of gas or the number of units for a given cost, and also understand that the intercept of such a graph represents the fixed charge	
A14	interpret linear graphs representing real-life situations; for example, graphs representing financial situations (eg gas, electricity, water, mobile phone bills, council tax) with or without fixed charges, and also understand that the intercept represents the fixed charge or deposit	
A14	plot and interpret distance-time graphs	
A14	interpret line graphs from real-life situations, for example conversion graphs	
A14	interpret graphs showing real-life situations in geometry, such as the depth of water in containers as they are filled at a steady rate	
A14	interpret non-linear graphs showing real-life situations, such as the height of a ball plotted against time	
A14h	draw an exponential graph	
A14h	understand the main features of an exponential graph	
A15h	calculate the area under a graph consisting of straight lines	
A15h	estimate the gradient at a point on a curve by drawing a tangent at that point and working out its gradient	
A15h	interpret the meaning (and give the units) of the gradient at a point on a curve	
A15h	use the areas of trapezia, triangles and rectangles to estimate the area under a curve	
A15h	interpret the meaning of the area calculated as the product of the units of the variable on the vertical axis and the units of the variable on the horizontal axis	
A16h	recognise the equation of a circle, centre (0, 0), radius r	
A16h	write down the equation of a circle, centre (0, 0) and radius r	
A16h	work out coordinates of points of intersection of a given circle and a given straight line	
A16h	use the fact that the angle between the tangent and radius is 90° to work out the gradient of a tangent and hence the equation of a tangent at a given point	

A17	solve simple linear equations by using inverse operations or by transforming both sides in the same way	
A17	solve simple linear equations with integer coefficients where the unknown appears on one or both sides of the equation or where the equation involves brackets	
A18	solve quadratic equations by factorising	
A18	read approximate solutions to a quadratic equation from a graph	
A18h	solve quadratic equations by factorising, completing the square or using the quadratic formula	
A18h	solve geometry problems that lead to a quadratic equation that can be solved by using the quadratic formula	
A18h	read approximate solutions from a graph	
A19	solve simultaneous linear equations by elimination or substitution or any other valid method	
A19	find approximate solutions using the point of intersection of two straight lines	
A19h	solve simultaneous equations when one is linear and the other quadratic	
A19h	appreciate that the solution of $f(x) = ax + b$ is found where $y = ax + b$ intersects with $y = f(x)$ eg the points of intersection of the graphs of $y = x^2 + 3x - 10$ and $y = 2x + 1$ are the solutions to the equation $x^2 + 3x - 10 = 2x + 1$ or $x^2 + x - 11 = 0$	
A20h	use a systematic method to find approximate solutions of equations where there is no simple analytical method	
A20h	use suffix notation in recursive formulae	
A20h	find approximate solutions using recursive formulae	
A21	set up simple linear equations	
A21	rearrange simple linear equations	
A21	set up simple linear equations to solve problems	
A21	set up a pair of simultaneous linear equations to solve problems	
A21	interpret solutions of equations in context	

A22	know the difference between $<$, $\leqslant$, $\geqslant$, $>$ and $\neq$	
A22	solve simple linear inequalities in one variable	
A22	represent the solution set of an inequality on a number line, knowing the correct conventions of an open circle for a strict inequality eg $x < 3$ and a closed circle for an inclusive inequality eg $x \leqslant 3$	
A22h	represent these inequalities on a given coordinate grid	
A22h	shade out the side of the boundary line that **does not** satisfy the inequality	
A22h	solve quadratic inequalities	
A22h	understand and use a solution set of discrete values written in the form { –2, –1, 0, 1, 2 }	
A22h	understand and use a solution set of continuous values written in the form $-3 < x < 3$	
A23	generate linear sequences	
A23	work out the value of the *n*th term of a linear sequence for any given value of *n*	
A23	generate sequences with a given term-to-term rule	
A23	generate a sequence where the *n*th term is given	
A23	work out the value of the *n*th term of any sequence for any given value of *n*	
A23	generate simple sequences derived from diagrams and complete a table of results that describes the pattern shown by the diagrams	
A23	describe how a sequence continues	
A24	solve simple problems involving arithmetic progressions	
A24	work with Fibonacci-type sequences (rule will be given)	
A24	know how to continue the terms of a quadratic sequence	
A24	work out the value of a term in a geometrical progression of the form r^n where n is an integer > 0	
A24h	work out the value of the *n*th term of a sequence for any given value of *n*	
A25	work out a formula for the *n*th term of a linear sequence	

A25	work out an expression in terms of *n* for the *n*th term of a linear sequence by knowing that the common difference can be used to generate a formula for the *n*th term	
A25h	work out a formula for the *n*th term of a sequence, which may contain linear or quadratic parts	

Ratio, proportion and rates of change

R1	convert between metric measures	
R1	recall and use conversions for metric measures for length, area, volume and capacity	
R1	use conversions between imperial units and metric units using common approximations, for example 5 miles ≈ 8 kilometres, 1 gallon ≈ 4.5 litres, 2.2 pounds ≈ 1 kilogram, 1 inch ≈ 2.5 centimetres	
R2	use and interpret maps and scale drawings	
R2	use a scale on a map to work out an actual length	
R2	use a scale with an actual length to work out a length on a map	
R2	construct scale drawings	
R2	use scale to estimate a length, for example use the height of a man to estimate the height of a building where both are shown in a scale drawing	
R2	work out a scale from a scale drawing given additional information	
R3	work out one quantity as a fraction or decimal of another quantity	
R3	use a fraction of a quantity to compare proportions	
R4	understand the meaning of ratio notation	
R4	simplify ratios to their simplest form $a : b$ where a and b are integers	
R4	write a ratio in the form $1 : n$ or $n : 1$	
R5	use ratios in the context of geometrical problems, for example similar shapes, scale drawings and problem solving involving scales and measures	
R5	interpret a ratio in a way that enables the correct proportion of an amount to be calculated	

R5	use ratio to solve, for example geometrical, algebraic, statistical, and numerical problems	
R5	use ratio to solve word problems using informal strategies or using the unitary method of solution	
R5	solve best-buy problems using informal strategies or using the unitary method of solution	
R6	make comparisons between two quantities and represent them as a ratio	
R6	compare the cost of items using the unit cost of one item as a fraction of the unit cost of another item	
R7	use equality of ratios to solve problems	
R8	understand the meaning of ratio as a fraction	
R8	understand that a line divided in the ratio 1 : 3 means that the smaller part is one-quarter of the whole	
R8	represent the ratio of two quantities in direct proportion as a linear relationship and represent the relationship graphically	
R8	relate ratios to fractions and use linear equations to solve problems	
R9	convert values between percentages, fractions and decimals in order to compare them, for example with probabilities	
R9	use percentages in real-life situations	
R9	interpret percentage as the operator ‘so many hundredths of’	
R9	work out the percentage of a shape that is shaded	
R9	shade a given percentage of a shape	
R9	calculate a percentage increase or decrease	
R9	solve percentage increase and decrease problems, for example, use $1.12 \times Q$ to calculate a 12% increase in the value of Q and $0.88 \times Q$ to calculate a 12% decrease in the value of Q	
R9	work out one quantity as a percentage of another quantity	
R9	use percentages, decimals or fractions to calculate proportions	

R9	calculate reverse percentages	
R9	solve simple interest problems	
R10	use proportion to solve problems using informal strategies or the unitary method of solution	
R10	use direct proportion to solve geometrical problems	
R10	calculate an unknown quantity from quantities that vary in direct proportion or inverse proportion	
R10	set up and use equations to solve word and other problems involving direct proportion or inverse proportion	
R10	relate algebraic solutions to graphical representation of the equations	
R10	sketch an appropriately shaped graph (partly or entirely non-linear) to represent a real-life situation	
R10	choose the graph that is sketched correctly from a selection of alternatives	
R10	recognise the graphs that represent direct and inverse proportion	
R11	understand and use compound measures and compound units including area, volume, speed, rates of pay, density and pressure	
R11	understand speed and know the relationship between speed, distance and time	
R11	understand units in common usage such as miles per hour or metres per second. The values used in the question will make the required unit clear	
R12	compare lengths, areas or volumes of similar shapes	
R12	understand, recall and use trigonometry ratios in right-angled triangles	
R13	understand that an equation of the form $y = kx$ represents direct proportion and that k is the constant of proportionality	
R13	understand that an equation of the form $y = \frac{k}{x}$ represents inverse proportion and that k is the constant of proportionality	
R13h	construct equations that describe direct and inverse proportion *** Review this as not a bullet in teaching guidance***	

R14	interpret the meaning of the gradient as the rate of change of the variable on the vertical axis compared to the horizontal axis	
R14	match direct and inverse proportion graphs to their equations and vice versa	
R14	draw graphs to represent direct and inverse proportion	
R15h	draw a tangent at a point on a curve and measure the gradient	
R15h	interpret the meaning of the gradient as the rate of change of the variable on the vertical axis compared to the horizontal axis	
R15h	understand that if the vertical axis represents speed/velocity and the horizontal axis represents time then the gradient will represent acceleration	
R15h	understand that if the vertical axis represents distance and the horizontal axis represents time then the gradient will represent speed/velocity	
R15h	understand the difference between positive and negative gradients as rates of change	
R15h	understand that the rate of change at a particular instant in time is represented by the gradient of the tangent to the curve at that point	
R15h	understand that the average rate of change is represented by a chord	
R16	solve problems involving repeated proportional change	
R16	use calculators to explore exponential growth and decay using a multiplier and the power	
R16	solve compound interest problems	
R16h	model growth and decay problems mathematically	
R16h	solve growth and decay problems, for example using multipliers or iterative processes	
R16h	understand that some iterations may have a limiting value	

Geometry and measures

G1	understand the standard conventions for equal sides and equal sides and parallel lines and diagrams	
G1	distinguish between acute, obtuse, reflex and right angles	
G1	name angles	
G1	use one lower-case letter or three upper-case letters to represent an angle, for example x or ABC	
G1	understand and draw lines that are parallel	
G1	understand that two lines that are perpendicular are at 90^o to each other	
G1	identify lines that are perpendicular	
G1	draw a perpendicular line in a diagram	
G1	use geometrical language	
G1	use letters to identify points and lines	
G1	recognise that, for example, in a rectangle $ABCD$ the points A, B, C and D go around in order	
G1	recognise reflection symmetry of 2D shapes	
G1	understand line symmetry	
G1	identify lines of symmetry on a shape or diagram	
G1	draw lines of symmetry on a shape or diagram	
G1	draw or complete a diagram with a given number of lines of symmetry	
G1	recognise rotational symmetry of 2D shapes	
G1	identify the order of rotational symmetry on a shape or diagram	
G1	draw or complete a diagram with rotational symmetry	
G1	identify and draw lines of symmetry on a Cartesian grid	
G1	identify the order of rotational symmetry of shapes on a Cartesian grid	
G1	draw or complete a diagram with rotational symmetry on a Cartesian grid	

G2	measure and draw lines to the nearest mm	
G2	measure and draw angles to the nearest degree	
G2	make accurate drawings of triangles and other 2D shapes using a ruler and a protractor	
G2	make an accurate scale drawing from a sketch, diagram or description	
G2	use a straight edge and a pair of compasses to do standard constructions	
G2	construct a triangle	
G2	construct an equilateral triangle with a given side or given side length	
G2	construct a perpendicular bisector of a given line	
G2	construct a perpendicular at a given point on a given line	
G2	construct a perpendicular from a given point to a given line	
G2	construct an angle bisector	
G2	construct an angle of 60°	
G2	draw parallel lines	
G2	draw circles or part circles given the radius or diameter	
G2	construct diagrams of 2D shapes	
G2	construct a region, for example, bounded by a circle and an intersecting line	
G2	construct loci, for example, given a fixed distance from a point and a fixed distance from a given line	
G2	construct loci, for example, given equal distances from two points	
G2	construct loci, for example, given equal distances from two line segments	
G2	construct a region that is defined as, for example, less than a given distance or greater than a given distance from a point or line segment	
G2	describe regions satisfying several conditions	

G3	work out the size of missing angles at a point	
G3	work out the size of missing angles at a point on a straight line	
G3	know that vertically opposite angles are equal	
G3	justify an answer with explanations such as ‘angles on a straight line’, etc.	
G3	understand and use the angle properties of parallel lines	
G3	recall and use the terms alternate angles and corresponding angles	
G3	work out missing angles using properties of alternate angles, corresponding angles and interior angles	
G3	understand the consequent properties of parallelograms	
G3	derive and use the proof that the angle sum of a triangle is 180^o	
G3	derive and use the proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices	
G3	use angle properties of equilateral, isosceles and right-angled triangles	
G3	use the fact that the angle sum of a quadrilateral is 360^o	
G3	calculate and use the sums of interior angles of polygons	
G3	recognise and name regular polygons: pentagons, hexagons, octagons and decagons	
G3	use the angle sum of irregular polygons	
G3	calculate and use the angles of regular polygons	
G3	use the fact that the sum of the interior angles of an n-sided polygon is $180(n - 2)$	
G3	use the fact that the sum of the exterior angles of any polygon is 360^o	
G3	use the relationship interior angle + exterior angle = 180^o	
G3	use the sum of the interior angles of a triangle to deduce the sum of the interior angles of any polygon	

G4	recall the properties and definitions of special types of quadrilaterals	
G4	name a given shape	
G4	identify and use symmetries of special types of quadrilaterals	
G4	identify a shape given its properties	
G4	list the properties of a given shape	
G4	draw a sketch of a named shape	
G4	identify quadrilaterals that have common properties	
G4	classify quadrilaterals using common geometric properties	
G5	understand congruence	
G5	identify shapes that are congruent	
G5	understand and use conditions for congruent triangles: SSS, SAS, ASA and RHS	
G5	recognise congruent shapes when rotated, reflected or in different orientations	
G5	understand and use SSS, SAS, ASA and RHS conditions to prove the congruence of triangles using formal arguments, and to verify standard ruler and compass constructions	
G6	understand similarity	
G6	understand similarity of triangles and of other plane figures, and use this to make geometric inferences	
G6	identify shapes that are similar, including all squares, all circles or all regular polygons with equal number of sides	
G6	recognise similar shapes when rotated, reflected or in different orientations	
G6	apply mathematical reasoning, explaining and justifying inferences and deductions	
G6	show step-by-step deduction in solving a geometrical problem	
G6	state constraints and give starting points when making deductions	

G7	describe and transform 2D shapes using single rotations	
G7	understand that rotations are specified by a centre and an angle	
G7	find a centre of rotation	
G7	rotate a shape about the origin or any other point	
G7	measure the angle of rotation using right angles	
G7	measure the angle of rotation using simple fractions of a turn or degrees	
G7	describe and transform 2D shapes using single reflections	
G7	understand that reflections are specified by a mirror line	
G7	find the equation of a line of reflection	
G7	describe and transform 2D shapes using translations	
G7	understand that translations are specified by a distance and direction (using a vector)	
G7	translate a given shape by a vector	
G7	describe and transform 2D shapes using enlargements by a positive scale factor	
G7	understand that an enlargement is specified by a centre and a scale factor	
G7	draw an enlargement	
G7	find the centre of enlargement	
G7	enlarge a shape on a grid (centre not specified)	
G7	recognise that enlargements preserve angle but not length	
G7	identify the scale factor of an enlargement of a shape as the ratio of the lengths of two corresponding sides	
G7	identify the scale factor of an enlargement as the ratio of the lengths of any two corresponding line segments	
G7	distinguish properties that are preserved under particular transformations	

G7	understand that lengths and angles are preserved under rotations, reflections and translations, so that any figure is congruent under any of these transformations	
G7	use congruence to show that translations, rotations and reflections preserve length and angle, so that any figure is congruent to its image under any of these transformations	
G7h	identify the scale factor of an enlargement	
G7h	construct enlargements with fractional and negative scale factors	
G8h	describe and transform 2D shapes using combined rotations, reflections, translations, or enlargements	
G8h	describe a combination of transformations as a single transformation	
G8h	understand and use the term ‘invariance’ for points, lines and shapes achieved by single or combined transformations	
G8h	map a point on a shape under a combination of transformations	
G8h	use column vector notation for translations	
G9	recall the definition of a circle	
G9	identify and name the parts of a circle	
G9	draw the parts of a circle	
G9	understand related terms of a circle	
G9	draw a circle given the radius or diameter	
G10h	understand that the tangent at any point on a circle is perpendicular to the radius at that point	
G10h	understand and use the fact that tangents from an external point are equal in length	
G10h	use congruent triangles to explain why the perpendicular from the centre to a chord bisects the chord	
G10h	understand that inscribed regular polygons can be constructed by equal division of a circle	

G10h	prove and use the fact that the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference	
G10h	prove and use the fact that the angle subtended at the circumference by a semicircle is a right angle	
G10h	prove and use the fact that angles in the same segment are equal	
G10h	prove and use the fact that opposite angles of a cyclic quadrilateral sum to 180°	
G10h	prove and use the alternate segment theorem	
G11	show step-by-step deduction in solving a geometrical problem	
G12	know the terms face, edge and vertex (vertices)	
G12	identify and name common solids, for example cube, cuboid, prism, cylinder, pyramid, cone and sphere	
G12	understand that cubes, cuboids, prisms and cylinders have uniform areas of cross-section	
G13	use 2D representations of 3D shapes	
G13	draw nets and show how they fold to make a 3D solid	
G13	analyse 3D shapes through 2D projections and cross sections, including plans and elevations	
G13	understand and draw front and side elevations and plans of shapes made from simple solids, for example a solid made from small cubes	
G13	understand and use isometric drawings	
G14	interpret scales on a range of measuring instruments, including those for time, temperature and mass, reading from the scale or marking a point on a scale to show a stated value	
G14	know that measurements using real numbers depend on the choice of unit	
G14	recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction	
G14	make sensible estimates of a range of measures in real-life situations, for example estimate the height of a man	

G14	choose appropriate units for estimating measurements, for example the height of a television mast would be measured in metres	
G15	use and interpret maps and scale drawings	
G15	use a scale on a map to work out an actual length	
G15	use a scale with an actual length to work out a length on a map	
G15	construct scale drawings	
G15	use scale to estimate a length, for example use the height of a man to estimate the height of a building where both are shown in a scale drawing	
G15	work out a scale from a scale drawing given additional information	
G15	recall and use the eight points of the compass (N, NE, E, SE, S, SW, W, NW) and their equivalent three-figure bearings	
G15	use compass point and three-figure bearings to specify direction	
G15	mark points on a diagram given the bearing from another point	
G15	draw a bearing between points on a map or scale drawing	
G15	measure the bearing of a point from another given point	
G15	work out the bearing of a point from another given point	
G15	work out the bearing to return to a point, given the bearing to leave that point	
G16	recall and use the formulae for the area of a rectangle, triangle, parallelogram and trapezium	
G16	work out the area of a rectangle	
G16	work out the area of a triangle	
G16	work out the area of a parallelogram	
G16	work out the area of a trapezium	
G16	calculate the area of compound shapes made from triangles and rectangles	
G16	calculate the area of compound shapes made from two or more rectangles, for example an L shape or T shape	

G16	calculate the area of shapes drawn on a grid	
G16	calculate the area of simple shapes	
G16	work out the surface area of nets made up of rectangles and triangles	
G16	recall and use the formula for the volume of a cube or cuboid	
G16	recall and use the formula for the volume of a cylinder	
G16	recall and use the formula for the volume of a prism	
G16	work out the volume of a cube or cuboid	
G16	work out the volume of a cylinder	
G16	work out the volume of a prism, for example a triangular prism	
G17	work out the perimeter of a rectangle	
G17	work out the perimeter of a triangle	
G17	calculate the perimeter of shapes made from triangles and rectangles	
G17	calculate the perimeter of compound shapes made from two or more rectangles	
G17	calculate the perimeter of shapes drawn on a grid	
G17	calculate the perimeter of simple shapes	
G17	recall and use the formula for the circumference of a circle	
G17	work out the circumference of a circle, given the radius or diameter	
G17	work out the radius or diameter of a circle, given the circumference	
G17	use $\pi = 3.14$ or the π button on a calculator	
G17	recall and use the formula for the area of a circle	
G17	work out the area of a circle, given the radius or diameter	
G17	work out the radius or diameter of a circle, given the area	
G17	work out the surface area of spheres, pyramids and cones	

G17	work out the surface area of compound solids constructed from cubes, cuboids, cones, pyramids, cylinders, spheres and hemispheres	
G17	work out the volume of spheres, pyramids and cones	
G17	work out the volume of compound solids constructed from cubes, cuboids, cones, pyramids, cylinders, spheres and hemispheres	
G17	solve real-life problems using known solid shapes	
G18	work out the perimeter of semicircles, quarter circles or other fractions of a circle	
G18	work out the area of semicircles, quarter circles or other fractions of a circle	
G18	calculate the length of arcs of circles	
G18	calculate the area of sectors of circles	
G18	given the lengths or areas of arcs, calculate the angle subtended at the centre	
G19	understand the effect of enlargement on perimeter	
G19	work out the side of one shape that is similar to another shape given the ratio or scale factor of lengths	
G19h	understand the effect of enlargement on areas of shapes	
G19h	understand the effect of enlargement on surface areas and volumes of solids	
G19h	compare the areas or volumes of similar shapes or solids, knowing that if $a : b$ is the ratio of lengths, then $a^2 : b^2$ is the ratio of areas and $a^3 : b^3$ is the ratio of volumes	
G19h	work out the area or volume of one shape/solid given the area or volume of a similar shape/solid and the ratio or scale factor of lengths of the shape/solid	
G20	understand, recall and use Pythagoras' theorem in 2D problems	
G20	understand, recall and use trigonometric ratios in right-angled triangles	
G20	use the trigonometric ratios in right-angled triangles to solve problems, including those involving bearings	
G20h	understand, recall and use Pythagoras' theorem in 3D problems	
G20h	understand, recall and use trigonometric ratios in 3D problems	

G20h	use these ratios in 3D contexts, including finding the angles between a line and a plane	
G21	recall exact values of sine, cosine and tangent for 0°, 30°, 45° and 60°	
G21	recall that sin 90° = 1 and cos 90° = 0	
G21	solve right-angled triangles with angles of 30°, 45° or 60° without using a calculator	
G22h	use the sine and cosine rules to solve 2D and 3D problems	
G23h	calculate the area of a triangle using $\frac{1}{2}ab\sin C$	
G23h	calculate the area of a triangle given the length of two sides and the included angle	
G24	understand and use vector notation for translations	
G24	use column vector notation to describe a translation in 2D	
G25	understand and use vector notation	
G25	calculate and represent graphically the sum of two vectors, the difference of two vectors and a scalar multiple of a vector	
G25	calculate the resultant of two vectors	
G25	understand and use the commutative and associative properties of vector addition	
G25h	solve simple geometrical problems in 2D using vector methods	
G25h	apply vector methods for simple geometric proofs	
G25h	recognise when lines are parallel using vectors	
G25h	recognise when three or more points are colinear using vectors	
G25h	use vectors to show three or more points are collinear	

Probability

P1	design and use two-way tables	
P1	complete a two-way table from given information	
P1	complete a frequency table for the outcomes of an experiment	
P1	understand and use the term relative frequency	
P1	consider differences, where they exist, between the theoretical probability of an outcome and its relative frequency in a practical situation	
P1	complete a frequency tree from given information	
P1	use a frequency tree to compare frequencies of outcomes	
P2	use lists or tables to find probabilities	
P2	understand that experiments rarely give the same results when there is a random process involved	
P2	appreciate the 'lack of memory' in a random situation, for example a fair coin is still equally likely to give heads or tails even after five heads in a row	
P3	understand and use the term relative frequency	
P3	consider differences where they exist between the theoretical probability of an outcome and its relative frequency in a practical situation	
P3	recall that an ordinary fair dice is an unbiased dice numbered 1, 2, 3, 4, 5 and 6 with equally likely outcomes	
P3	estimate probabilities by considering relative frequency	
P4	understand when outcomes can or cannot happen at the same time	
P4	use this understanding to calculate probabilities	
P4	appreciate that the sum of the probabilities of all possible mutually exclusive outcomes has to be 1	
P4	find the probability of a single outcome from knowing the probability of all other outcomes	
P5	understand that the greater the number of trials in an experiment, the more reliable the results are likely to be	

P5	understand how a relative frequency diagram may show a settling down as sample size increases, enabling an estimate of a probability to be reliably made; and that if an estimate of a probability is required, the relative frequency of the largest number of trials available should be used	
P6	complete tables and/or grids to show outcomes and probabilities	
P6	complete a tree diagram to show outcomes and probabilities	
P6	understand that P(A) means the probability of event A	
P6	understand that $P(A')$ means the probability of event **not** A	
P6	understand that $P(A \cup B)$ means the probability of event A or B or both	
P6	understand that $P(A \cap B)$ means the probability of event A and B	
P6	understand a Venn diagram consisting of a universal set and at most two sets, which may or may not intersect	
P6	shade areas on a Venn diagram involving at most two sets, which may or may not intersect	
P6	solve problems given a Venn diagram	
P6	solve problems where a Venn diagram approach is a suitable strategy to use but a diagram is not given in the question	
P7	list all the outcomes for a single event in a systematic way	
P7	list all the outcomes for two events in a systematic way	
P7	design and use two-way tables	
P7	complete a two-way table from given information	
P7	design and use frequency trees	
P7	work out probabilities by counting or listing equally likely outcomes	
P8	know when it is appropriate to add probabilities	
P8	know when it is appropriate to multiply probabilities	
P8	understand the meaning of independence for events	
P8	calculate probabilities when events are dependent	

P8	understand the implications of with or without replacement problems for the probabilities obtained	
P8	complete a tree diagram to show outcomes and probabilities	
P8	use a tree diagram as a method for calculating probabilities for independent or dependent events	
P9h	understand conditional probability	
P9h	understand the implications of with or without replacement problems for the probabilities obtained	
P9h	complete a tree diagram to show outcomes and probabilities	
P9h	use a tree diagram as a method for calculating conditional probabilities	
P9h	use a Venn diagram as a method for calculating conditional probabilities	

Statistics

S1	find patterns in data that may lead to a conclusion being drawn	
S1	look for unusual data values such as a value that does not fit an otherwise good correlation	
S1	understand that samples may or may not be representative of a population	
S1	understand that the size and construction of a sample will affect how representative it is	
S2	draw any of the above charts or diagrams	
S2	draw bar charts including composite bar charts, dual bar charts and multiple bar charts	
S2	understand which of the diagrams are appropriate for different types of data	
S2	interpret any of the types of diagram	
S2	obtain information from any of the types of diagram	
S2	understand that a time series is a series of data points typically spaced over uniform time intervals	
S2	plot and interpret time-series graphs	

S2	use a time-series graph to predict a subsequent value	
S2	understand that if data points are joined with a line then the line will not represent actual values but will show a trend	
S2	design and use two-way tables	
S2	complete a two-way table from given information	
S3h	understand which diagrams are appropriate for different types of data	
S3h	construct suitable diagrams for grouped discrete and continuous data	
S3h	interpret diagrams for grouped discrete and continuous data	
S4	decide whether data is discrete or continuous and use this decision to make sound judgements in choosing suitable diagrams for the data	
S4	understand the difference between grouped and ungrouped data	
S4	understand the advantages and disadvantages of grouping data	
S4	distinguish between primary and secondary data	
S4	use lists, tables or diagrams to find values for the above measures	
S4	find the mean for a discrete frequency distribution	
S4	find the median for a discrete frequency distribution	
S4	find the mode or modal class for frequency distributions	
S4	calculate an estimate of the mean for a grouped frequency distribution, knowing why it is an estimate	
S4	find the interval containing the median for a grouped frequency distribution	
S4	choose an appropriate measure to be the ‘average’, according to the nature of the data	
S4	identify outliers	
S4	find patterns in data that may lead to a conclusion being drawn	
S4h	calculate quartiles and inter-quartile range from a small data set using the positions of the lower quartile and upper quartile respectively	

S4h	read off lower quartile, median and upper quartile from a cumulative frequency diagram or a box plot and calculate inter-quartile range	
S4h	find an estimate of the median or other information from a histogram	
S4h	choose an appropriate measure according to the nature of the data to be the 'average'	
S4h	compare two diagrams in order to make decisions about a hypothesis	
S4h	compare two distributions in order to make decisions about a hypothesis by comparing the range or the inter-quartile range if available, and a suitable measure of average, such as the mean or median	
S5	use measures of central tendency and measures of dispersion to describe a population	
S5	use statistical diagrams to describe a population	
S6	recognise and name positive, negative or no correlation as types of correlation	
S6	recognise and name strong, moderate or weak correlation as strengths of correlation	
S6	understand that just because a correlation exists, it does not necessarily mean that causality is present	
S6	draw a line of best fit by eye for data with strong enough correlation, or know that a line of best fit is not justified due to the lack of correlation	
S6	understand outliers and make decisions whether or not to include them when drawing a line of best fit	
S6	use a line of best fit to estimate unknown values when appropriate	
S6	look for unusual data values such as a value that does not fit an otherwise good correlation	