GCSE Maths Revision Checklist

Higher Tier all, Foundation all non-shaded

Number

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

write out lists of multiples and factors to identify common multiples or common factors of two or more integers				
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)				
work out a root of a number from a product of prime factors				
identify all permutations and combinations and represent them in a variety of formats				
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.				
recall squares of numbers up to 15×15 and the cubes of 1, 2, 3, 4, 5 and 10, also knowing the corresponding roots				
calculate and recognise powers of 2, 3, 4, 5				
calculate and recognise powers of 10				
understand the notation and be able to work out the value of squares, cubes and powers of 10				
recognise the notation $\sqrt{25}$				
solve equations such as $x^2 = 25$, giving both the positive and negative roots				
estimate the value of a power of a given positive number				
estimate the value of the root of any given positive number				
identify between which two integers the square root of a positive number lies				
identify between which two integers the cube root of a positive number lies				
use index laws for multiplication and division of integer powers				
calculate with positive integer indices				
calculate values using fractional indices				
calculate with positive and negative integer indices				

use index laws for multiplication and division of positive, negative and fractional indices				
identify equivalent fractions				
write a fraction in its simplest form				
simplify a fraction by cancelling all common factors, using a calculator where appropriate, for example, simplifying fractions that represent probabilities				
convert between mixed numbers and improper fractions				
compare fractions				
compare fractions in statistics and geometry questions				
add and subtract fractions by writing them with a common denominator				
convert mixed numbers to improper fractions and add and subtract mixed numbers				
give answers in terms of π and use values given in terms of π in calculations.				
simplify surds				
rationalise a denominator of the form $\sqrt{a}$ or $b\sqrt{a}$				
simplify expressions using the rules of surds				
expand brackets where the terms may be written in surd form				
solve equations which may be written in surd form				
know, use and understand the term standard from				
write an ordinary number in standard form				
write a number written in standard form as an ordinary number				
order and calculate with numbers written in standard form				
solve simple equations where the numbers are written in standard form				
interpret calculator displays				

use a calculator effectively for standard form calculations				
solve standard form problems with and without a calculator				
convert between fractions and decimals using place value				
compare the value of fractions and decimals				
convert recurring decimals into fractions				
convert fractions into recurring decimals				
use formal algebraic methods to convert recurring decimals into fractions				
understand the meaning of ratio notation				
interpret a ratio as a fraction				
use fractions and ratios in the context of geometrical problems, for example similar shapes, scale drawings and problem solving involving scales and measures				
understand that a line divided in the ratio 1 : 3 means that the smaller part is one-quarter of the whole				
calculate a fraction of a quantity				
calculate a percentage of a quantity				
use fractions, decimals or percentages to find quantities				
use fractions, decimals or percentages to calculate proportions of shapes that are shaded				
use fractions, decimals or percentages to calculate lengths, areas or volumes				
understand and use unit fractions as multiplicative inverses				
multiply and divide a fraction by an integer, by a unit fraction and by a general fraction				
interpret a fraction, decimal or percentage as a multiplier when solving problems				
use fractions, decimals or percentages to interpret or compare statistical diagrams or data sets				

convert between fractions, decimals and percentages to find the most appropriate method of calculation in a question; for example, 62% of £80 is $0.62 \times$ £80 and 25% of £80 is £80 $\div$ 4				
know and use standard metric and imperial measures				
know and use compound measures such as area, volume and speed				
choose appropriate units for estimating measurements, for example a television mast would be measured in metres				
make sensible estimates of a range of measures in everyday settings				
make sensible estimates of a range of measures in real-life situations, for example estimate the height of a man				
evaluate results obtained				
use approximation to estimate the value of a calculation				
work out the value of a calculation and check the answer using approximations				
perform money calculations, writing answers using the correct notation				
round numbers to the nearest whole number, 10, 100 or 1000				
round numbers to a specified number of decimal places				
round numbers to a specified number of significant figures				
use inequality notation to specify error intervals due to truncation or rounding				
recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction				
write down the maximum or minimum figure for a value rounded to a given accuracy				
combine upper or lower bounds appropriately to achieve an overall maximum or minimum for a situation				
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

use notation and symbols correctly				
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				
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				
substitute numbers into a formula				
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				
recognise that, for example, $5x + 1 = 16$ is an equation				
recognise that, for example, $V = IR$ is a formula				
recognise that $x + 3$ is an expression				
recognise that $(x + 2)^2 \equiv x^2 + 4x + 4$ is an identity				
recognise that $2x + 5 < 16$ is an inequality				
write an expression				
know the meaning of the word 'factor' for both numerical work and algebraic work				
understand that algebra can be used to generalise the laws of arithmetic				
manipulate an expression by collecting like terms				
write expressions to solve problems				
write expressions using squares and cubes				
factorise algebraic expressions by taking out common factors				
multiply two linear expressions, such as $(x \pm a)(x \pm b)$ and $(cx \pm a)(dx \pm b)$, for example $(2x + 3)(3x - 4)$				

multiply a single term over a bracket, for example, $a(b + c) = ab + ac$				
know the meaning of and be able to simplify, for example $3x - 2 + 4(x + 5)$				
know the meaning of and be able to factorise, for example $3x^2y - 9y$ or $4x^2 + 6xy$				
factorise quadratic expressions using the sum and product method, or by inspection (FOIL)				
factorise quadratics of the form $x^2 + bx + c$				
factorise expressions written as the difference of two squares of the form $x^2 - a^2$				
use the index laws for multiplication and division of integer powers				
simplify algebraic expressions, for example by cancelling common factors in fractions or using index laws				
multiply two or more binomial expressions				
factorise quadratic expressions of the form $ax^2 + bx + c$				
simplify by factorising and cancelling expressions of the form $\frac{ax^2 + bx + c}{dx^2 + ex + f}$				
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				
change the subject of a formula				
recognise that, for example, $5x + 5 = 16$ is an equation, but $5x + 5 \equiv 5(x + 1)$ is an identity				
show that two expressions are equivalent				
use identities including equating coefficients				
use algebraic expressions to support an argument or verify a statement				

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

point and the gradient				
work out the gradients of lines that are parallel and perpendicular to a given line				
show that two lines are parallel or perpendicular using gradients				
manipulate the equations of straight lines so that it is possible to tell whether or not lines are perpendicular				
know that the gradients of perpendicular lines are the negative reciprocal of each other				
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)				
work out the gradient and the intersection with the axes				
interpret quadratic graphs by finding roots, intercepts and turning points				
complete the square				
deduce turning points by completing the square				
draw, sketch, recognise and interpret linear functions				
calculate values for a quadratic and draw the graph				
draw, sketch, recognise and interpret quadratic graphs				
draw, sketch, recognise and interpret graphs of the form $y = x^3 + k$ where k is an integer				
draw, sketch, recognise and interpret the graph $y = \frac{1}{x}$ with $x \neq 0$				
find an approximate value of y for a given value of x, or the approximate values of x for a given value of y				
draw, sketch, recognise and interpret graphs of the form $y = k^x$ for positive values of k				
know the shapes of the graphs of functions $y = \sin x$, $y = \cos x$ and $y = \tan x$				
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				
recognise transformations of functions and be able to write down the function of a transformation given the original function				
plot a graph representing a real-life problem from information given in words, in a table or as a formula				
identify the correct equation of a real-life graph from a drawing of the graph				
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				
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				
plot and interpret distance-time graphs				
interpret line graphs from real-life situations, for example conversion graphs				
interpret graphs showing real-life situations in geometry, such as the depth of water in containers as they are filled at a steady rate				
interpret non-linear graphs showing real-life situations, such as the height of a ball plotted against time				
draw an exponential graph				
understand the main features of an exponential graph				
calculate the area under a graph consisting of straight lines				
estimate the gradient at a point on a curve by drawing a tangent at that point and working out its gradient				
interpret the meaning (and give the units) of the gradient at a point on a curve				
use the areas of trapezia, triangles and rectangles to estimate the area under a curve				

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				
recognise the equation of a circle, centre (0, 0), radius *r*				
write down the equation of a circle, centre (0, 0) and radius *r*				
work out coordinates of points of intersection of a given circle and a given straight line				
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				
solve simple linear equations by using inverse operations or by transforming both sides in the same way				
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				
solve quadratic equations by factorising				
read approximate solutions to a quadratic equation from a graph				
solve quadratic equations by factorising, completing the square or using the quadratic formula				
solve geometry problems that lead to a quadratic equation that can be solved by using the quadratic formula				
read approximate solutions from a graph				
solve simultaneous linear equations by elimination or substitution or any other valid method				
find approximate solutions using the point of intersection of two straight lines				
solve simultaneous equations when one is linear and the other quadratic				
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 $x^2 + x$				

$-11 = 0$				
use a systematic method to find approximate solutions of equations where there is no simple analytical method				
use suffix notation in recursive formulae				
find approximate solutions using recursive formulae				
set up simple linear equations				
rearrange simple linear equations				
set up simple linear equations to solve problems				
set up a pair of simultaneous linear equations to solve problems				
interpret solutions of equations in context				
know the difference between $<$, $\leqslant$, $\geqslant$, $>$ and $\neq$				
solve simple linear inequalities in one variable				
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 $x \leqslant 3$				
represent these inequalities on a given coordinate grid				
shade out the side of the boundary line that **does not** satisfy the inequality				
solve quadratic inequalities				
understand and use a solution set of discrete values written in the form { $-2, -1, 0, 1, 2$ }				
understand and use a solution set of continuous values written in the form $-3 < x < 3$				
generate linear sequences				
work out the value of the nth term of a linear sequence for any given value of n				
generate sequences with a given term-to-term rule				

generate a sequence where the *n*th term is given				
work out the value of the *n*th term of any sequence for any given value of *n*				
generate simple sequences derived from diagrams and complete a table of results that describes the pattern shown by the diagrams				
describe how a sequence continues				
solve simple problems involving arithmetic progressions				
work with Fibonacci-type sequences (rule will be given)				
know how to continue the terms of a quadratic sequence				
work out the value of a term in a geometrical progression of the form r^n where n is an integer > 0				
work out the value of the *n*th term of a sequence for any given value of *n*				
work out a formula for the *n*th term of a linear sequence				
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				
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

convert between metric measures				
recall and use conversions for metric measures for length, area, volume and capacity				
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				
use and interpret maps and scale drawings				
use a scale on a map to work out an actual length				
use a scale with an actual length to work out a length on a map				

construct scale drawings				
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				
work out a scale from a scale drawing given additional information				
work out one quantity as a fraction or decimal of another quantity				
use a fraction of a quantity to compare proportions				
understand the meaning of ratio notation				
simplify ratios to their simplest form $a : b$ where a and b are integers				
write a ratio in the form $1 : n$ or $n : 1$				
use ratios in the context of geometrical problems, for example similar shapes, scale drawings and problem solving involving scales and measures				
interpret a ratio in a way that enables the correct proportion of an amount to be calculated				
use ratio to solve, for example geometrical, algebraic, statistical, and numerical problems				
use ratio to solve word problems using informal strategies or using the unitary method of solution				
solve best-buy problems using informal strategies or using the unitary method of solution				
make comparisons between two quantities and represent them as a ratio				
compare the cost of items using the unit cost of one item as a fraction of the unit cost of another item				
use equality of ratios to solve problems				
understand the meaning of ratio as a fraction				
understand that a line divided in the ratio 1 : 3 means that the smaller part is one-quarter of the whole				
represent the ratio of two quantities in direct proportion as a linear relationship and represent the relationship graphically				

relate ratios to fractions and use linear equations to solve problems				
convert values between percentages, fractions and decimals in order to compare them, for example with probabilities				
use percentages in real-life situations				
interpret percentage as the operator 'so many hundredths of'				
work out the percentage of a shape that is shaded				
shade a given percentage of a shape				
calculate a percentage increase or decrease				
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				
work out one quantity as a percentage of another quantity				
use percentages, decimals or fractions to calculate proportions				
calculate reverse percentages				
solve simple interest problems				
use proportion to solve problems using informal strategies or the unitary method of solution				
use direct proportion to solve geometrical problems				
calculate an unknown quantity from quantities that vary in direct proportion or inverse proportion				
set up and use equations to solve word and other problems involving direct proportion or inverse proportion				
relate algebraic solutions to graphical representation of the equations				
sketch an appropriately shaped graph (partly or entirely non-linear) to represent a real-life situation				
choose the graph that is sketched correctly from a selection of alternatives				
recognise the graphs that represent direct and inverse proportion				

understand and use compound measures and compound units including area, volume, speed, rates of pay, density and pressure				
understand speed and know the relationship between speed, distance and time				
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				
compare lengths, areas or volumes of similar shapes				
understand, recall and use trigonometry ratios in right-angled triangles				
understand that an equation of the form $y = kx$ represents direct proportion and that k is the constant of proportionality				
understand that an equation of the form $y = \frac{k}{x}$ represents inverse proportion and that k is the constant of proportionality				
construct equations that describe direct and inverse proportion				
interpret the meaning of the gradient as the rate of change of the variable on the vertical axis compared to the horizontal axis				
match direct and inverse proportion graphs to their equations and vice versa				
draw graphs to represent direct and inverse proportion				
draw a tangent at a point on a curve and measure the gradient				
interpret the meaning of the gradient as the rate of change of the variable on the vertical axis compared to the horizontal axis				
understand that if the vertical axis represents speed/velocity and the horizontal axis represents time then the gradient will represent acceleration				
understand that if the vertical axis represents distance and the horizontal axis represents time then the gradient will represent speed/velocity				
understand the difference between positive and negative gradients as rates of change				
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				
understand that the average rate of change is represented by a chord				
solve problems involving repeated proportional change				
use calculators to explore exponential growth and decay using a multiplier and the power				
solve compound interest problems				
model growth and decay problems mathematically				
solve growth and decay problems, for example using multipliers or iterative processes				
understand that some iterations may have a limiting value				

Geometry and measures

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

understand line symmetry				
identify lines of symmetry on a shape or diagram				
draw lines of symmetry on a shape or diagram				
draw or complete a diagram with a given number of lines of symmetry				
recognise rotational symmetry of 2D shapes				
identify the order of rotational symmetry on a shape or diagram				
draw or complete a diagram with rotational symmetry				
identify and draw lines of symmetry on a Cartesian grid				
identify the order of rotational symmetry of shapes on a Cartesian grid				
draw or complete a diagram with rotational symmetry on a Cartesian grid				
measure and draw lines to the nearest mm				
measure and draw angles to the nearest degree				
make accurate drawings of triangles and other 2D shapes using a ruler and a protractor				
make an accurate scale drawing from a sketch, diagram or description				
use a straight edge and a pair of compasses to do standard constructions				
construct a triangle				
construct an equilateral triangle with a given side or given side length				
construct a perpendicular bisector of a given line				
construct a perpendicular at a given point on a given line				
construct a perpendicular from a given point to a given line				
construct an angle bisector				
construct an angle of 60°				
draw parallel lines				

draw circles or part circles given the radius or diameter				
construct diagrams of 2D shapes				
construct a region, for example, bounded by a circle and an intersecting line				
construct loci, for example, given a fixed distance from a point and a fixed distance from a given line				
construct loci, for example, given equal distances from two points				
construct loci, for example, given equal distances from two line segments				
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				
describe regions satisfying several conditions				
work out the size of missing angles at a point				
work out the size of missing angles at a point on a straight line				
know that vertically opposite angles are equal				
justify an answer with explanations such as 'angles on a straight line', etc.				
understand and use the angle properties of parallel lines				
recall and use the terms alternate angles and corresponding angles				
work out missing angles using properties of alternate angles, corresponding angles and interior angles				
understand the consequent properties of parallelograms				
derive and use the proof that the angle sum of a triangle is 180^o				
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				
use angle properties of equilateral, isosceles and right-angled triangles				
use the fact that the angle sum of a quadrilateral is 360^o				

calculate and use the sums of interior angles of polygons				
recognise and name regular polygons: pentagons, hexagons, octagons and decagons				
use the angle sum of irregular polygons				
calculate and use the angles of regular polygons				
use the fact that the sum of the interior angles of an n-sided polygon is $180(n-2)$				
use the fact that the sum of the exterior angles of any polygon is 360^o				
use the relationship interior angle + exterior angle = 180^o				
use the sum of the interior angles of a triangle to deduce the sum of the interior angles of any polygon				
recall the properties and definitions of special types of quadrilaterals				
name a given shape				
identify and use symmetries of special types of quadrilaterals				
identify a shape given its properties				
list the properties of a given shape				
draw a sketch of a named shape				
identify quadrilaterals that have common properties				
classify quadrilaterals using common geometric properties				
understand congruence				
identify shapes that are congruent				
understand and use conditions for congruent triangles: SSS, SAS, ASA and RHS				
recognise congruent shapes when rotated, reflected or in different orientations				

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				
understand similarity				
understand similarity of triangles and of other plane figures, and use this to make geometric inferences				
identify shapes that are similar, including all squares, all circles or all regular polygons with equal number of sides				
recognise similar shapes when rotated, reflected or in different orientations				
apply mathematical reasoning, explaining and justifying inferences and deductions				
show step-by-step deduction in solving a geometrical problem				
state constraints and give starting points when making deductions				
describe and transform 2D shapes using single rotations				
understand that rotations are specified by a centre and an angle				
find a centre of rotation				
rotate a shape about the origin or any other point				
measure the angle of rotation using right angles				
measure the angle of rotation using simple fractions of a turn or degrees				
describe and transform 2D shapes using single reflections				
understand that reflections are specified by a mirror line				
find the equation of a line of reflection				
describe and transform 2D shapes using translations				
understand that translations are specified by a distance and direction (using a vector)				
translate a given shape by a vector				

describe and transform 2D shapes using enlargements by a positive scale factor				
understand that an enlargement is specified by a centre and a scale factor				
draw an enlargement				
find the centre of enlargement				
enlarge a shape on a grid (centre not specified)				
recognise that enlargements preserve angle but not length				
identify the scale factor of an enlargement of a shape as the ratio of the lengths of two corresponding sides				
identify the scale factor of an enlargement as the ratio of the lengths of any two corresponding line segments				
distinguish properties that are preserved under particular transformations				
understand that lengths and angles are preserved under rotations, reflections and translations, so that any figure is congruent under any of these transformations				
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				
identify the scale factor of an enlargement				
construct enlargements with fractional and negative scale factors				
describe and transform 2D shapes using combined rotations, reflections, translations, or enlargements				
describe a combination of transformations as a single transformation				
understand and use the term 'invariance' for points, lines and shapes achieved by single or combined transformations				
map a point on a shape under a combination of transformations				
use column vector notation for translations				

recall the definition of a circle				
identify and name the parts of a circle				
draw the parts of a circle				
understand related terms of a circle				
draw a circle given the radius or diameter				
understand that the tangent at any point on a circle is perpendicular to the radius at that point				
understand and use the fact that tangents from an external point are equal in length				
use congruent triangles to explain why the perpendicular from the centre to a chord bisects the chord				
understand that inscribed regular polygons can be constructed by equal division of a circle				
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				
prove and use the fact that the angle subtended at the circumference by a semicircle is a right angle				
prove and use the fact that angles in the same segment are equal				
prove and use the fact that opposite angles of a cyclic quadrilateral sum to 180°				
prove and use the alternate segment theorem				
show step-by-step deduction in solving a geometrical problem				
know the terms face, edge and vertex (vertices)				
identify and name common solids, for example cube, cuboid, prism, cylinder, pyramid, cone and sphere				
understand that cubes, cuboids, prisms and cylinders have uniform areas of cross-section				
use 2D representations of 3D shapes				

draw nets and show how they fold to make a 3D solid				
analyse 3D shapes through 2D projections and cross sections, including plans and elevations				
understand and draw front and side elevations and plans of shapes made from simple solids, for example a solid made from small cubes				
understand and use isometric drawings				
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				
know that measurements using real numbers depend on the choice of unit				
recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction				
make sensible estimates of a range of measures in real-life situations, for example estimate the height of a man				
choose appropriate units for estimating measurements, for example the height of a television mast would be measured in metres				
use and interpret maps and scale drawings				
use a scale on a map to work out an actual length				
use a scale with an actual length to work out a length on a map				
construct scale drawings				
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				
work out a scale from a scale drawing given additional information				
recall and use the eight points of the compass (N, NE, E, SE, S, SW, W, NW) and their equivalent three-figure bearings				
use compass point and three-figure bearings to specify direction				
mark points on a diagram given the bearing from another point				

draw a bearing between points on a map or scale drawing				
measure the bearing of a point from another given point				
work out the bearing of a point from another given point				
work out the bearing to return to a point, given the bearing to leave that point				
recall and use the formulae for the area of a rectangle, triangle, parallelogram and trapezium				
work out the area of a rectangle				
work out the area of a triangle				
work out the area of a parallelogram				
work out the area of a trapezium				
calculate the area of compound shapes made from triangles and rectangles				
calculate the area of compound shapes made from two or more rectangles, for example an L shape or T shape				
calculate the area of shapes drawn on a grid				
calculate the area of simple shapes				
work out the surface area of nets made up of rectangles and triangles				
recall and use the formula for the volume of a cube or cuboid				
recall and use the formula for the volume of a cylinder				
recall and use the formula for the volume of a prism				
work out the volume of a cube or cuboid				
work out the volume of a cylinder				
work out the volume of a prism, for example a triangular prism				
work out the perimeter of a rectangle				
work out the perimeter of a triangle				

calculate the perimeter of shapes made from triangles and rectangles				
calculate the perimeter of compound shapes made from two or more rectangles				
calculate the perimeter of shapes drawn on a grid				
calculate the perimeter of simple shapes				
recall and use the formula for the circumference of a circle				
work out the circumference of a circle, given the radius or diameter				
work out the radius or diameter of a circle, given the circumference				
use $\pi = 3.14$ or the π button on a calculator				
recall and use the formula for the area of a circle				
work out the area of a circle, given the radius or diameter				
work out the radius or diameter of a circle, given the area				
work out the surface area of spheres, pyramids and cones				
work out the surface area of compound solids constructed from cubes, cuboids, cones, pyramids, cylinders, spheres and hemispheres				
work out the volume of spheres, pyramids and cones				
work out the volume of compound solids constructed from cubes, cuboids, cones, pyramids, cylinders, spheres and hemispheres				
solve real-life problems using known solid shapes				
work out the perimeter of semicircles, quarter circles or other fractions of a circle				
work out the area of semicircles, quarter circles or other fractions of a circle				
calculate the length of arcs of circles				
calculate the area of sectors of circles				
given the lengths or areas of arcs, calculate the angle subtended at the centre				

understand the effect of enlargement on perimeter				
work out the side of one shape that is similar to another shape given the ratio or scale factor of lengths				
understand the effect of enlargement on areas of shapes				
understand the effect of enlargement on surface areas and volumes of solids				
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				
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				
understand, recall and use Pythagoras' theorem in 2D problems				
understand, recall and use trigonometric ratios in right-angled triangles				
use the trigonometric ratios in right-angled triangles to solve problems, including those involving bearings				
understand, recall and use Pythagoras' theorem in 3D problems				
understand, recall and use trigonometric ratios in 3D problems				
use these ratios in 3D contexts, including finding the angles between a line and a plane				
recall exact values of sine, cosine and tangent for 0°, 30°, 45° and 60°				
recall that sin 90° = 1 and cos 90° = 0				
solve right-angled triangles with angles of 30°, 45° or 60° without using a calculator				
use the sine and cosine rules to solve 2D and 3D problems				
calculate the area of a triangle using $\frac{1}{2}\ ab \sin C$				
calculate the area of a triangle given the length of two sides and the included angle				

understand and use vector notation for translations				
use column vector notation to describe a translation in 2D				
understand and use vector notation				
calculate and represent graphically the sum of two vectors, the difference of two vectors and a scalar multiple of a vector				
calculate the resultant of two vectors				
understand and use the commutative and associative properties of vector addition				
solve simple geometrical problems in 2D using vector methods				
apply vector methods for simple geometric proofs				
recognise when lines are parallel using vectors				
recognise when three or more points are colinear using vectors				
use vectors to show three or more points are collinear				

Probability

design and use two-way tables				
complete a two-way table from given information				
complete a frequency table for the outcomes of an experiment				
understand and use the term relative frequency				
consider differences, where they exist, between the theoretical probability of an outcome and its relative frequency in a practical situation				
complete a frequency tree from given information				
use a frequency tree to compare frequencies of outcomes				
use lists or tables to find probabilities				
understand that experiments rarely give the same results when there is a random process involved				

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				
understand and use the term relative frequency				
consider differences where they exist between the theoretical probability of an outcome and its relative frequency in a practical situation				
recall that an ordinary fair dice is an unbiased dice numbered 1, 2, 3, 4, 5 and 6 with equally likely outcomes				
estimate probabilities by considering relative frequency				
understand when outcomes can or cannot happen at the same time				
use this understanding to calculate probabilities				
appreciate that the sum of the probabilities of all possible mutually exclusive outcomes has to be 1				
find the probability of a single outcome from knowing the probability of all other outcomes				
understand that the greater the number of trials in an experiment, the more reliable the results are likely to be				
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				
complete tables and/or grids to show outcomes and probabilities				
complete a tree diagram to show outcomes and probabilities				
understand that P(A) means the probability of event A				
understand that P(A') means the probability of event **not** A				
understand that P($A \cup B$) means the probability of event A or B or both				
understand that P($A \cap B$) means the probability of event A and B				
understand a Venn diagram consisting of a universal set and at most two sets, which may or may not intersect				

shade areas on a Venn diagram involving at most two sets, which may or may not intersect				
solve problems given a Venn diagram				
solve problems where a Venn diagram approach is a suitable strategy to use but a diagram is not given in the question				
list all the outcomes for a single event in a systematic way				
list all the outcomes for two events in a systematic way				
design and use two-way tables				
complete a two-way table from given information				
design and use frequency trees				
work out probabilities by counting or listing equally likely outcomes				
know when it is appropriate to add probabilities				
know when it is appropriate to multiply probabilities				
understand the meaning of independence for events				
calculate probabilities when events are dependent				
understand the implications of with or without replacement problems for the probabilities obtained				
complete a tree diagram to show outcomes and probabilities				
use a tree diagram as a method for calculating probabilities for independent or dependent events				
understand conditional probability				
understand the implications of with or without replacement problems for the probabilities obtained				
complete a tree diagram to show outcomes and probabilities				
use a tree diagram as a method for calculating conditional probabilities				
use a Venn diagram as a method for calculating conditional probabilities				

Statistics

find patterns in data that may lead to a conclusion being drawn				
look for unusual data values such as a value that does not fit an otherwise good correlation				
understand that samples may or may not be representative of a population				
understand that the size and construction of a sample will affect how representative it is				
draw any of the above charts or diagrams				
draw bar charts including composite bar charts, dual bar charts and multiple bar charts				
understand which of the diagrams are appropriate for different types of data				
interpret any of the types of diagram				
obtain information from any of the types of diagram				
understand that a time series is a series of data points typically spaced over uniform time intervals				
plot and interpret time-series graphs				
use a time-series graph to predict a subsequent value				
understand that if data points are joined with a line then the line will not represent actual values but will show a trend				
design and use two-way tables				
complete a two-way table from given information				
understand which diagrams are appropriate for different types of data				
construct suitable diagrams for grouped discrete and continuous data				
interpret diagrams for grouped discrete and continuous data				
decide whether data is discrete or continuous and use this decision to make sound judgements in choosing suitable diagrams for the data				

understand the difference between grouped and ungrouped data				
understand the advantages and disadvantages of grouping data				
distinguish between primary and secondary data				
use lists, tables or diagrams to find values for the above measures				
find the mean for a discrete frequency distribution				
find the median for a discrete frequency distribution				
find the mode or modal class for frequency distributions				
calculate an estimate of the mean for a grouped frequency distribution, knowing why it is an estimate				
find the interval containing the median for a grouped frequency distribution				
choose an appropriate measure to be the 'average', according to the nature of the data				
identify outliers				
find patterns in data that may lead to a conclusion being drawn				
calculate quartiles and inter-quartile range from a small data set using the positions of the lower quartile and upper quartile respectively				
read off lower quartile, median and upper quartile from a cumulative frequency diagram or a box plot and calculate inter-quartile range				
find an estimate of the median or other information from a histogram				
choose an appropriate measure according to the nature of the data to be the 'average'				
compare two diagrams in order to make decisions about a hypothesis				
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				
use measures of central tendency and measures of dispersion to describe a population				

use statistical diagrams to describe a population				
recognise and name positive, negative or no correlation as types of correlation				
recognise and name strong, moderate or weak correlation as strengths of correlation				
understand that just because a correlation exists, it does not necessarily mean that causality is present				
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				
understand outliers and make decisions whether or not to include them when drawing a line of best fit				
use a line of best fit to estimate unknown values when appropriate				
look for unusual data values such as a value that does not fit an otherwise good correlation				