# GCSE Maths Revision Checklist

## 8300 Higher Tier

**Number**

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| --- | --- | --- |
| 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 |  |
| 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 or |  |
| 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* ⩽ 20, in order to estimate a mean |  |

**Algebra**

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| 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 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, 5*x* + 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  *x*2 + 4*x* + 4 is an identity |  |
| A3 | recognise that 2*x* + 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* ± *a*)(*x* ± *b*) and (*cx* ± *a*)(*dx* ± *b*), for example (2*x +* 3)(3*x* − 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 3*x* − 2 + 4(*x +* 5) |  |
| A4 | know the meaning of and be able to factorise, for example 3*x* 2*y* − 9*y* or 4*x* 2 + 6*xy* |  |
| 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 |  |
| 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 hourly rate + bonus |  |
| A5 | change the subject of a formula |  |
| A6 | recognise that, for example, 5*x* + 5 = 16 is an equation, but 5*x* + 5  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* =  with *x* ≠ 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 <, ⩽, ⩾, > and ≠ |  |
| 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* ⩽ 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 *rn* where *n* is an integer > 0 |  |
| A24h | work out the value of the nth 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*thterm of a linear sequence by knowing that the common difference can be used to generate a formula for the *n*thterm |  |
| 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**

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| 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 Q to calculate a 12% increase in the value of Q and 0.88 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 =*  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\*\*\* |  |

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| 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**

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| 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 90o 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 180o |  |
| 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 360o |  |
| 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 360o |  |
| G3 | use the relationship interior angle + exterior angle = 180o |  |
| 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 π = 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  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 ∪ B) means the probability of event A or B or both |  |
| P6 | understand that P(A ∩ 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**

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| --- | --- | --- |
| 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 |  |