SYLLABUS

Cambridge IGCSE®
Mathematics

0580

For examination in June and November 2017 and 2018.
Also available for examination in March 2017 and 2018
for India only.

Contents

1. Introduction

1.1 Why choose Cambridge?

Cambridge International Examinations is part of the University of Cambridge. We prepare school students for life, helping them develop an informed curiosity and a lasting passion for learning. Our international qualifications are recognised by the world's best universities and employers, giving students a wide range of options in their education and career. As a not-for-profit organisation, we devote our resources to delivering high-quality educational programmes that can unlock learners' potential.

Our programmes set the global standard for international education. They are created by subject experts, are rooted in academic rigour, and provide a strong platform for progression. Over 10 000 schools in 160 countries work with us to prepare nearly a million learners for their future with an international education from Cambridge.

Cambridge learners

Cambridge programmes and qualifications develop not only subject knowledge but also skills. We encourage Cambridge learners to be:

- **confident** in working with information and ideas – their own and those of others
- **responsible** for themselves, responsive to and respectful of others
- **reflective** as learners, developing their ability to learn
- **innovative** and equipped for new and future challenges
- **engaged** intellectually and socially, ready to make a difference.

Recognition

Cambridge IGCSE is recognised by leading universities and employers worldwide, and is an international passport to progression and success. It provides a solid foundation for moving on to higher level studies. Learn more at **www.cie.org.uk/recognition**

Support for teachers

A wide range of materials and resources is available to support teachers and learners in Cambridge schools. Resources suit a variety of teaching methods in different international contexts. Through subject discussion forums and training, teachers can access the expert advice they need for teaching our qualifications. More details can be found in Section 2 of this syllabus and at **www.cie.org.uk/teachers**

Support for exams officers

Exams officers can trust in reliable, efficient administration of exams entries and excellent personal support from our customer services. Learn more at **www.cie.org.uk/examsofficers**

Our systems for managing the provision of international qualifications and education programmes for learners aged 5 to 19 are certified as meeting the internationally recognised standard for quality management, ISO 9001:2008. Learn more at **www.cie.org.uk/ISO9001**

1.2   Why choose Cambridge IGCSE?

Cambridge IGCSEs are international in outlook, but retain a local relevance. The syllabuses provide opportunities for contextualised learning and the content has been created to suit a wide variety of schools, avoid cultural bias and develop essential lifelong skills, including creative thinking and problem-solving.

Our aim is to balance knowledge, understanding and skills in our programmes and qualifications to enable students to become effective learners and to provide a solid foundation for their continuing educational journey.

Through our professional development courses and our support materials for Cambridge IGCSEs, we provide the tools to enable teachers to prepare learners to the best of their ability and work with us in the pursuit of excellence in education.

Cambridge IGCSEs are considered to be an excellent preparation for Cambridge International AS and A Levels, the Cambridge AICE (Advanced International Certificate of Education) Group Award, Cambridge Pre-U, and other education programmes, such as the US Advanced Placement program and the International Baccalaureate Diploma programme. Learn more about Cambridge IGCSEs at **www.cie.org.uk/cambridgesecondary2**

Guided learning hours

Cambridge IGCSE syllabuses are designed on the assumption that learners have about 130 guided learning hours per subject over the duration of the course, but this is for guidance only. The number of hours required to gain the qualification may vary according to local curricular practice and the learners' prior experience of the subject.

1.3   Why choose Cambridge IGCSE Mathematics?

Cambridge IGCSE Mathematics is accepted by universities and employers as proof of mathematical knowledge and understanding. Successful Cambridge IGCSE Mathematics candidates 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.

Prior learning

We recommend that learners who are beginning this course should have previously studied an appropriate lower secondary mathematics programme.

Progression

Cambridge IGCSEs are general qualifications that enable learners to progress directly to employment or to proceed to further qualifications.

Candidates who are awarded grades A* to C in Cambridge IGCSE Mathematics Extended curriculum are well prepared to follow courses leading to Cambridge International AS and A Level Mathematics, or the equivalent.

There are a number of mathematics syllabuses at both Cambridge IGCSE and Cambridge International AS and A Level offered by Cambridge. Find out more at **www.cie.org.uk**

1.4   Cambridge ICE (International Certificate of Education)

Cambridge ICE is a group award for Cambridge IGCSE. It gives schools the opportunity to benefit from offering a broad and balanced curriculum by recognising the achievements of learners who pass examinations in a number of different subjects.

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

1.5   How can I find out more?

If you are already a Cambridge school

You can make entries for this qualification through your usual channels. If you have any questions, please contact us at **info@cie.org.uk**

If you are not yet a Cambridge school

Learn about the benefits of becoming a Cambridge school at **www.cie.org.uk/startcambridge**. Email us at **info@cie.org.uk** to find out how your organisation can register to become a Cambridge school.

2.   Teacher support

2.1   Support materials

We send Cambridge syllabuses, past question papers and examiner reports to cover the last examination series to all Cambridge schools.

You can also go to our public website at **www.cie.org.uk/igcse** to download current and future syllabuses together with specimen papers or past question papers and examiner reports from one series.

For teachers at registered Cambridge schools a range of additional support materials for specific syllabuses is available from Teacher Support, our secure online support for Cambridge teachers. Go to **http://teachers.cie.org.uk** (username and password required).

2.2   Endorsed resources

We work with publishers providing a range of resources for our syllabuses including print and digital materials. Resources endorsed by Cambridge go through a detailed quality assurance process to ensure they provide a high level of support for teachers and learners.

We have resource lists which can be filtered to show all resources, or just those which are endorsed by Cambridge. The resource lists include further suggestions for resources to support teaching.

2.3   Training

We offer a range of support activities for teachers to ensure they have the relevant knowledge and skills to deliver our qualifications. See **www.cie.org.uk/events** for further information.

3.   Syllabus content at a glance

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

Centres are reminded that 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.

Centres are also reminded that, 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 6, 'Syllabus content', candidates will be expected to apply them in the solution of problems.

4.   Assessment at a glance

Cambridge IGCSE Mathematics is assessed via two components. All candidates take **two** written papers. Candidates who follow the Core curriculum take Papers 1 and 3 and are eligible for grades C to G. Candidates who follow the Extended curriculum take Papers 2 and 4 and are eligible for grades A* to E.

Component		Weighting
Paper 1 (Core) **1 hour** Short-answer questions based on the Core curriculum. 56 marks. Externally marked.		35%
Paper 2 (Extended) **1 hour 30 minutes** Short-answer questions based on the Extended curriculum. 70 marks. Externally marked.		35%
Paper 3 (Core) **2 hours** Structured questions based on the Core curriculum. 104 marks. Externally marked.		65%
Paper 4 (Extended) **2 hours 30 minutes** Structured questions based on the Extended curriculum. 130 marks. Externally marked.		65%

- 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.

Availability

This syllabus is examined in the June and November examination series. This syllabus is also available for examination in March for India only.

This syllabus is available to private candidates.

Detailed timetables are available from **www.cie.org.uk/examsofficers**

Combining this with other syllabuses

Candidates can combine this syllabus in an examination series with any other Cambridge syllabus, except:

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

Please note that Cambridge IGCSE, Cambridge International Level 1/Level 2 Certificates and Cambridge O Level syllabuses are at the same level.

5. Syllabus aims and assessment objectives

5.1 Syllabus aims

The aims of the curriculum are the same for all candidates. The aims are set out below and describe the educational purposes of a course in mathematics for the Cambridge IGCSE examination. They are not listed in order of priority.

The aims are to enable candidates to:

1. develop their mathematical knowledge and oral, written and practical skills in a way which encourages confidence and provides satisfaction and enjoyment
2. read mathematics, and write and talk about the subject in a variety of ways
3. develop a feel for number, carry out calculations and understand the significance of the results obtained
4. apply mathematics in everyday situations and develop an understanding of the part which mathematics plays in the world around them
5. solve problems, present the solutions clearly, check and interpret the results
6. develop an understanding of mathematical principles
7. 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
8. use mathematics as a means of communication with emphasis on the use of clear expression
9. develop an ability to apply mathematics in other subjects, particularly science and technology
10. develop the abilities to reason logically, to classify, to generalise and to prove
11. appreciate patterns and relationships in mathematics
12. produce and appreciate imaginative and creative work arising from mathematical ideas
13. 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
14. appreciate the interdependence of different branches of mathematics
15. acquire a foundation appropriate to their further study of mathematics and of other disciplines.

5.2 Assessment objectives

The two assessment objectives in Cambridge IGCSE Mathematics 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.

5.3 Relationship between assessment objectives and components

The relationship between the assessment objectives and the scheme of assessment is shown in the tables below.

Assessment objective	Paper 1 (marks)	Paper 3 (marks)	Core assessment
AO1: Mathematical techniques	42–48	78–88	75–85%
AO2: Applying mathematical techniques to solve problems	8–14	16–26	15–25%

Assessment objective	Paper 2 (marks)	Paper 4 (marks)	Extended assessment
AO1: Mathematical techniques	28–35	52–65	40–50%
AO2: Applying mathematical techniques to solve problems	35–42	65–78	50–60%

The weightings 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%

5.4 Grade descriptions

Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of a candidate's performance in the examination may be balanced by a better performance in others.

Grade F

At this level, candidates are expected to identify and obtain necessary information. They would be expected to recognise if their solutions to problems are sensible. An understanding of simple situations should enable candidates to describe them, using symbols, words and diagrams. They draw simple, basic conclusions with explanations where appropriate.

- With an understanding of place value, candidates should be able to perform calculations using the four rules on positive integers and decimal fractions (one operation only), using a calculator where necessary. They should be able to 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. Candidates should appreciate the idea of direct proportion and the solution of simple problems involving ratio should be expected. Basic knowledge of percentage is needed to apply to simple problems involving percentage parts of quantities. They need to understand and apply metric units of length, mass and capacity, together with conversion between units in these areas of measure. The ability to recognise and continue a straightforward pattern in sequences and understand the terms multiples, factors and squares is needed as a foundation to higher grade levels of applications in the areas of number and algebra.

- At this level, the algebra is very basic, involving the construction of simple algebraic expressions, substituting numbers for letters and evaluating simple formulae. Candidates should appreciate how a simple linear equation can represent a practical situation and be able to solve such equations.

- Knowledge of names and recognition of simple plane figures and common solids is basic to an understanding of shape and space. This will be applied to the perimeter and area of a rectangle and other rectilinear shapes. The skill of using geometrical instruments, ruler, protractor and compasses is required for applying to measuring lengths and angles and drawing a triangle given three sides.

- Candidates should be familiar with reading data from a variety of sources and be able to extract data from them, in particular timetables. The tabulation of the data is expected in order to form frequency tables and draw a bar chart. They will need the skill of plotting given points on a graph and reading a travel graph. From a set of numbers, they should be able to calculate the mean.

Grade C

At this level, candidates are expected to show some insight into the mathematical structures of problems, which enables them to justify generalisations, arguments or solutions. Mathematical presentation and stages of derivations should be more extensive in order to generate fuller solutions. They should appreciate the difference between mathematical explanation and experimental evidence.

- Candidates should now apply the four rules of number to positive and negative integers, fractions and decimal fractions, in order to solve problems. Percentage should be extended to problems involving calculating one quantity as a percentage of another and its application to percentage change. Calculations would now involve several operations and allow candidates to demonstrate fluent and efficient use of calculators, as well as giving reasonable approximations. The relationship between decimal and standard form of a number should be appreciated and applied to positive and negative powers of 10. They should be familiar with the differences between simple and compound interest and apply this to calculating both.

- Candidates now need to extend their basic knowledge of sequences to recognise, and in simple cases formulate, rules for generating a pattern or sequence. While extending the level of difficulty of solving linear equations by involving appropriate algebraic manipulation, candidates are also expected to solve simple simultaneous equations in two unknowns. Work with formulae extends into harder substitution and evaluating the remaining term, as well as transforming simple formulae. The knowledge of basic algebra is extended to the use of brackets and common factor factorisation. On graph work, candidates should be able to plot points 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.

- Candidates are expected to extend perimeter and area beyond rectilinear shapes to circles. They are expected to appreciate and use area and volume units in relation to finding the volume and surface area of a prism and cylinder. The basic construction work, with appropriate geometrical instruments, should now be extended and applied to accurate scale diagrams to solve a two-dimensional problem. Pythagoras' theorem and trigonometry of right-angled triangles should be understood and applied to solving, by calculation, problems in a variety of contexts. The calculation of angles in a variety of geometrical figures, including polygons and to some extent circles, should be expected from straightforward diagrams.

- Candidates should be able to use a frequency table to construct a pie chart. They need to understand and construct a scatter diagram and apply this to a judgement of the correlation existing between two quantities.

Grade A

At this level, candidates should make clear, concise and accurate statements, demonstrating ease and confidence in the use of symbolic forms and accuracy of arithmetic manipulation. They should apply the mathematics they know in familiar and unfamiliar contexts.

- Candidates are expected to apply their knowledge of rounding to determining the bounds of intervals, which may follow calculations of, for example, areas. They should understand and use direct and inverse proportion. A further understanding of percentages should be evident by relating percentage change to change to a multiplying factor and vice versa, e.g. multiplication by 1.03 results in a 3% increase.

- Knowledge of the four rules for fractions should be applied to the simplification of algebraic fractions. Building on their knowledge of algebraic manipulation, candidates should be able to manipulate linear, simultaneous and quadratic equations. They should be able to 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. Their knowledge of graphs of algebraic functions should be extended to the intersections and gradients of these graphs.

- The basic knowledge of scale factors should be extended to two and three dimensions and applied to calculating lengths, areas and volumes between actual values and scale models. The basic right-angled trigonometry knowledge should be applied to three-dimensional situations as well as being extended to an understanding of and solving problems on non-right-angled triangles.

- At this level, candidates should be able to process data, discriminating between necessary and redundant information. The basic work on graphs in practical situations should be extended to making quantitative and qualitative deductions from distance-time and speed-time graphs.

6.   Syllabus 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. $A = \{x: x$ 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 $\qquad$ n(A) "…is an element of…" $\qquad$ $\in$ "…is not an element of…" $\qquad$ $\notin$ Complement of set A $\qquad$ A' The empty set $\qquad$ $\varnothing$ Universal set $\qquad$ $\mathscr{E}$ A is a subset of B $\qquad$ $A \subseteq B$ A is a proper subset of B $\qquad$ $A \subset B$ A is not a subset of B $\qquad$ $A \nsubseteq B$ A is not a proper subset of B $\qquad$ $A \not\subset B$ Union of A and B $\qquad$ $A \cup B$ Intersection of A and B $\qquad$ $A \cap B$
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. Use the standard form $A \times 10^n$ where n is a positive or negative integer, and $1 \leqslant A < 10$.	$5^{\frac{1}{2}} = \sqrt{5}$ Evaluate 5^{-2}, $100^{\frac{1}{2}}$, $8^{-\frac{2}{3}}$ Work out $2^{-3} \times 2^4$ 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
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
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. Obtain appropriate upper and lower bounds to solutions of simple problems given data to a specified accuracy.	e.g. measured lengths. e.g. the calculation of the perimeter or the area of a rectangle.
E1.11	Demonstrate an understanding of ratio and proportion. Increase and decrease a quantity by a given ratio. Use common measures of rate. Calculate average speed.	Divide a quantity in a given ratio. Direct and inverse proportion. Use scales in practical situations.
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. Extract data from tables and charts.	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.
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. Expand products of algebraic expressions. Factorise where possible expressions of the form: $ax + bx + kay + kby$ $a^2x^2 - b^2y^2$ $a^2 + 2ab + b^2$ $ax^2 + bx + c$	e.g. expand $3x(2x - 4y)$, $(x + 4)(x - 7)$ e.g. factorise $9x^2 + 15xy$
E2.3	Manipulate algebraic fractions. Factorise and simplify rational expressions.	e.g. $\dfrac{x}{3} + \dfrac{x-4}{2}$, $\dfrac{2x}{3} - \dfrac{3(x-5)}{2}$, $\dfrac{3a}{4} \times \dfrac{9a}{10}$, $\dfrac{3a}{4} \div \dfrac{9a}{10}$, $\dfrac{1}{x-2} + \dfrac{2}{x-3}$ 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. Use the rules of indices.	e.g. solve $32^x = 2$ e.g. simplify $3x^{-4} \times \dfrac{2}{3}x^{\frac{1}{2}}$ $\qquad\qquad \dfrac{2}{5}x^{\frac{1}{2}} \div 2x^{-2}$ $\qquad\qquad \left(\dfrac{2x^5}{3}\right)^3$
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
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 integral 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
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
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	Notes/Examples
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. 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. Recognise and describe reflections, rotations, translations and enlargements.	Positive and fractional scale factors for enlargements only. 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. $\lvert \overrightarrow{AB} \rvert$ or $\lvert \mathbf{a} \rvert$. 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 <u>a</u>.
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. 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.	

7. Other information

Equality and inclusion

Cambridge International Examinations has taken great care in the preparation of this syllabus and assessment materials to avoid bias of any kind. To comply with the UK Equality Act (2010), Cambridge has designed this qualification with the aim of avoiding direct and indirect discrimination.

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

Candidates who are unable to access the assessment of any component may be eligible to receive an award based on the parts of the assessment they have taken.

Information on access arrangements is found in the *Cambridge Handbook* which can be downloaded from the website **www.cie.org.uk/examsofficers**

Language

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

Grading and reporting

Cambridge IGCSE results are shown by one of the grades A*, A, B, C, D, E, F or G indicating the standard achieved, A* being the highest and G the lowest. 'Ungraded' indicates that the candidate's performance fell short of the standard required for grade G. 'Ungraded' will be reported on the statement of results but not on the certificate. The letters Q (result pending), X (no results) and Y (to be issued) may also appear on the statement of results but not on the certificate.

Entry codes

To maintain the security of our examinations, we produce question papers for different areas of the world, known as 'administrative zones'. Where the component entry code has 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. Information about entry codes can be found in the *Cambridge Guide to Making Entries*.