3 Subject content

Candidates may follow either the Core curriculum or the Extended curriculum. Candidates aiming for grades A* to C should follow the Extended curriculum.

C1 Number		
	Core curriculum	Notes/Examples
C1.1	Identify and use natural numbers, integers (positive, negative and zero), prime numbers, square numbers, common factors and common multiples, rational and irrational numbers (e.g. π, $\sqrt{2}$), real numbers.	Includes expressing numbers as a product of prime factors. Finding the Lowest Common Multiple (LCM) and Highest Common Factor (HCF) of two numbers.
C1.2	*Extended curriculum only*	
C1.3	Calculate squares, square roots, cubes and cube roots of numbers.	
C1.4	Use directed numbers in practical situations.	e.g. temperature changes, flood levels.
C1.5	Use the language and notation of simple vulgar and decimal fractions and percentages in appropriate contexts. Recognise equivalence and convert between these forms.	
C1.6	Order quantities by magnitude and demonstrate familiarity with the symbols $=$, $\neq$, $>$, $<$, $\geqslant$, $\leqslant$.	
C1.7	Understand the meaning and rules of indices. Use the standard form $A \times 10^n$ where n is a positive or negative integer, and $1 \leqslant A < 10$.	Evaluate 2^5, 5^{-2}, 100^0 Work out $2^{-3} \times 2^4$ Convert numbers into and out of standard form. Calculate with values in standard form.
C1.8	Use the four rules for calculations with whole numbers, decimals and vulgar (and mixed) fractions, including correct ordering of operations and use of brackets.	

E1 Number

	Extended curriculum	Notes/Examples
E1.1	Identify and use natural numbers, integers (positive, negative and zero), prime numbers, square numbers, common factors and common multiples, rational and irrational numbers (e.g. π, $\sqrt{2}$), real numbers.	Includes expressing numbers as a product of prime factors. Finding the Lowest Common Multiple (LCM) and Highest Common Factor (HCF) of two or more numbers.

E1.2	Use language, notation and Venn diagrams to describe sets and represent relationships between sets.	Notation

Definition of sets

e.g. $A = \{x: x$ is a natural number$\}$

$B = \{(x,y): y = mx + c\}$

$C = \{x: a \leqslant x \leqslant b\}$

$D = \{a, b, c, \ldots\}$

Number of elements in set A	$n(A)$
"…is an element of…"	$\in$
"…is not an element of…"	$\notin$
Complement of set A	A'
The empty set	$\varnothing$
Universal set	$\mathscr{E}$
A is a subset of B	$A \subseteq B$
A is a proper subset of B	$A \subset B$
A is not a subset of B	$A \nsubseteq B$
A is not a proper subset of B	$A \not\subset B$
Union of A and B	$A \cup B$
Intersection of A and B	$A \cap B$

E1.3	Calculate squares, square roots, cubes and cube roots of numbers.	
E1.4	Use directed numbers in practical situations.	e.g. temperature changes, flood levels.
E1.5	Use the language and notation of simple vulgar and decimal fractions and percentages in appropriate contexts. Recognise equivalence and convert between these forms.	Includes the conversion of recurring decimals to fractions, e.g. change $0.\dot{7}$ to a fraction.
E1.6	Order quantities by magnitude and demonstrate familiarity with the symbols $=, \neq, >, <, \geqslant, \leqslant$.	
E1.7	Understand the meaning and rules of indices.	$5^{\frac{1}{2}} = \sqrt{5}$ Evaluate 5^{-2}, $100^{\frac{1}{2}}$, $8^{-\frac{2}{3}}$ Work out $2^{-3} \times 2^{4}$
	Use the standard form $A \times 10^n$ where n is a positive or negative integer, and $1 \leqslant A < 10$.	Convert numbers into and out of standard form. Calculate with values in standard form.
E1.8	Use the four rules for calculations with whole numbers, decimals and vulgar (and mixed) fractions, including correct ordering of operations and use of brackets.	

C1 Number

Core curriculum continued	Notes/Examples continued
C1.9 Make estimates of numbers, quantities and lengths, give approximations to specified numbers of significant figures and decimal places and round off answers to reasonable accuracy in the context of a given problem.	
C1.10 Give appropriate upper and lower bounds for data given to a specified accuracy.	e.g. measured lengths.
C1.11 Demonstrate an understanding of ratio and proportion. Use common measures of rate. Calculate average speed.	Divide a quantity in a given ratio. Direct and inverse proportion. Use scales in practical situations.
C1.12 Calculate a given percentage of a quantity. Express one quantity as a percentage of another. Calculate percentage increase or decrease.	
C1.13 Use a calculator efficiently. Apply appropriate checks of accuracy.	
C1.14 Calculate times in terms of the 24-hour and 12-hour clock. Read clocks, dials and timetables.	
C1.15 Calculate using money and convert from one currency to another.	
C1.16 Use given data to solve problems on personal and small business finance involving earnings, simple interest and compound interest. Extract data from tables and charts.	Includes discount, profit and loss. Knowledge of compound interest formula is not required.
C1.17 *Extended curriculum only*	

E1 Number

	Extended curriculum continued	Notes/Examples continued
E1.9	Make estimates of numbers, quantities and lengths, give approximations to specified numbers of significant figures and decimal places and round off answers to reasonable accuracy in the context of a given problem.	
E1.10	Give appropriate upper and lower bounds for data given to a specified accuracy.	e.g. measured lengths.
	Obtain appropriate upper and lower bounds to solutions of simple problems given data to a specified accuracy.	e.g. the calculation of the perimeter or the area of a rectangle.
E1.11	Demonstrate an understanding of ratio and proportion.	Divide a quantity in a given ratio. Direct and inverse proportion.
	Increase and decrease a quantity by a given ratio.	
	Use common measures of rate.	Use scales in practical situations.
	Calculate average speed.	
E1.12	Calculate a given percentage of a quantity.	
	Express one quantity as a percentage of another.	
	Calculate percentage increase or decrease.	
	Carry out calculations involving reverse percentages.	e.g. finding the cost price given the selling price and the percentage profit.
E1.13	Use a calculator efficiently.	
	Apply appropriate checks of accuracy.	
E1.14	Calculate times in terms of the 24-hour and 12-hour clock.	
	Read clocks, dials and timetables.	
E1.15	Calculate using money and convert from one currency to another.	
E1.16	Use given data to solve problems on personal and small business finance involving earnings, simple interest and compound interest.	Includes discount, profit and loss.
		Knowledge of compound interest formula is required.
	Extract data from tables and charts.	Value of investment $= P\left(1 + \dfrac{r}{100}\right)^n$ where P is the amount invested, r is the percentage rate of interest and n is the number of years of compound interest.
E1.17	Use exponential growth and decay in relation to population and finance.	e.g. depreciation, bacteria growth.

C2 Algebra and graphs

Core curriculum	Notes/Examples
C2.1 Use letters to express generalised numbers and express basic arithmetic processes algebraically.	
Substitute numbers for words and letters in formulae.	
Transform simple formulae.	
Construct simple expressions and set up simple equations.	
C2.2 Manipulate directed numbers.	
Use brackets and extract common factors.	e.g. expand $3x(2x - 4y)$, $(x + 4)(x - 7)$
	e.g. factorise $9x^2 + 15xy$
C2.3 *Extended curriculum only*	
C2.4 Use and interpret positive, negative and zero indices.	
Use the rules of indices.	e.g. simplify $3x^4 \times 5x$, $10x^3 \div 2x^2$, $(x^6)^2$
C2.5 Solve simple linear equations in one unknown.	
Solve simultaneous linear equations in two unknowns.	

E2 Algebra and graphs

Extended curriculum	Notes/Examples
E2.1 Use letters to express generalised numbers and express basic arithmetic processes algebraically.	
Substitute numbers for words and letters in complicated formulae.	
Construct and transform complicated formulae and equations.	e.g. transform formulae where the subject appears twice.
E2.2 Manipulate directed numbers.	
Use brackets and extract common factors.	e.g. expand $3x(2x - 4y)$, $(x + 4)(x - 7)$,
	e.g. factorise $9x^2 + 15xy$
Expand products of algebraic expressions.	
Factorise where possible expressions of the form:	
$ax + bx + kay + kby$	
$a^2x^2 - b^2y^2$	
$a^2 + 2ab + b^2$	
$ax^2 + bx + c$	
E2.3 Manipulate algebraic fractions.	e.g. $\dfrac{x}{3} + \dfrac{x-4}{2}$, $\dfrac{2x}{3} - \dfrac{3(x-5)}{2}$, $\dfrac{3a}{4} \times \dfrac{9a}{10}$,
	$\dfrac{3a}{4} \div \dfrac{9a}{10}$, $\dfrac{1}{x-2} + \dfrac{2}{x-3}$
Factorise and simplify rational expressions.	e.g. $\dfrac{x^2 - 2x}{x^2 - 5x + 6}$
E2.4 Use and interpret positive, negative and zero indices.	
Use and interpret fractional indices.	e.g. solve $32^x = 2$
Use the rules of indices.	e.g. simplify $3x^{-4} \times \dfrac{2}{3}x^{\frac{1}{2}}$
	$\dfrac{2}{5}x^{\frac{1}{2}} \div 2x^{-2}$
	$\left(\dfrac{2x^5}{3}\right)^3$
E2.5 Solve simple linear equations in one unknown.	
Solve simultaneous linear equations in two unknowns.	
Solve quadratic equations by factorisation, completing the square or by use of the formula.	
Solve simple linear inequalities.	

C2 Algebra and graphs

Core curriculum continued	Notes/Examples continued
C2.6	*Extended curriculum only*	
C2.7	Continue a given number sequence.	
	Recognise patterns in sequences and relationships between different sequences.	
	Find the *n*th term of sequences.	Linear sequences, simple quadratic and cubic sequences.
C2.8	*Extended curriculum only*	
C2.9	Interpret and use graphs in practical situations including travel graphs and conversion graphs.	
	Draw graphs from given data.	
C2.10	Construct tables of values for functions of the form $ax + b$, $\pm x^2 + ax + b$, $\frac{a}{x}$ ($x \neq 0$), where a and b are integer constants.	
	Draw and interpret such graphs.	
	Solve linear and quadratic equations approximately by graphical methods.	
C2.11	*Extended curriculum only*	
C2.12	*Extended curriculum only*	

E2 Algebra and graphs

Extended curriculum continued	Notes/Examples continued
E2.6 Represent inequalities graphically and use this representation in the solution of simple linear programming problems.	The conventions of using broken lines for strict inequalities and shading unwanted regions will be expected.
E2.7 Continue a given number sequence. Recognise patterns in sequences and relationships between different sequences. Find the nth term of sequences.	Linear sequences, quadratic and cubic sequences, exponential sequences and simple combinations of these.
E2.8 Express direct and inverse variation in algebraic terms and use this form of expression to find unknown quantities.	
E2.9 Interpret and use graphs in practical situations including travel graphs and conversion graphs. Draw graphs from given data. Apply the idea of rate of change to easy kinematics involving distance-time and speed-time graphs, acceleration and deceleration. Calculate distance travelled as area under a linear speed-time graph.	
E2.10 Construct tables of values and draw graphs for functions of the form ax^n, where a is a rational constant, and $n = -2, -1, 0, 1, 2, 3$, and simple sums of not more than three of these and for functions of the form a^x, where a is a positive integer. Solve associated equations approximately by graphical methods. Draw and interpret graphs representing exponential growth and decay problems.	
E2.11 Estimate gradients of curves by drawing tangents.	
E2.12 Use function notation, e.g. f(x) = $3x - 5$, f: $x \mapsto 3x - 5$, to describe simple functions. Find inverse functions f^{-1}(x). Form composite functions as defined by gf(x) = g(f(x)).	

C3 Geometry

Core curriculum

Notes/Examples

C3.1 Use and interpret the geometrical terms: point, line, parallel, bearing, right angle, acute, obtuse and reflex angles, perpendicular, similarity and congruence.

Use and interpret vocabulary of triangles, quadrilaterals, circles, polygons and simple solid figures including nets.

C3.2 Measure lines and angles.

Construct a triangle given the three sides using ruler and pair of compasses only.

Construct other simple geometrical figures from given data using ruler and protractor as necessary.

Construct angle bisectors and perpendicular bisectors using straight edge and pair of compasses only.

C3.3 Read and make scale drawings.

C3.4 Calculate lengths of similar figures.

C3.5 Recognise rotational and line symmetry (including order of rotational symmetry) in two dimensions.

Includes properties of triangles, quadrilaterals and circles directly related to their symmetries.

E3 Geometry

Extended curriculum	Notes/Examples
E3.1 Use and interpret the geometrical terms: point, line, parallel, bearing, right angle, acute, obtuse and reflex angles, perpendicular, similarity and congruence. Use and interpret vocabulary of triangles, quadrilaterals, circles, polygons and simple solid figures including nets.	
E3.2 Measure lines and angles. Construct a triangle given the three sides using ruler and pair of compasses only. Construct other simple geometrical figures from given data using ruler and protractor as necessary. Construct angle bisectors and perpendicular bisectors using straight edge and pair of compasses only.	
E3.3 Read and make scale drawings.	
E3.4 Calculate lengths of similar figures. Use the relationships between areas of similar triangles, with corresponding results for similar figures and extension to volumes and surface areas of similar solids.	
E3.5 Recognise rotational and line symmetry (including order of rotational symmetry) in two dimensions. Recognise symmetry properties of the prism (including cylinder) and the pyramid (including cone). 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.	Includes properties of triangles, quadrilaterals and circles directly related to their symmetries.

C3 Geometry

Core curriculum continued	Notes/Examples continued
C3.6 Calculate unknown angles using the following geometrical properties:	Candidates will be expected to use the correct geometrical terminology when giving reasons for answers.

C3.6   Calculate unknown angles using the following geometrical properties:

- angles at a point
- angles at a point on a straight line and intersecting straight lines
- angles formed within parallel lines
- angle properties of triangles and quadrilaterals
- angle properties of regular polygons
- angle in a semi-circle
- angle between tangent and radius of a circle.

C3.7   Use the following loci and the method of intersecting loci for sets of points in two dimensions which are:

- at a given distance from a given point
- at a given distance from a given straight line
- equidistant from two given points
- equidistant from two given intersecting straight lines.

E3 Geometry

Extended curriculum continued	Notes/Examples continued

E3.6 Calculate unknown angles using the following geometrical properties:

- angles at a point
- angles at a point on a straight line and intersecting straight lines
- angles formed within parallel lines
- angle properties of triangles and quadrilaterals
- angle properties of regular polygons
- angle in a semi-circle
- angle between tangent and radius of a circle.
- angle properties of irregular polygons
- angle at the centre of a circle is twice the angle at the circumference
- angles in the same segment are equal
- angles in opposite segments are supplementary; cyclic quadrilaterals.

Candidates will be expected to use the correct geometrical terminology when giving reasons for answers.

E3.7 Use the following loci and the method of intersecting loci for sets of points in two dimensions which are:

- at a given distance from a given point
- at a given distance from a given straight line
- equidistant from two given points
- equidistant from two given intersecting straight lines.

C4 Mensuration

Core curriculum	Notes/Examples
C4.1	Use current units of mass, length, area, volume and capacity in practical situations and express quantities in terms of larger or smaller units.	Convert between units including units of area and volume.
C4.2	Carry out calculations involving the perimeter and area of a rectangle, triangle, parallelogram and trapezium and compound shapes derived from these.	
C4.3	Carry out calculations involving the circumference and area of a circle.	
C4.4	Carry out calculations involving the volume of a cuboid, prism and cylinder and the surface area of a cuboid and a cylinder.	
C4.5	Carry out calculations involving the areas and volumes of compound shapes.	

C5 Co-ordinate geometry

Core curriculum	Notes/Examples
C5.1	Demonstrate familiarity with Cartesian co-ordinates in two dimensions.	
C5.2	Find the gradient of a straight line.	Problems will involve finding the gradient where the graph is given.
C5.3	*Extended curriculum only*	
C5.4	Interpret and obtain the equation of a straight line graph in the form $y = mx + c$.	Problems will involve finding the equation where the graph is given.
C5.5	Determine the equation of a straight line parallel to a given line.	e.g. find the equation of a line parallel to $y = 4x - 1$ that passes through (0, –3).
C5.6	*Extended curriculum only*	

E4 Mensuration	
Extended curriculum	Notes/Examples
E4.1	Use current units of mass, length, area, volume and capacity in practical situations and express quantities in terms of larger or smaller units.	Convert between units including units of area and volume.
E4.2	Carry out calculations involving the perimeter and area of a rectangle, triangle, parallelogram and trapezium and compound shapes derived from these.	
E4.3	Carry out calculations involving the circumference and area of a circle. Solve problems involving the arc length and sector area as fractions of the circumference and area of a circle.	
E4.4	Carry out calculations involving the volume of a cuboid, prism and cylinder and the surface area of a cuboid and a cylinder. Carry out calculations involving the surface area and volume of a sphere, pyramid and cone.	Formulae will be given for the surface area and volume of the sphere, pyramid and cone.
E4.5	Carry out calculations involving the areas and volumes of compound shapes.	

E5 Co-ordinate geometry	
Extended curriculum	Notes/Examples
E5.1	Demonstrate familiarity with Cartesian co-ordinates in two dimensions.	
E5.2	Find the gradient of a straight line. Calculate the gradient of a straight line from the co-ordinates of two points on it.	
E5.3	Calculate the length and the co-ordinates of the midpoint of a straight line from the co-ordinates of its end points.	
E5.4	Interpret and obtain the equation of a straight line graph in the form $y = mx + c$.	
E5.5	Determine the equation of a straight line parallel to a given line.	e.g. find the equation of a line parallel to $y = 4x - 1$ that passes through (0, –3).
E5.6	Find the gradient of parallel and perpendicular lines.	e.g. find the gradient of a line perpendicular to $y = 3x + 1$. e.g. find the equation of a line perpendicular to one passing through the co-ordinates (1, 3) and (–2, –9).

C6 Trigonometry

	Core curriculum	Notes/Examples
C6.1	Interpret and use three-figure bearings.	Measured clockwise from the North, i.e. 000°–360°.
C6.2	Apply Pythagoras' theorem and the sine, cosine and tangent ratios for acute angles to the calculation of a side or of an angle of a right-angled triangle.	Angles will be quoted in, and answers required in, degrees and decimals to one decimal place.
C6.3	*Extended curriculum only*	
C6.4	*Extended curriculum only*	

E6 Trigonometry

	Extended curriculum	Notes/Examples
E6.1	Interpret and use three-figure bearings.	Measured clockwise from the North, i.e. 000°–360°.
E6.2	Apply Pythagoras' theorem and the sine, cosine and tangent ratios for acute angles to the calculation of a side or of an angle of a right-angled triangle.	Angles will be quoted in, and answers required in, degrees and decimals to one decimal place.
	Solve trigonometrical problems in two dimensions involving angles of elevation and depression.	
	Extend sine and cosine values to angles between 90° and 180°.	
E6.3	Solve problems using the sine and cosine rules for any triangle and the formula area of triangle = $\frac{1}{2} ab \sin C$.	
E6.4	Solve simple trigonometrical problems in three dimensions including angle between a line and a plane.	

C7 Matrices and transformations

Core curriculum	Notes/Examples
C7.1	Describe a translation by using a vector represented by e.g. $\begin{pmatrix} x \\ y \end{pmatrix}$, $\overrightarrow{AB}$ or **a**.	
	Add and subtract vectors.	
	Multiply a vector by a scalar.	
C7.2	Reflect simple plane figures in horizontal or vertical lines.	
	Rotate simple plane figures about the origin, vertices or midpoints of edges of the figures, through multiples of 90°.	
	Construct given translations and enlargements of simple plane figures.	Positive and fractional scale factors for enlargements only.
	Recognise and describe reflections, rotations, translations and enlargements.	Positive and fractional scale factors for enlargements only.
C7.3	*Extended curriculum only*	
C7.4	*Extended curriculum only*	
C7.5	*Extended curriculum only*	

E7 Matrices and transformations

Extended curriculum	Notes/Examples

E7.1 Describe a translation by using a vector represented by e.g. $\begin{pmatrix} x \\ y \end{pmatrix}$, $\overrightarrow{AB}$ or **a**.

Add and subtract vectors.

Multiply a vector by a scalar.

E7.2 Reflect simple plane figures.

Rotate simple plane figures through multiples of 90°.

Construct given translations and enlargements of simple plane figures.

Recognise and describe reflections, rotations, translations and enlargements.

Positive, fractional and negative scale factors for enlargements.

Positive, fractional and negative scale factors for enlargements.

E7.3 Calculate the magnitude of a vector $\begin{pmatrix} x \\ y \end{pmatrix}$ as $\sqrt{x^2 + y^2}$.

Represent vectors by directed line segments.

Use the sum and difference of two vectors to express given vectors in terms of two coplanar vectors.

Use position vectors.

*Vectors will be printed as $\overrightarrow{AB}$ or **a** and their magnitudes denoted by modulus signs, e.g. $|\overrightarrow{AB}|$ or $|\textbf{a}|$.*

*In their answers to questions, candidates are expected to indicate **a** in some definite way, e.g. by an arrow or by underlining, thus $\overrightarrow{AB}$ or a̲.*

E7.4 Display information in the form of a matrix of any order.

Calculate the sum and product (where appropriate) of two matrices.

Calculate the product of a matrix and a scalar quantity.

Use the algebra of 2 × 2 matrices including the zero and identity 2 × 2 matrices.

Calculate the determinant |**A**| and inverse $\textbf{A}^{-1}$ of a non-singular matrix **A**.

E7.5 Use the following transformations of the plane: reflection (M), rotation (R), translation (T), enlargement (E), and their combinations.

Identify and give precise descriptions of transformations connecting given figures.

Describe transformations using co-ordinates and matrices (singular matrices are excluded).

If M(a) = b and R(b) = c, the notation RM(a) = c will be used. Invariants under these transformations may be assumed.

C8 Probability

Core curriculum		Notes/Examples
C8.1	Calculate the probability of a single event as either a fraction, decimal or percentage.	Problems could be set involving extracting information from tables or graphs.
C8.2	Understand and use the probability scale from 0 to 1.	
C8.3	Understand that the probability of an event occurring = 1 – the probability of the event not occurring.	
C8.4	Understand relative frequency as an estimate of probability.	
C8.5	*Extended curriculum only*	

C9 Statistics

Core curriculum		Notes/Examples
C9.1	Collect, classify and tabulate statistical data. Read, interpret and draw simple inferences from tables and statistical diagrams.	
C9.2	Construct and read bar charts, pie charts, pictograms, simple frequency distributions, histograms with equal intervals and scatter diagrams.	
C9.3	Calculate the mean, median, mode and range for individual and discrete data and distinguish between the purposes for which they are used.	
C9.4	*Extended curriculum only*	
C9.5	*Extended curriculum only*	
C9.6	Understand what is meant by positive, negative and zero correlation with reference to a scatter diagram.	
C9.7	Draw a straight line of best fit by eye.	

E8 Probability

	Extended curriculum	Notes/Examples
E8.1	Calculate the probability of a single event as either a fraction, decimal or percentage.	Problems could be set involving extracting information from tables or graphs.
E8.2	Understand and use the probability scale from 0 to 1.	
E8.3	Understand that the probability of an event occurring = 1 – the probability of the event not occurring.	
E8.4	Understand relative frequency as an estimate of probability.	
E8.5	Calculate the probability of simple combined events, using possibility diagrams and tree diagrams where appropriate.	In possibility diagrams, outcomes will be represented by points on a grid, and in tree diagrams, outcomes will be written at the end of branches and probabilities by the side of the branches.

E9 Statistics

	Extended curriculum	Notes/Examples
E9.1	Collect, classify and tabulate statistical data. Read, interpret and draw simple inferences from tables and statistical diagrams.	
E9.2	Construct and read bar charts, pie charts, pictograms, simple frequency distributions, histograms with equal and unequal intervals and scatter diagrams.	For unequal intervals on histograms, areas are proportional to frequencies and the vertical axis is labelled 'frequency density'.
E9.3	Calculate the mean, median, mode and range for individual and discrete data and distinguish between the purposes for which they are used.	
E9.4	Calculate an estimate of the mean for grouped and continuous data. Identify the modal class from a grouped frequency distribution.	
E9.5	Construct and use cumulative frequency diagrams. Estimate and interpret the median, percentiles, quartiles and inter-quartile range.	
E9.6	Understand what is meant by positive, negative and zero correlation with reference to a scatter diagram.	
E9.7	Draw a straight line of best fit by eye.	