Cambridge Secondary 2

Cambridge IGCSE

Syllabus

Cambridge IGCSE®
Mathematics 0580

For examination in June and November 2019.
Also available for examination in March 2019 for India only.

Version 1

CAMBRIDGE International Examinations

Why choose Cambridge?

Cambridge International Examinations prepares school students for life, helping them develop an informed curiosity and a lasting passion for learning. We are part of Cambridge Assessment, a department of the University of Cambridge.

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'We think the Cambridge curriculum is superb preparation for university.'

Christoph Guttentag, Dean of Undergraduate Admissions, Duke University, USA

Quality management

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Contents

Changes to this syllabus

For information on changes to this syllabus for 2019, see page 37

The latest syllabus is version 1, published September 2016. There are no significant changes which affect teaching.

Any textbooks endorsed to support the syllabus for examination from 2017 are still suitable for use with this syllabus.

1 Why choose this syllabus?

Key benefits

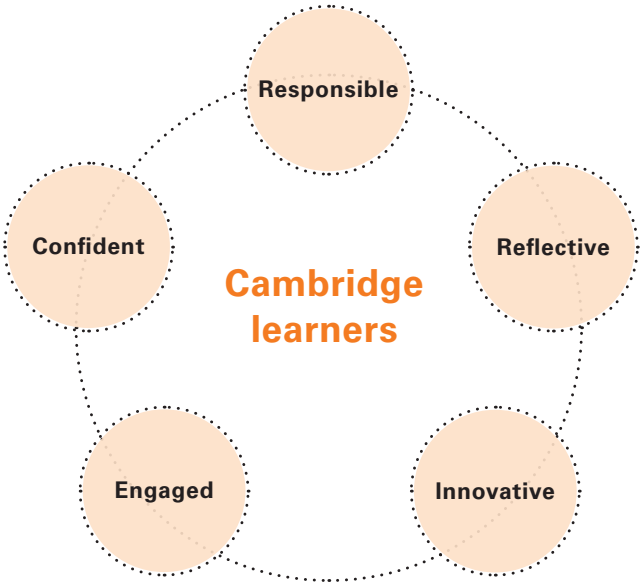
Cambridge IGCSE® syllabuses are created especially for international students. For over 25 years, we have worked with schools and teachers worldwide to develop syllabuses that are suitable for different countries, different types of schools and for learners with a wide range of abilities.

Cambridge IGCSE Mathematics learners gain lifelong benefits, including:

- the development of their mathematical knowledge
- confidence, by developing a feel for numbers, patterns and relationships
- an ability to consider and solve problems and present and interpret results
- skills in communication and reasoning using mathematical concepts
- a solid foundation for further study.

Our programmes balance a thorough knowledge and understanding of a subject and help to develop the skills learners need for their next steps in education or employment.

Our approach encourages learners to be:



'The strength of Cambridge IGCSE qualifications is internationally recognised and has provided an international pathway for our students to continue their studies around the world.'

Gary Tan, Head of Schools and CEO, Raffles International Group of Schools, Indonesia

Recognition and progression

The combination of knowledge and skills in Cambridge IGCSE Mathematics gives learners a solid foundation for further study. Candidates who achieve grades A* to C are well prepared to follow a wide range of courses including Cambridge International AS & A Level Mathematics.

Cambridge IGCSEs are accepted and valued by leading universities and employers around the world as evidence of academic achievement. Many universities require a combination of Cambridge International AS & A Levels and Cambridge IGCSEs to meet their entry requirements.

Learn more at **www.cie.org.uk/recognition**

Supporting teachers

We provide a wide range of practical resources, detailed guidance and innovative training and professional development so that you can give your learners the best possible preparation for Cambridge IGCSE.

Support for Cambridge IGCSE

Teaching resources

- Syllabus
- Scheme of work
- Learner guide
- Endorsed textbooks and digital resources
- Teacher support **teachers.cie.org.uk**
- Discussion forum
- Resource List

Exam preparation resources

- Question papers
- Mark schemes
- Example candidate responses to understand what examiners are looking for at key grades
- Examiner reports to improve future teaching

Training

- Face-to-face workshops around the world
- Online self-study training
- Online tutor-led training
- Professional development qualifications

Community

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‘Cambridge IGCSE is one of the most sought-after and recognised qualifications in the world. It is very popular in Egypt because it provides the perfect preparation for success at advanced level programmes.’

Mrs Omnia Kassabgy, Managing Director of British School in Egypt BSE

2 Syllabus overview

Aims

The syllabus aims summarise the context in which you should view the syllabus content and describe the purposes of a course based on this syllabus. They are not listed in order of priority.

The aims are to enable candidates to:

- develop their mathematical knowledge and oral, written and practical skills in a way which encourages confidence and provides satisfaction and enjoyment
- read mathematics, and write and talk about the subject in a variety of ways
- develop a feel for number, carry out calculations and understand the significance of the results obtained
- apply mathematics in everyday situations and develop an understanding of the part which mathematics plays in the world around them
- solve problems, present the solutions clearly, check and interpret the results
- develop an understanding of mathematical principles
- recognise when and how a situation may be represented mathematically, identify and interpret relevant factors and, where necessary, select an appropriate mathematical method to solve the problem
- use mathematics as a means of communication with emphasis on the use of clear expression
- develop an ability to apply mathematics in other subjects, particularly science and technology
- develop the abilities to reason logically, to classify, to generalise and to prove
- appreciate patterns and relationships in mathematics
- produce and appreciate imaginative and creative work arising from mathematical ideas
- develop their mathematical abilities by considering problems and conducting individual and co-operative enquiry and experiment, including extended pieces of work of a practical and investigative kind
- appreciate the interdependence of different branches of mathematics
- acquire a foundation appropriate to their further study of mathematics and of other disciplines.

Content

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

All candidates will study the following topics:

1 Number
2 Algebra and graphs
3 Geometry
4 Mensuration
5 Co-ordinate geometry
6 Trigonometry
7 Matrices and transformations
8 Probability
9 Statistics

The study of mathematics offers opportunities for the use of ICT, particularly spreadsheets and graph-drawing packages. For example, spreadsheets may be used in the work on percentages (C1.12 and E1.12), personal and small business finance (C1.16 and E1.16), algebraic formulae (C2.1 and E2.1), statistics (C9 and E9), etc. Graph-drawing packages may be used in the work on graphs in practical situations and graphs of functions (C2 and E2), statistics (C9 and E9), etc. It is important to note that use or knowledge of ICT will **not** be assessed in the examination papers.

Although use of an electronic calculator is permitted on all examination papers, candidates should develop a full range of mental and non-calculator skills during the course of study. Questions demonstrating the mastery of such skills may be asked in the examination.

As well as demonstrating skill in the techniques listed in section 3, 'Subject content', candidates will be expected to apply them in the solution of problems.

The weightings in the assessment of the main topic areas of Mathematics are shown in the table below:

Components	Number %	Algebra %	Space and shape %	Statistics and probability %
Core (Papers 1 and 3)	30–35	20–25	30–35	10–15
Extended (Papers 2 and 4)	15–20	35–40	30–35	10–15

Teacher support for Cambridge IGCSE Mathematics

We provide a wide range of support resources to give your learners the best possible preparation for Cambridge programmes and qualifications. Support for IGCSE Mathematics includes a Scheme of Work and Example Candidate Responses. These and other resources are available online through Teacher Support at **https://teachers.cie.org.uk**

Assessment

All candidates take two papers.

Candidates who have studied the Core syllabus content, or who are expected to achieve a grade D or below should be entered for Paper 1 and Paper 3. These candidates will be eligible for grades C to G.

Candidates who have studied the Extended syllabus content, and who are expected to achieve a grade C or above should be entered for Paper 2 and Paper 4. These candidates will be eligible for grades A* to E.

Core candidates take:

Paper 1 Core 1 hour
56 marks 35%

Short-answer questions based on the Core curriculum

Externally marked

and:

Paper 3 Core 2 hours
104 marks 65%

Structured questions based on the Core curriculum

Externally marked.

Extended candidates take:

Paper 2 Extended 1 hour 30 minutes
70 marks 35%

Short-answer questions based on the Extended curriculum

Externally marked

and:

Paper 4 Extended 2 hours 30 minutes
130 marks 65%

Structured questions based on the Extended curriculum

Externally marked.

- Candidates should have an electronic calculator for all papers. Algebraic or graphical calculators are not permitted. Three significant figures will be required in answers except where otherwise stated.
- Candidates should use the value of π from their calculators if their calculator provides this. Otherwise, they should use the value of 3.142 given on the front page of the question paper only.
- Tracing paper may be used as an additional material for all of the written papers.

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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. Definition of sets e.g. $A = \{x: x \text{ is a natural number}\}$ $B = \{(x,y): y = mx + c\}$ $C = \{x: a \leqslant x \leqslant b\}$ $D = \{a, b, c, \ldots\}$	Notation 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. Value of investment = $P\left(1+\frac{r}{100}\right)^n$ where P is the amount invested, r is the percentage rate of interest and n is the number of years of compound interest.
	Extract data from tables and charts.	
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. $\frac{x}{3} + \frac{x-4}{2}$, $\frac{2x}{3} - \frac{3(x-5)}{2}$, $\frac{3a}{4} \times \frac{9a}{10}$, $\frac{3a}{4} \div \frac{9a}{10}$, $\frac{1}{x-2} + \frac{2}{x-3}$
	Factorise and simplify rational expressions.	e.g. $\frac{x^2 - 2x}{x^2 - 5x + 6}$
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 $3x^{-4} \times \frac{2}{3}x^{\frac{1}{2}}$ $\frac{2}{5}x^{\frac{1}{2}} \div 2x^{-2}$ $\left(\frac{2x^5}{3}\right)^3$
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: • 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.	Candidates will be expected to use the correct geometrical terminology when giving reasons for answers.
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

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.

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.

Notes/Examples continued

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

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. Solve trigonometrical problems in two dimensions involving angles of elevation and depression. Extend sine and cosine values to angles between 90° and 180°.	Angles will be quoted in, and answers required in, degrees and decimals to one decimal place.
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.	Positive, fractional and negative scale factors for enlargements.
	Recognise and describe reflections, rotations, translations and enlargements.	Positive, fractional and negative scale factors for enlargements.
E7.3	Calculate the magnitude of a vector $\begin{pmatrix} x \\ y \end{pmatrix}$ as $\sqrt{x^2 + y^2}$.	Vectors will be printed as $\overrightarrow{AB}$ or **a** and their magnitudes denoted by modulus signs, e.g. $\lvert\overrightarrow{AB}\rvert$ or $\lvert\mathbf{a}\rvert$.
	Represent vectors by directed line segments.	
	Use the sum and difference of two vectors to express given vectors in terms of two coplanar vectors.	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 a.
	Use position vectors.	
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 I**A**I and inverse $\mathbf{A}^{-1}$ 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.	If M(a) = b and R(b) = c, the notation RM(a) = c will be used. Invariants under these transformations may be assumed.
	Identify and give precise descriptions of transformations connecting given figures.	
	Describe transformations using co-ordinates and matrices (singular matrices are excluded).	

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.	

4 Details of the assessment

For information on the Assessment objectives (AOs), see section 5.

Core Assessment

Paper 1 – Core

1 hour, 56 marks
Candidates answer **all** questions.
This paper consists of short-answer questions based on the Core curriculum.
This is a compulsory component for Core candidates.
This written paper is an externally set assessment, marked by Cambridge.

Paper 3 – Core

2 hours, 104 marks
Candidates answer **all** questions.
This paper consists of structured questions based on the Core curriculum.
This is a compulsory component for Core candidates.
This written paper is an externally set assessment, marked by Cambridge.

Extended Assessment

Paper 2 – Extended

1 hour 30 minutes, 70 marks
Candidates answer **all** questions.
This paper consists of short-answer questions based on the Extended curriculum.
This is a compulsory component for Extended candidates.
This written paper is an externally set assessment, marked by Cambridge.

Paper 4 – Extended

2 hours 30 minutes, 130 marks
Candidates answer **all** questions.
This paper consists of structured questions based on the Extended curriculum.
This is a compulsory component for Extended candidates.
This written paper is an externally set assessment, marked by Cambridge.

5 Assessment objectives

The assessment objectives (AOs) are:

AO1 Mathematical techniques

AO2 Applying mathematical techniques to solve problems

AO1 Mathematical techniques

Candidates should be able to:

- organise, interpret and present information accurately in written, tabular, graphical and diagrammatic forms
- perform calculations by suitable methods
- use an electronic calculator and also perform some straightforward calculations without a calculator
- understand systems of measurement in everyday use and make use of them in the solution of problems
- estimate, approximate and work to degrees of accuracy appropriate to the context and convert between equivalent numerical forms
- use mathematical and other instruments to measure and to draw to an acceptable degree of accuracy
- interpret, transform and make appropriate use of mathematical statements expressed in words or symbols
- recognise and use spatial relationships in two and three dimensions, particularly in solving problems
- recall, apply and interpret mathematical knowledge in the context of everyday situations.

AO2 Applying mathematical techniques to solve problems

In questions which are set in context and/or which require a sequence of steps to solve, candidates should be able to:

- make logical deductions from given mathematical data
- recognise patterns and structures in a variety of situations, and form generalisations
- respond to a problem relating to a relatively unstructured situation by translating it into an appropriately structured form
- analyse a problem, select a suitable strategy and apply an appropriate technique to obtain its solution
- apply combinations of mathematical skills and techniques in problem solving
- set out mathematical work, including the solution of problems, in a logical and clear form using appropriate symbols and terminology.

Weighting for assessment objectives

The approximate weightings allocated to each of the assessment objectives (AOs) are summarised below.

Assessment objectives as a percentage of the Core qualification

Assessment objective	Weighting in IGCSE %
AO1 Mathematical techniques	75–85
AO2 Applying mathematical techniques to solve problems	15–25

Assessment objectives as a percentage of the Extended qualification

Assessment objective	Weighting in IGCSE %
AO1 Mathematical techniques	40–50
AO2 Applying mathematical techniques to solve problems	50–60

Assessment objectives as a percentage of each component

Assessment objective	Weighting in components %			
	Paper 1	Paper 2	Paper 3	Paper 4
AO1 Mathematical techniques	75–85	40–50	75–85	40–50
AO2 Applying mathematical techniques to solve problems	15–25	50–60	15–25	50–60

6 What else you need to know

This section is an overview of other information you need to know about this syllabus. It will help to share the administrative information with your exams officer so they know when you will need their support. Find more information about our administrative processes at **www.cie.org.uk/examsofficers**

Before you start

Previous study

We recommend that learners starting this course should have studied a mathematics curriculum such as the Cambridge Secondary 1 programme or equivalent national educational framework.

Guided learning hours

We design Cambridge IGCSE syllabuses based on learners having about 130 guided learning hours for each subject during the course. The number of hours a learner needs to achieve the qualification will vary according to local practice and their previous experience of the subject.

Availability and timetables

You can enter candidates in the June and November exam series. If your school is in India, you can enter your candidates in the March exam series. You can view the timetable for your administrative zone at **www.cie.org.uk/timetables**

Private candidates can enter for this syllabus.

Combining with other syllabuses

Candidates can take this syllabus alongside other Cambridge syllabuses in a single exam series. The only exceptions are:

- Cambridge IGCSE (9–1) Mathematics (0626)
- Cambridge IGCSE International Mathematics (0607)
- syllabuses with the same title at the same level.

Cambridge IGCSE, Cambridge IGCSE (9–1) (Level 1/Level 2 Certificates) and Cambridge O Level syllabuses are at the same level.

Group awards: Cambridge ICE

Cambridge ICE (International Certificate of Education) is a group award for Cambridge IGCSE. It allows schools to offer a broad and balanced curriculum by recognising the achievements of learners who pass examinations in a range of different subjects.

Learn more about Cambridge ICE at **www.cie.org.uk/cambridgesecondary2**

Making entries

Exams officers are responsible for submitting entries to Cambridge. We encourage them to work closely with you to make sure they enter the right number of candidates for the right combination of syllabus components. Entry option codes and instructions for submitting entries are in the *Cambridge Guide to Making Entries*. Your exams officer has a copy of this guide.

Option codes for entries

To keep our exams secure we allocate all Cambridge schools to one of six administrative zones. Each zone has a specific timetable. The majority of option codes have two digits:

- the first digit is the component number given in the syllabus
- the second digit is the location code, specific to an administrative zone.

Support for exams officers

We know how important exams officers are to the successful running of exams. We provide them with the support they need to make your entries on time. Your exams officer will find this support, and guidance for all other phases of the Cambridge Exams Cycle, at **www.cie.org.uk/examsofficers**

Retakes

Candidates can retake the whole qualification as many times as they want to. This is a linear qualification so candidates cannot re-sit individual components.

Equality and inclusion

We have taken great care to avoid bias of any kind in the preparation of this syllabus and related assessment materials. In compliance with the UK Equality Act (2010) we have designed this qualification to avoid any direct and indirect discrimination.

The standard assessment arrangements may present unnecessary barriers for candidates with disabilities or learning difficulties. We can put arrangements in place for these candidates to enable them to access the assessments and receive recognition of their attainment. We do not agree access arrangements if they give candidates an unfair advantage over others or if they compromise the standards being assessed.

Candidates who cannot access the assessment of any component may be able to receive an award based on the parts of the assessment they have completed.

Information on access arrangements is in the *Cambridge Handbook* at **www.cie.org.uk/examsofficers**

Language

This syllabus and the related assessment materials are available in English only.

After the exam

Grading and reporting

Grades A*, A, B, C, D, E, F or G indicate the standard a candidate achieved at Cambridge IGCSE.

A* is the highest and G is the lowest. 'Ungraded' means that the candidate's performance did not meet the standard required for grade G. 'Ungraded' is reported on the statement of results but not on the certificate. In specific circumstances your candidates may see one of the following letters on their statement of results:

- Q (result pending)
- X (no result)
- Y (to be issued)

These letters do not appear on the certificate.

Grade descriptions

Grade descriptions are provided to give an indication of the standards of achievement candidates awarded particular grades are likely to show. Weakness in one aspect of the examination may be balanced by a better performance in some other aspect.

A **Grade A** Cambridge IGCSE Mathematics candidate will be able to:

- make clear, concise and accurate statements, demonstrating ease and confidence in the use of symbolic forms and accuracy of arithmetic manipulation
- apply the mathematics they know in familiar and unfamiliar contexts
- apply their knowledge of rounding to determining the bounds of intervals, including in calculations of, for example, areas
- understand and use direct and inverse proportion
- demonstrate an understanding of percentages by relating percentage change to a multiplying factor and vice versa, e.g. multiplication by 1.03 results in a 3 per cent increase
- apply knowledge of the four rules for fractions to simplifying algebraic fractions
- apply algebraic manipulation to linear, simultaneous and quadratic equations
- use positive, negative and fractional indices in both numerical and algebraic work, and interpret the description of a situation in terms of algebraic formulae and equations
- apply their knowledge of graphs of algebraic functions to the intersections and gradients of these graphs
- apply knowledge of scale factors to two and three dimensions and apply to calculating lengths, areas and volumes between actual values and scale models
- apply knowledge of right-angled trigonometry to three-dimensional situations as well as demonstrate an understanding of how to solve problems on non-right-angled triangles
- process data, discriminating between necessary and redundant information
- use graphs in practical situations to make quantitative and qualitative deductions from distance-time and speed-time graphs.

A **Grade C** Cambridge IGCSE Mathematics candidate will be able to:

- demonstrate insight into the mathematical structures of problems, enabling them to justify generalisations, arguments or solutions
- use mathematical presentation and stages of derivations in order to generate fuller solutions
- appreciate the difference between mathematical explanation and experimental evidence
- apply the four rules of number to positive and negative integers, fractions and decimal fractions, in order to solve problems
- apply their understanding of percentage to problems involving one quantity as a percentage of another and its application to percentage change
- carry out calculations involving several operations and demonstrate fluent and efficient use of calculators, as well as giving reasonable approximations
- appreciate the relationship between decimal and standard form of a number and apply to positive and negative powers of 10
- show familiarity with the differences between simple and compound interest and apply this to calculating both
- apply their knowledge of sequences to recognise, and in simple cases formulate, rules for generating a pattern or sequence
- solve linear equations involving appropriate algebraic manipulation, and solve simple simultaneous equations in two unknowns
- transform simple formulae and work with other formulae involving substitution, and evaluate the remaining term
- use brackets and common factor factorisation
- plot points on graphs from given values and use them to draw and interpret graphs in practical situations, including travel and conversion graphs and algebraic graphs of linear and quadratic functions
- apply knowledge of perimeter and area to circles
- appreciate and use area and volume units in relation to finding the volume and surface area of a prism and cylinder
- demonstrate construction work, with appropriate geometrical instruments, and apply to accurate scale diagrams to solve a two-dimensional problem
- understand and apply Pythagoras' theorem and trigonometry of right-angled triangles to solving, by calculation, problems in a variety of contexts
- calculate angles in a variety of geometrical figures, including polygons and to some extent circles, from straightforward diagrams
- use a frequency table to construct a pie chart
- understand and construct a scatter diagram and apply this to a judgement of the correlation existing between two quantities.

A **Grade F** Cambridge IGCSE Mathematics candidate will be able to:

- identify and obtain necessary information
- recognise whether their solutions to problems are sensible
- understand simple situations in order to describe them, using symbols, words and diagrams
- draw simple, basic conclusions with explanations where appropriate
- use an understanding of place value to perform calculations using the four rules on positive integers and decimal fractions (one operation only), using a calculator where necessary
- convert between fractions, decimals and percentages for the purpose of comparing quantities between 0 and 1 in a variety of forms, and reduce a fraction to its simplest form
- appreciate the idea of direct proportion and solve simple problems involving ratio
- use basic knowledge of percentage to apply to simple problems involving percentage parts of quantities
- understand and apply metric units of length, mass and capacity, together with conversion between units in these areas of measure
- recognise and continue a straightforward pattern in sequences and understand the terms multiples, factors and squares as a foundation to higher grade levels of applications in the areas of number and algebra
- use a very basic knowledge of algebra to construct simple algebraic expressions, substitute numbers for letters and evaluate simple formulae
- appreciate how a simple linear equation can represent a practical situation and be able to solve such equations
- use a basic knowledge of names and recognition of simple plane figures and common solids to understand shape and space, and apply to the perimeter and area of a rectangle and other rectilinear shapes
- use geometrical instruments – ruler, protractor and compasses – to measure lengths and angles and draw a triangle given three sides
- read data from a variety of sources and be able to extract data from them, in particular timetables
- tabulate data in order to form frequency tables and draw a bar chart
- plot given points on a graph and read a travel graph
- calculate the mean, given a set of numbers.

Changes to this syllabus for 2019

The syllabus has been updated. The latest syllabus is version 1, published September 2016.

This docuent has been refreshed and rebranded. The subject content and the specimens remain the same.

Minor changes to the wording of some sections have been made to improve clarity.

Any textbooks endorsed to support the syllabus for examination from 2016 are still suitable for use with this syllabus.

‘While studying Cambridge IGCSE and Cambridge International A Levels, students broaden their horizons through a global perspective and develop a lasting passion for learning.’

Zhai Xiaoning, Deputy Principal, The High School Affiliated to Renmin University of China

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