Key: Extended only
Core note

please do your own research - I am human and may make mistakes

Extended subject content

1 Number

E1.1 Types of number	Notes and examples
Identify and use: • natural numbers • integers (positive, zero and negative) • prime numbers • square numbers • cube numbers • common factors • common multiples • rational and irrational numbers • reciprocals.	Example tasks include: • convert between numbers and words, e.g. six billion is 6 000 000 000 10 007 is ten thousand and seven • express 72 as a product of its prime factors • find the highest common factor (HCF) of two numbers • find the lowest common multiple (LCM) of two numbers.

E1.2 Sets	Notes and examples
Understand and use set language, notation and Venn diagrams to describe sets and represent relationships between sets.	Venn diagrams are limited to two or three sets. The following set notation will be used: • $n(A)$ Number of elements in set A • $\in$ "… is an element of …" • $\notin$ "… is not an element of …" • A' Complement of set A • $\varnothing$ The empty set • $\mathscr{E}$ Universal set • $A \subseteq B$ A is a subset of B • $A \nsubseteq B$ A is not a subset of B • $A \cup B$ Union of A and B • $A \cap B$ Intersection of A and B. Example definition of sets: $A = \{x: x \text{ is a natural number}\}$ $B = \{(x, y): y = mx + c\}$ $C = \{x: a \leqslant x \leqslant b\}$ $D = \{a, b, c, \ldots\}$.

E1.3 Powers and roots	Notes and examples
Calculate with the following: • squares • square roots • cubes • cube roots • other powers and roots of numbers.	Includes recall of squares and their corresponding roots from 1 to 15, and recall of cubes and their corresponding roots of 1, 2, 3, 4, 5 and 10, e.g.: • Write down the value of $\sqrt{169}$. • Work out $5^2 \times \sqrt[3]{8}$.

1 Number (continued)

E1.4 Fractions, decimals and percentages	Notes and examples
1 Use the language and notation of the following in appropriate contexts: • proper fractions • improper fractions • mixed numbers • decimals • percentages.	Candidates are expected to be able to write fractions in their simplest form. Recurring decimal notation **is** required, e.g. • $0.1\dot{7} = 0.1777\ldots$ • $0.1\dot{2}\dot{3} = 0.1232323\ldots$ • $0.\overline{123} = 0.123123\ldots$
2 Recognise equivalence and convert between these forms.	Includes converting between recurring decimals and fractions and vice versa, e.g. write $0.1\dot{7}$ as a fraction.

E1.5 Ordering	Notes and examples
Order quantities by magnitude and demonstrate familiarity with the symbols $=$, $\neq$, $>$, $<$, $\geqslant$ and $\leqslant$.	

E1.6 The four operations	Notes and examples
Use the four operations for calculations with integers, fractions and decimals, including correct ordering of operations and use of brackets.	Includes: • negative numbers • improper fractions • mixed numbers • practical situations, e.g. temperature changes.

E1.7 Indices I	Notes and examples
1 Understand and use indices (positive, zero, negative, and fractional).	Examples include: • $6^{\frac{1}{2}} = \sqrt{6}$ • $16^{\frac{1}{4}} = \sqrt[4]{16}$ • find the value of 7^{-2}, $81^{\frac{1}{2}}$, $8^{-\frac{2}{3}}$.
2 Understand and use the rules of indices.	e.g. find the value of $2^{-3} \times 2^4$, $(2^3)^2$, $2^3 \div 2^4$.

E1.8 Standard form	Notes and examples
1 Use the standard form $A \times 10^n$ where n is a positive or negative integer and $1 \leqslant A < 10$.	
2 Convert numbers into and out of standard form.	Core candidates are expected to calculate with standard form only on Paper 3.
3 Calculate with values in standard form.	

1 Number (continued)

E1.9 Estimation	Notes and examples
1 Round values to a specified degree of accuracy.	Includes decimal places and significant figures. e.g. write 5764 correct to the nearest thousand.
2 Make estimates for calculations involving numbers, quantities and measurements.	e.g. by writing each number correct to 1 significant figure, estimate the value of $\frac{41.3}{9.79 \times 0.765}$.
3 Round answers to a reasonable degree of accuracy in the context of a given problem.	

E1.10 Limits of accuracy	Notes and examples
1 Give upper and lower bounds for data rounded to a specified accuracy.	e.g. write down the upper bound of a length measured correct to the nearest metre.
2 Find upper and lower bounds of the results of calculations which have used data rounded to a specified accuracy.	Example calculations include: • calculate the upper bound of the perimeter or the area of a rectangle given dimensions measured to the nearest centimetre • find the lower bound of the speed given rounded values of distance and time.

E1.11 Ratio and proportion	Notes and examples
Understand and use ratio and proportion to:	
• give ratios in their simplest form	e.g. 20 : 30 : 40 in its simplest form is 2 : 3 : 4.
• divide a quantity in a given ratio	
• use proportional reasoning and ratios in context.	e.g. adapt recipes; use map scales; determine best value.

1 Number (continued)

E1.12 Rates	Notes and examples
1 Use common measures of rate.	e.g. calculate with: • hourly rates of pay • exchange rates between currencies • flow rates • fuel consumption.
2 Apply other measures of rate.	e.g. calculate with: • pressure • density • population density. Required formulas will be given in the question.
3 Solve problems involving average speed.	Knowledge of speed/distance/time formula is required. e.g. A cyclist travels 45 km in 3 hours 45 minutes. What is their average speed? Notation used will be, e.g. m/s (metres per second), g/cm^3 (grams per cubic centimetre).

E1.13 Percentages	Notes and examples
1 Calculate a given percentage of a quantity.	
2 Express one quantity as a percentage of another.	
3 Calculate percentage increase or decrease.	
4 Calculate with simple and compound interest.	Problems may include repeated percentage change. Formulas are **not** given.
5 Calculate using reverse percentages.	e.g. find the cost price given the selling price and the percentage profit. Percentage calculations may include: • deposit • discount • profit and loss (as an amount or a percentage) • earnings • percentages over 100%.

E1.14 Using a calculator	Notes and examples
1 Use a calculator efficiently.	e.g. know not to round values within a calculation and to only round the final answer.
2 Enter values appropriately on a calculator.	e.g. enter 2 hours 30 minutes as 2.5 hours or 2° 30’ 0’’.
3 Interpret the calculator display appropriately.	e.g. in money 4.8 means \$4.80; in time 3.25 means 3 hours 15 minutes.

1 Number (continued)

E1.15 Time	Notes and examples
1 Calculate with time: seconds (s), minutes (min), hours (h), days, weeks, months, years, including the relationship between units.	1 year = 365 days.
2 Calculate times in terms of the 24-hour and 12-hour clock.	In the 24-hour clock, for example, 3.15 a.m. will be denoted by 03 15 and 3.15 p.m. by 15 15.
3 Read clocks and timetables.	Includes problems involving time zones, local times and time differences.

E1.16 Money	Notes and examples
1 Calculate with money.	
2 Convert from one currency to another.	

E1.17 Exponential growth and decay	Notes and examples
Use exponential growth and decay.	e.g. depreciation, population change. Knowledge of *e* is **not** required.

E1.18 Surds	Notes and examples
1 Understand and use surds, including simplifying expressions.	Examples include: • $\sqrt{20} = 2\sqrt{5}$ • $\sqrt{200} - \sqrt{32} = 6\sqrt{2}$.
2 Rationalise the denominator.	Examples include: • $\frac{10}{\sqrt{5}} = 2\sqrt{5}$ • $\frac{1}{-1+\sqrt{3}} = \frac{1+\sqrt{3}}{2}$.

2 Algebra and graphs

E2.1 Introduction to algebra	Notes and examples
1 Know that letters can be used to represent generalised numbers.	
2 Substitute numbers into expressions and formulas.	

E2.2 Algebraic manipulation	Notes and examples
1 Simplify expressions by collecting like terms.	Simplify means give the answer in its simplest form, e.g. $2a^2 + 3ab - 1 + 5a^2 - 9ab + 4 = 7a^2 - 6ab + 3$.
2 Expand products of algebraic expressions.	e.g. expand $3x(2x - 4y)$, $(3x + y)(x - 4y)$. Includes products of more than two brackets, e.g. expand $(x - 2)(x + 3)(2x + 1)$.
3 Factorise by extracting common factors.	Factorise means factorise fully, e.g. $9x^2 + 15xy = 3x(3x + 5y)$.
4 Factorise expressions of the form: • $ax + bx + kay + kby$ • $a^2x^2 - b^2y^2$ • $a^2 + 2ab + b^2$ • $ax^2 + bx + c$ • $ax^3 + bx^2 + cx$.	Simplify means give the answer in its simplest form, e.g. $2a + 3b + 5a - 9b = 7a - 6b$. e.g. expand $3x(2x - 4y)$. Includes products of two brackets involving one variable, e.g. expand $(2x + 1)(x - 4)$.
5 Complete the square for expressions in the form $ax^2 + bx + c$.	

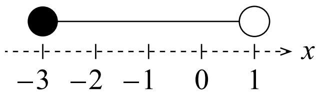
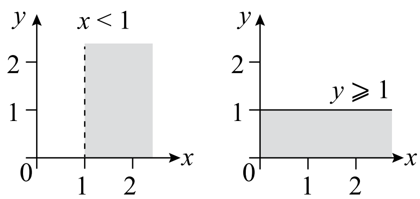
E2.3 Algebraic fractions	Notes and examples
1 Manipulate algebraic fractions.	Examples include: • $\frac{x}{3} + \frac{x-4}{2}$ • $\frac{2x}{3} - \frac{3(x-5)}{2}$ • $\frac{3a}{4} \times \frac{9a}{10}$ • $\frac{3a}{4} \div \frac{9a}{10}$ • $\frac{1}{x-2} + \frac{x+1}{x-3}$.
2 Factorise and simplify rational expressions.	e.g. $\frac{x^2 - 2x}{x^2 - 5x + 6}$.

2 Algebra and graphs (continued)

E2.4 Indices II	Notes and examples
1 Understand and use indices (positive, zero, negative and fractional).	e.g. solve: • $32^x = 2$ • $5^{x+1} = 25^x$.
2 Understand and use the rules of indices.	e.g. simplify: • $3x^{-4} \times \frac{2}{3}x^{\frac{1}{2}}$ • $\frac{2}{5}x^{\frac{1}{2}} \div 2x^{-2}$ • $\left(\frac{2x^5}{3}\right)^3$. e.g. simplify: • $(5x^3)^2$ • $12a^5 \div 3a^{-2}$ • $6x^7y^4 \times 5x^{-5}y$. Knowledge of logarithms is **not** required.

E2.5 Equations	Notes and examples
1 Construct expressions, equations and formulas.	e.g. write an expression for the product of two consecutive even numbers. Includes constructing simultaneous equations.
2 Solve linear equations in one unknown.	Examples include: • $3x + 4 = 10$ • $5 - 2x = 3(x + 7)$.
3 Solve fractional equations with numerical and linear algebraic denominators.	Examples include: • $\frac{x}{2x+1} = 4$ • $\frac{2}{x+2} + \frac{3}{2x-1} = 1$ • $\frac{x}{x+2} = \frac{3}{x-6}$.
4 Solve simultaneous linear equations in two unknowns.	
5 Solve simultaneous equations, involving one linear and one non-linear.	With powers no higher than two.
6 Solve quadratic equations by factorisation, completing the square and by use of the quadratic formula.	Includes writing a quadratic expression in completed square form. Candidates may be expected to give solutions in surd form. The quadratic formula is given in the List of formulas.
7 Change the subject of formulas.	e.g. change the subject of a formula where: • the subject appears twice • there is a power or root of the subject.

2 Algebra and graphs (continued)

E2.6 Inequalities	Notes and examples
1 Represent and interpret inequalities, including on a number line.	When representing and interpreting inequalities on a number line: • open circles should be used to represent strict inequalities (<, >) • closed circles should be used to represent inclusive inequalities ($\leqslant$, $\geqslant$). e.g. $-3 \leqslant x < 1$ 
2 Construct, solve and interpret linear inequalities.	Examples include: • $3x < 2x + 4$ • $-3 \leqslant 3x - 2 < 7$.
3 Represent and interpret linear inequalities in two variables graphically.	The following conventions should be used: • broken lines should be used to represent strict inequalities (<, >) • solid lines should be used to represent inclusive inequalities ($\leqslant$, $\geqslant$) • shading should be used to represent unwanted regions (unless otherwise directed in the question). e.g. 
4 List inequalities that define a given region.	Linear programming problems are **not** included.

E2.7 Sequences	Notes and examples
1 Continue a given number sequence or pattern.	Subscript notation may be used, e.g. T_n is the nth term of sequence T.
2 Recognise patterns in sequences, including the term-to-term rule, and relationships between different sequences.	Includes linear, quadratic, cubic and exponential sequences and simple combinations of these.
3 Find and use the nth term of sequences. (a) linear (b) simple quadratic (c) simple cubic.	

2 Algebra and graphs (continued)

E2.8 Proportion	Notes and examples
Express direct and inverse proportion in algebraic terms and use this form of expression to find unknown quantities.	Includes linear, square, square root, cube and cube root proportion. Knowledge of proportional symbol ($\propto$) is required.

E2.9 Graphs in practical situations	Notes and examples
1 Use and interpret graphs in practical situations including travel graphs and conversion graphs.	Includes estimation and interpretation of the gradient of a tangent at a point.
2 Draw graphs from given data.	e.g. interpret the gradient of a straight-line graph as a rate of change. e.g. draw a distance–time graph to represent a journey.
3 Apply the idea of rate of change to simple kinematics involving distance–time and speed–time graphs, acceleration and deceleration.	
4 Calculate distance travelled as area under a speed–time graph.	Areas will involve linear sections of the graph only.

E2.10 Graphs of functions	Notes and examples
1 Construct tables of values, and draw, recognise and interpret graphs for functions of the following forms: • ax^n (includes sums of no more than three of these) • $ab^x + c$ where $n = -2, -1, -\frac{1}{2}, 0, \frac{1}{2}, 1, 2, 3$; a and c are rational numbers; and b is a positive integer.	Examples include: • $y = x^3 + x - 4$ • $y = 2x + \dfrac{3}{x^2}$ • $y = \frac{1}{4} \times 2^x$.
2 Solve associated equations graphically, including finding and interpreting roots by graphical methods.	e.g. finding the intersection of a line and a curve.
3 Draw and interpret graphs representing exponential growth and decay problems.	

1 Construct tables of values, and draw, recognise and interpret graphs for functions of the following forms:
- $ax + b$
- $\pm x^2 + ax + b$
- $\dfrac{a}{x}$ $(x \neq 0)$

where a and b are integer constants.

2 Algebra and graphs (continued)

E2.11 Sketching curves	Notes and examples
Recognise, sketch and interpret graphs of the following functions: (a) linear (b) quadratic (c) cubic (d) reciprocal (e) exponential.	Functions will be equivalent to: • $ax + by = c$ • $y = ax^2 + bx + c$ • $y = ax^3 + b$ • $y = ax^3 + bx^2 + cx$ • $y = \frac{a}{x} + b$ • $y = ar^x + b$ where a, b and c are rational numbers and r is a rational, positive number. Knowledge of turning points, roots and symmetry is required. Knowledge of vertical and horizontal asymptotes is required. Finding turning points of quadratics by completing the square is required.

E2.12 Differentiation	Notes and examples
1 Estimate gradients of curves by drawing tangents.	
2 Use the derivatives of functions of the form ax^n, where a is a rational constant and n is a positive integer or zero, and simple sums of not more than three of these.	$\frac{dy}{dx}$ notation will be expected.
3 Apply differentiation to gradients and stationary points (turning points).	
4 Discriminate between maxima and minima by any method.	Maximum and minimum points may be identified by: • an accurate sketch • use of the second differential • inspecting the gradient either side of a turning point. Candidates are **not** expected to identify points of inflection.

2 Algebra and graphs (continued)

E2.13 Functions	Notes and examples
1 Understand functions, domain and range and use function notation.	Examples include: • $\mathrm{f}(x) = 3x - 5$ • $\mathrm{g}(x) = \dfrac{3(x+4)}{5}$ • $\mathrm{h}(x) = 2x^2 + 3$.
2 Understand and find inverse functions $\mathrm{f}^{-1}(x)$.	
3 Form composite functions as defined by $\mathrm{gf}(x) = \mathrm{g}(\mathrm{f}(x))$.	e.g. $\mathrm{f}(x) = \dfrac{3}{x+2}$ and $\mathrm{g}(x) = (3x+5)^2$. Find $\mathrm{fg}(x)$. Give your answer as a fraction in its simplest form. Candidates are **not** expected to find the domains and ranges of composite functions. This topic may include mapping diagrams.

3 Coordinate geometry

E3.1 Coordinates	Notes and examples
Use and interpret Cartesian coordinates in two dimensions.	

E3.2 Drawing linear graphs	Notes and examples
Draw straight-line graphs for linear equations. Equations will be given in the form $y = mx + c$ (e.g. $y = -2x + 5$), unless a table of values is given.	Examples include: • $y = -2x + 5$ • $y = 7 - 4x$ • $3x + 2y = 5$.

E3.3 Gradient of linear graphs	Notes and examples
1 Find the gradient of a straight line.	From a grid only.
2 Calculate the gradient of a straight line from the coordinates of two points on it.	

E3.4 Length and midpoint	Notes and examples
1 Calculate the length of a line segment. 2 Find the coordinates of the midpoint of a line segment.	

E3.5 Equations of linear graphs	Notes and examples
Interpret and obtain the equation of a straight-line graph.	Questions may: • use and request lines in different forms, e.g. $ax + by = c$ $y = mx + c$ $x = k$ • involve finding the equation when the graph is given • ask for the gradient or y-intercept of a graph from an equation, e.g. find the gradient and y-intercept of the graph with equation $5x + 4y = 8$. $y = 6x + 3$. Candidates are expected to give equations of a line in a fully simplified form.

3 Coordinate geometry (continued)

E3.6 Parallel lines	Notes and examples
Find the gradient and equation of a straight line parallel to a given line.	e.g. find the equation of the line parallel to $y = 4x - 1$ that passes through $(1, -3)$.

E3.7 Perpendicular lines	Notes and examples
Find the gradient and equation of a straight line perpendicular to a given line.	Examples include: • find the gradient of a line perpendicular to $2y = 3x + 1$ • find the equation of the perpendicular bisector of the line joining the points $(-3, 8)$ and $(9, -2)$.

4 Geometry

E4.1 Geometrical terms	Notes and examples
1 Use and interpret the following geometrical terms: • point • vertex • line • plane • parallel • perpendicular • perpendicular bisector • bearing • right angle • acute, obtuse and reflex angles • interior and exterior angles • similar • congruent • scale factor.	Candidates are **not** expected to show that two shapes are congruent.
2 Use and interpret the vocabulary of: • triangles • special quadrilaterals • polygons • nets • solids.	Includes the following terms. Triangles: • equilateral • isosceles • scalene • right-angled. Quadrilaterals: • square • rectangle • kite • rhombus • parallelogram • trapezium.

continued

4 Geometry (continued)

E4.1 Geometrical terms (continued)	Notes and examples
	Polygons: • regular and irregular polygons • pentagon • hexagon • octagon • decagon. Solids: • cube • cuboid • prism • cylinder • pyramid • cone • sphere • hemisphere • frustum • face • surface • edge.
3 Use and interpret the vocabulary of a circle.	Includes the following terms: • centre • radius (plural radii) • diameter • circumference • semicircle • chord • tangent • major and minor arc • sector • segment.

4 Geometry (continued)

E4.2 Geometrical constructions	Notes and examples
1 Measure and draw lines and angles.	A ruler should be used for all straight edges. Constructions of perpendicular bisectors and angle bisectors are **not** required.
2 Construct a triangle, given the lengths of all sides, using a ruler and pair of compasses only.	e.g. construct a rhombus by drawing two triangles. Construction arcs must be shown.
3 Draw, use and interpret nets.	Examples include: • draw nets of cubes, cuboids, prisms and pyramids • use measurements from nets to calculate volumes and surface areas.

E4.3 Scale drawings	Notes and examples
1 Draw and interpret scale drawings.	A ruler must be used for all straight edges.
2 Use and interpret three-figure bearings.	Bearings are measured clockwise from north (000° to 360°). e.g. find the bearing of A from B if the bearing of B from A is 025°. Includes an understanding of the terms north, east, south and west. e.g. point D is due east of point C.

E4.4 Similarity	Notes and examples
1 Calculate lengths of similar shapes.	
2 Use the relationships between lengths and areas of similar shapes and lengths, surface areas and volumes of similar solids.	Includes use of scale factor, e.g. $\frac{\text{Volume of } A}{\text{Volume of } B} = \frac{(\text{Length of } A)^3}{(\text{Length of } B)^3}$.
3 Solve problems and give simple explanations involving similarity.	Includes showing that two triangles are similar using geometric reasons.

E4.5 Symmetry	Notes and examples
1 Recognise line symmetry and order of rotational symmetry in two dimensions.	Includes properties of triangles, quadrilaterals and polygons directly related to their symmetries.
2 Recognise symmetry properties of prisms, cylinders, pyramids and cones.	e.g. identify planes and axes of symmetry.

4 Geometry (continued)

E4.6 Angles	Notes and examples
1 Calculate unknown angles and give simple explanations using the following geometrical properties: • sum of angles at a point = 360° • sum of angles at a point on a straight line = 180° • vertically opposite angles are equal • angle sum of a triangle = 180° and angle sum of a quadrilateral = 360°.	Knowledge of 3-letter notation for angles is required, e.g. angle ABC. Candidates are expected to use the correct geometrical terminology when giving reasons for answers.
2 Calculate unknown angles and give geometric explanations for angles formed within parallel lines: • corresponding angles are equal • alternate angles are equal • co-interior angles sum to 180° (supplementary).	
3 Know and use angle properties of regular and irregular polygons.	Includes exterior and interior angles, and angle sum.

E4.7 Circle theorems I	Notes and examples
Calculate unknown angles and give explanations using the following geometrical properties of circles: • angle in a semicircle = 90° • angle between tangent and radius = 90° • angle at the centre is twice the angle at the circumference • angles in the same segment are equal • opposite angles of a cyclic quadrilateral sum to 180° (supplementary) • alternate segment theorem.	Candidates are expected to use the geometrical properties listed in the syllabus when giving reasons for answers.

E4.8 Circle theorems II	Notes and examples
Use the following symmetry properties of circles: • equal chords are equidistant from the centre • the perpendicular bisector of a chord passes through the centre • tangents from an external point are equal in length.	Candidates are expected to use the geometrical properties listed in the syllabus when giving reasons for answers.

5 Mensuration

E5.1 Units of measure	**Notes and examples**
Use metric units of mass, length, area, volume and capacity in practical situations and convert quantities into larger or smaller units.	Units include: • mm, cm, m, km • mm^2, cm^2, m^2, km^2 • mm^3, cm^3, m^3 • ml, l • g, kg. Conversion between units includes: • between different units of area, e.g. $cm^2 \leftrightarrow m^2$ • between units of volume and capacity, e.g. $m^3 \leftrightarrow$ litres.

E5.2 Area and perimeter	**Notes and examples**
Carry out calculations involving the perimeter and area of a rectangle, triangle, parallelogram and trapezium.	Except for the area of a triangle, formulas are **not** given.

E5.3 Circles, arcs and sectors	**Notes and examples**
1 Carry out calculations involving the circumference and area of a circle.	Answers may be asked for in terms of π. Formulas are given in the List of formulas.
2 Carry out calculations involving arc length and sector area as fractions of the circumference and area of a circle.	Includes minor and major sectors. area of a circle, where the sector angle is a factor of 360°.

E5.4 Surface area and volume	**Notes and examples**
Carry out calculations and solve problems involving the surface area and volume of a: • cuboid • prism • cylinder • sphere • pyramid • cone.	Answers may be asked for in terms of π. The following formulas are given in the List of formulas: • curved surface area of a cylinder • curved surface area of a cone • surface area of a sphere • volume of a prism • volume of a pyramid • volume of a cylinder • volume of a cone • volume of a sphere. The term prism refers to any solid with a uniform cross-section, e.g. a cylindrical sector.

5 Mensuration (continued)

E5.5 Compound shapes and parts of shapes	Notes and examples
1 Carry out calculations and solve problems involving perimeters and areas of: • compound shapes • parts of shapes.	Answers may be asked for in terms of π.
2 Carry out calculations and solve problems involving surface areas and volumes of: • compound solids • parts of solids.	e.g. find the surface area and volume of a frustum.

6 Trigonometry

E6.1 Pythagoras' theorem	Notes and examples
Know and use Pythagoras' theorem.	

E6.2 Right-angled triangles	Notes and examples
1 Know and use the sine, cosine and tangent ratios for acute angles in calculations involving sides and angles of a right-angled triangle.	Angles will be given in degrees and answers should be written in degrees, with decimals correct to one decimal place.
2 Solve problems in two dimensions using Pythagoras' theorem and trigonometry.	Knowledge of bearings may be required.
3 Know that the perpendicular distance from a point to a line is the shortest distance to the line.	
4 Carry out calculations involving angles of elevation and depression.	

E6.3 Exact trigonometric values	Notes and examples
Know the exact values of: 1 $\sin x$ and $\cos x$ for $x = 0°, 30°, 45°, 60°$ and $90°$. 2 $\tan x$ for $x = 0°, 30°, 45°$ and $60°$.	

E6.4 Trigonometric functions	Notes and examples
1 Recognise, sketch and interpret the following graphs for $0° \leqslant x \leqslant 360°$: • $y = \sin x$ • $y = \cos x$ • $y = \tan x$.	
2 Solve trigonometric equations involving $\sin x$, $\cos x$ or $\tan x$, for $0° \leqslant x \leqslant 360°$.	e.g. solve: • $\sin x = \frac{\sqrt{3}}{2}$ for $0° \leqslant x \leqslant 360°$ • $2\cos x + 1 = 0$ for $0° \leqslant x \leqslant 360°$.

6 Trigonometry (continued)

E6.5 Non-right-angled triangles	**Notes and examples**
1 Use the sine and cosine rules in calculations involving lengths and angles for any triangle.	Includes problems involving obtuse angles and the ambiguous case.
2 Use the formula area of triangle $= \frac{1}{2}ab\sin C$.	The sine and cosine rules and the formula for area of a triangle are given in the List of formulas.

E6.6 Pythagoras' theorem and trigonometry in 3D	**Notes and examples**
Carry out calculations and solve problems in three dimensions using Pythagoras' theorem and trigonometry, including calculating the angle between a line and a plane.	

7 Transformations and vectors

E7.1 Transformations	Notes and examples
Recognise, describe and draw the following transformations: vertical or horizontal 1 Reflection of a shape in a straight line.	Questions may involve combinations of transformations. A ruler must be used for all straight edges. Questions will **not** involve combinations of transformations. A ruler must be used for all straight edges.
2 Rotation of a shape about a centre through multiples of 90°.	
3 Enlargement of a shape from a centre by a scale factor.	Positive, fractional and negative scale factors may be used.
4 Translation of a shape by a vector $\begin{pmatrix} x \\ y \end{pmatrix}$.	

E7.2 Vectors in two dimensions	Notes and examples
1 Describe a translation using a vector represented by $\begin{pmatrix} x \\ y \end{pmatrix}$, $\overrightarrow{AB}$ or $\mathbf{a}$.	Vectors will be printed as $\overrightarrow{AB}$ or $\mathbf{a}$.
2 Add and subtract vectors.	
3 Multiply a vector by a scalar.	

E7.3 Magnitude of a vector	Notes and examples
Calculate the magnitude of a vector $\begin{pmatrix} x \\ y \end{pmatrix}$ as $\sqrt{x^2 + y^2}$.	The magnitudes of vectors will be denoted by modulus signs, e.g. • $\lvert\mathbf{a}\rvert$ is the magnitude of $\mathbf{a}$ • $\lvert\overrightarrow{AB}\rvert$ is the magnitude of $\overrightarrow{AB}$.

E7.4 Vector geometry	Notes and examples
1 Represent vectors by directed line segments.	
2 Use position vectors.	
3 Use the sum and difference of two or more vectors to express given vectors in terms of two coplanar vectors.	
4 Use vectors to reason and to solve geometric problems.	Examples include: • show that vectors are parallel • show that 3 points are collinear • solve vector problems involving ratio and similarity.

8 Probability

E8.1 Introduction to probability	Notes and examples
1 Understand and use the probability scale from 0 to 1.	$\mathrm{P}(A)$ is the probability of A $\mathrm{P}(A')$ is the probability of not A
2 Understand and use probability notation.	
3 Calculate the probability of a single event.	Probabilities should be given as a fraction, decimal or percentage. Problems may require using information from tables, graphs or Venn diagrams. (limited to two sets).
4 Understand that the probability of an event not occurring = 1 – the probability of the event occurring.	e.g. $\mathrm{P}(B) = 0.8$, find $\mathrm{P}(B')$

E8.2 Relative and expected frequencies	Notes and examples
1 Understand relative frequency as an estimate of probability.	e.g. use results of experiments with a spinner to estimate the probability of a given outcome.
2 Calculate expected frequencies.	e.g. use probability to estimate an expected value from a population. Includes understanding what is meant by fair, bias and random.

E8.3 Probability of combined events	Notes and examples
Calculate the probability of combined events using, where appropriate:	Combined events could be with or without replacement.
• sample space diagrams	Venn diagrams will be limited to two sets.
• Venn diagrams	The notation $\mathrm{P}(A \cap B)$ and $\mathrm{P}(A \cup B)$ may be used in the context of Venn diagrams.
• tree diagrams.	On tree diagrams outcomes will be written at the end of branches and probabilities by the side of the branches.

E8.4 Conditional probability	Notes and examples
Calculate conditional probability using Venn diagrams, tree diagrams and tables.	Knowledge of notation, $\mathrm{P}(A\|B)$, and formulas relating to conditional probability is **not** required.

9 Statistics

E9.1 Classifying statistical data	Notes and examples
Classify and tabulate statistical data.	e.g. tally tables, two-way tables.

E9.2 Interpreting statistical data	Notes and examples
1 Read, interpret and draw inferences from tables and statistical diagrams.	
2 Compare sets of data using tables, graphs and statistical measures.	e.g. compare averages and measures of spread between two data sets.
3 Appreciate restrictions on drawing conclusions from given data.	

E9.3 Averages and measures of spread	Notes and examples
1 Calculate the mean, median, mode, quartiles, range and interquartile range for individual data and distinguish between the purposes for which these are used.	
2 Calculate an estimate of the mean for grouped discrete or grouped continuous data.	
3 Identify the modal class from a grouped frequency distribution.	

E9.4 Statistical charts and diagrams	Notes and examples
Draw and interpret:	
(a) bar charts	Includes composite (stacked) and dual (side-by-side) bar charts.
(b) pie charts	
(c) pictograms	
(d) stem-and-leaf diagrams	Stem-and-leaf diagrams should have ordered data with a key.
(e) simple frequency distributions.	

9 Statistics (continued)

E9.5 Scatter diagrams	Notes and examples
1 Draw and interpret scatter diagrams.	Plotted points should be clearly marked, for example as small crosses (×).
2 Understand what is meant by positive, negative and zero correlation.	
3 Draw by eye, interpret and use a straight line of best fit.	A line of best fit: • should be a single ruled line drawn by inspection • should extend across the full data set • does not need to coincide exactly with any of the points but there should be a roughly even distribution of points either side of the line over its entire length.

E9.6 Cumulative frequency diagrams	Notes and examples
1 Draw and interpret cumulative frequency tables and diagrams.	Plotted points on a cumulative frequency diagram should be clearly marked, for example as small crosses (×), and be joined with a smooth curve.
2 Estimate and interpret the median, percentiles, quartiles and interquartile range from cumulative frequency diagrams.	

E9.7 Histograms	Notes and examples
1 Draw and interpret histograms. 2 Calculate with frequency density.	On histograms, the vertical axis is labelled 'Frequency density'. Frequency density is defined as $\text{frequency density} = \text{frequency} \div \text{class width}$.