



# Syllabus

## Cambridge IGCSE®

### Mathematics 0580

For examination in June and November 2020, 2021 and 2022.  
Also available for examination in March 2020, 2021 and 2022 for India only.



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## Why choose Cambridge?

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

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 and qualifications set the global standard for international education. They are created by subject experts, rooted in academic rigour and reflect the latest educational research. They provide a strong platform for learners to progress from one stage to the next, and are well supported by teaching and learning resources.

Our mission is to provide educational benefit through provision of international programmes and qualifications for school education and to be the world leader in this field. Together with schools, we develop Cambridge learners who are confident, responsible, reflective, innovative and engaged – equipped for success in the modern world.

Every year, nearly a million Cambridge students from 10 000 schools in 160 countries prepare for their future with an international education from Cambridge International.

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

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

### Quality management

Our systems for managing the provision of international qualifications and education programmes for students aged 5 to 19 are certified as meeting the internationally recognised standard for quality management, ISO 9001:2008. Learn more at [www.cambridgeinternational.org/ISO9001](http://www.cambridgeinternational.org/ISO9001)



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## Changes to this syllabus

For information about changes to this syllabus for 2020, 2021 and 2022, go to page 41.



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# 1 Why choose this syllabus?

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## Key benefits

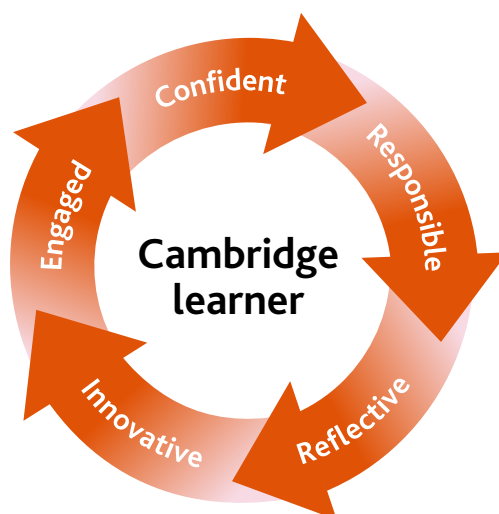
Cambridge IGCSE® syllabuses are created especially for international students. For over 25 years, we have worked with schools and teachers worldwide to develop syllabuses that are suitable for different countries, different types of schools and for learners with a wide range of abilities.

Cambridge IGCSE Mathematics supports learners in building competency, confidence and fluency in their use of techniques and mathematical understanding. This course helps learners to develop a feel for quantity, patterns and relationships. Learners will develop their reasoning, problem-solving and analytical skills in a variety of abstract and real-life contexts.

Cambridge IGCSE Mathematics provides a strong foundation of mathematical knowledge both for candidates studying mathematics at a higher level and those who will require mathematics to support skills in other subjects. The course is tiered to allow all candidates to achieve and progress in their mathematical studies.

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 perform well should be able to progress to the advanced study of mathematics. Teachers and learners should discuss anticipated achievement, taking into account learners' individual strengths in the subject.

From Cambridge IGCSE Mathematics learners can progress to Cambridge IGCSE Additional Mathematics or straight to Cambridge International AS & A Level Mathematics, or other qualifications at that level.

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 or equivalent to meet their entry requirements.

UK NARIC, the national agency in the UK for the recognition and comparison of international qualifications and skills, has carried out an independent benchmarking study of Cambridge IGCSE and found it to be comparable to the standard of GCSE in the UK. This means students can be confident that their Cambridge IGCSE qualifications are accepted as equivalent to UK GCSEs by leading universities worldwide.

Learn more at [www.cambridgeinternational.org/recognition](http://www.cambridgeinternational.org/recognition)

**'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

## 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.

### Teaching resources

- School Support Hub  
[www.cambridgeinternational.org/support](http://www.cambridgeinternational.org/support)
- Syllabus
- Scheme of work
- Learner guide
- Discussion forum
- Resource list
- Endorsed textbooks and digital resources

### 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

Support for  
Cambridge  
IGCSE

### Training

- Face-to-face workshops around the world
- Online self-study training
- Online tutor-led training
- Cambridge Professional Development Qualifications

### Community

You can find useful information, as well as share your ideas and experiences with other teachers, on our social media channels and community forums.

Find out more at  
[www.cambridgeinternational.org/social-media](http://www.cambridgeinternational.org/social-media)

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## 2 Syllabus overview

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### Aims

The aims describe the purposes of a course based on this syllabus.

The aims are to enable students to:

- develop an understanding of mathematical principles, concepts and methods in a way which encourages confidence, provides satisfaction and enjoyment, and develops a positive attitude towards mathematics
- develop a feel for number and understand the significance of the results obtained
- apply mathematics in everyday situations and develop an understanding of the part that mathematics plays in learners' own lives and the world around them
- analyse and solve problems, present the solutions clearly, and check and interpret the results
- recognise when and how a situation may be represented mathematically, identify and interpret relevant factors, select an appropriate mathematical method to solve the problem, and evaluate the method used
- use mathematics as a means of communication with emphasis on the use of clear expression and structured argument
- develop an ability to apply mathematics in other subjects, particularly science and technology
- develop the ability to reason logically, make deductions and inferences, and draw conclusions
- appreciate patterns and relationships in mathematics and make generalisations
- appreciate the interdependence of different areas of mathematics
- acquire a foundation for further study of mathematics or for other disciplines.



### Support for Cambridge IGCSE Mathematics

Our School Support Hub [www.cambridgeinternational.org/support](http://www.cambridgeinternational.org/support) provides Cambridge schools with a secure site for downloading specimen and past question papers, mark schemes, grade thresholds and other curriculum resources specific to this syllabus. The School Support Hub community offers teachers the opportunity to connect with each other and to ask questions related to the syllabus.

## Content overview

All candidates will study the following topics:

Number	Algebra	Shape and space	Probability and statistics
Number	Algebra and graphs	Geometry	Probability
	Coordinate geometry	Mensuration	Statistics
		Trigonometry	
		Vectors and transformations	

The course is tiered to enable effective differentiation for learners. The Core content is intended for learners targeting grades G–C, and the Extended content is intended for learners targeting grades D–A\*. All of the Core content is in the Extended content.

The subject content is organised by topic: number, algebra, shape and space, and probability and statistics. The content is not presented in a teaching order.

This content structure and the use of tiering allows flexibility for teachers to plan delivery appropriately for their learners.

Learners should be able to both use techniques listed in the content and apply them to solve problems.

Calculators are allowed throughout the assessment. Learners should know when and how to use their calculator, how to check their answers and how to apply rounding appropriately when solving a problem.

Learners should be able to show their working and be able to communicate mathematically, using appropriate notation and structure to communicate their reasoning within a problem.

Components	Number %	Algebra %	Shape and space %	Probability and statistics %
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



## Assessment overview

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  
35%

56 marks

Short-answer questions

Questions will be based on the Core curriculum

Externally assessed

### Extended candidates take:

**Paper 2 (Extended)** 1 hour 30 minutes  
35%

70 marks

Short-answer questions

Questions will be based on the Extended curriculum

Externally assessed

### and:

**Paper 3 (Core)** 2 hours  
65%

104 marks

Structured questions

Questions will be based on the Core curriculum

Externally assessed

### and:

**Paper 4 (Extended)** 2 hours 30 minutes  
65%

130 marks

Structured questions

Questions will be based on the Extended curriculum

Externally assessed

- Candidates should have a scientific calculator for all papers.
- Three significant figures will be required in answers (or one decimal place for answers in degrees) except where otherwise stated.
- Candidates should use the value of  $\pi$  from their calculator or the value of 3.142.

## Assessment objectives

The assessment objectives (AOs) are:

### AO1 Demonstrate knowledge and understanding of mathematical techniques

Candidates should be able to recall and apply mathematical knowledge, terminology and definitions to carry out routine procedures or straightforward tasks requiring single or multi-step solutions in mathematical or everyday situations including:

- organising, processing and presenting information accurately in written, tabular, graphical and diagrammatic forms
- using and interpreting mathematical notation correctly
- performing calculations and procedures by suitable methods, including using a calculator
- understanding systems of measurement in everyday use and making use of these
- estimating, approximating and working to degrees of accuracy appropriate to the context and converting between equivalent numerical forms
- using geometrical instruments to measure and to draw to an acceptable degree of accuracy
- recognising and using spatial relationships in two and three dimensions.

### AO2 Reason, interpret and communicate mathematically when solving problems

Candidates should be able to analyse a problem, select a suitable strategy and apply appropriate techniques to obtain its solution, including:

- making logical deductions, making inferences and drawing conclusions from given mathematical data
- recognising patterns and structures in a variety of situations, and forming generalisations
- presenting arguments and chains of reasoning in a logical and structured way
- interpreting and communicating information accurately and changing from one form of presentation to another
- assessing the validity of an argument and critically evaluating a given way of presenting information
- solving unstructured problems by putting them into a structured form involving a series of processes
- applying combinations of mathematical skills and techniques using connections between different areas of mathematics in problem solving
- interpreting results in the context of a given problem and evaluating the methods used and solutions obtained.

## 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 Demonstrate knowledge and understanding of mathematical techniques	60–70
AO2 Reason, interpret and communicate mathematically when solving problems	30–40

### Assessment objectives as a percentage of the Extended qualification

Assessment objective	Weighting in IGCSE %
AO1 Demonstrate knowledge and understanding of mathematical techniques	40–50
AO2 Reason, interpret and communicate mathematically when solving 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 Demonstrate knowledge and understanding of mathematical techniques	60–70	40–50	60–70	40–50
AO2 Reason, interpret and communicate mathematically when solving problems	30–40	50–60	30–40	50–60

## 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	Notes/Examples
	<b>Core curriculum</b>	
C1.1	Identify and use natural numbers, integers (positive, negative and zero), prime numbers, square and cube numbers, common factors and common multiples, rational and irrational numbers (e.g. $\pi$ , $\sqrt{2}$ ), real numbers, reciprocals.	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	Understand notation of Venn diagrams.  Definition of sets e.g. $A = \{x: x \text{ is a natural number}\}$ $B = \{a, b, c, \dots\}$	Notation Number of elements in set $A$ $n(A)$ Universal set $\mathcal{U}$ Union of $A$ and $B$ $A \cup B$ Intersection of $A$ and $B$ $A \cap B$
C1.3	Calculate with squares, square roots, cubes and cube roots and other powers and roots of numbers.	Work out $3^2 \times \sqrt[4]{16}$
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 $=, \neq, >, <, \geq, \leq$ .	
C1.7	Understand the meaning of indices (fractional, negative and zero) and use the rules of indices.  Use the standard form $A \times 10^n$ where $n$ is a positive or negative integer, and $1 \leq A < 10$ .	$5^{\frac{1}{2}} = \sqrt{5}$ Find the value of $5^{-2}$ , $100^{\frac{1}{2}}$ , $8^{-\frac{2}{3}}$ Work out $2^{-3} \times 2^4$ , $(2^3)^2$ , $(2^{-3} \div 2^4)$ 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 fractions (including mixed numbers and improper fractions), including correct ordering of operations and use of brackets.	Applies to positive and negative numbers.

E1	Number	Notes/Examples
	Extended curriculum	
E1.1	Identify and use natural numbers, integers (positive, negative and zero), prime numbers, square and cube numbers, common factors and common multiples, rational and irrational numbers (e.g. $\pi$ , $\sqrt{2}$ ), real numbers, reciprocals.	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. $A = \{x: x \text{ is a natural number}\}$ $B = \{(x, y): y = mx + c\}$ $C = \{x: a \leq x \leq b\}$ $D = \{a, b, c, \dots\}$	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 $\emptyset$ Universal set $\mathcal{U}$ $A$ is a subset of $B$ $A \subseteq B$ $A$ is a proper subset of $B$ $A \subset B$ $A$ is not a subset of $B$ $A \not\subseteq B$ $A$ 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 with squares, square roots, cubes and cube roots and other powers and roots of numbers.	Work out $3^2 \times \sqrt[4]{16}$
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 $=, \neq, >, <, \geq, \leq$ .	
E1.7	Understand the meaning of indices (fractional, negative and zero) and use the rules of indices.  Use the standard form $A \times 10^n$ where $n$ is a positive or negative integer, and $1 \leq A < 10$ .	$5^{\frac{1}{2}} = \sqrt{5}$ Find the value of $5^{-2}$ , $100^{\frac{1}{2}}$ , $8^{-\frac{2}{3}}$ Work out $2^{-3} \times 2^4$ , $(2^3)^2$ , $(2^{-3} \div 2^4)$ 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 fractions (including mixed numbers and improper fractions), including correct ordering of operations and use of brackets.	Applies to positive and negative numbers.

C1	Number	Notes/Examples
	Core curriculum 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. Calculate average speed. Use common measures of rate.	To include numerical problems involving direct and inverse proportion. Use ratio and scales in practical situations. Formulae for other rates will be given in the question e.g. pressure and density.
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 household finance involving earnings, simple interest and compound interest. Extract data from tables and charts.	Includes discount, profit and loss. Knowledge of compound interest formula <b>is</b> required.
C1.17	<i>Extended curriculum only.</i>	

E1	Number	Notes/Examples
	Extended curriculum 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. 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. Calculate average speed. Use common measures of rate.	To include numerical problems involving direct and inverse proportion.  Use ratio and scales in practical situations. Formulae for other rates will be given in the question e.g. pressure and density.
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 household 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.
E1.17	Use exponential growth and decay in relation to population and finance.	e.g. depreciation, growth of bacteria.

**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.  
Rearrange simple formulae.  
Construct simple expressions and set up simple equations.
- C2.2 Manipulate directed numbers.  
Use brackets and extract common factors.  
Expand products of algebraic expressions.
- C2.3 *Extended curriculum only.*
- C2.4 Use and interpret positive, negative and zero indices.  
Use the rules of indices.
- C2.5 Derive and solve simple linear equations in one unknown.  
Derive and solve simultaneous linear equations in two unknowns.
- e.g. expand  $3x(2x - 4y)$   
e.g. factorise  $9x^2 + 15xy$   
Two brackets only, e.g. expand  $(x + 4)(x - 7)$
- e.g. simplify  $3x^4 \times 5x$ ,  $10x^3 \div 2x^2$ ,  $(x^6)^2$



**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 rearrange complicated formulae and equations.
- e.g. rearrange 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  $3x(2x - 4y)$   
e.g. factorise  $9x^2 + 15xy$   
e.g. expand  $(x + 4)(x - 7)$   
Includes products of more than two brackets, e.g.  $(x + 4)(x - 7)(2x + 1)$
- 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. Use the rules of indices.
- e.g. solve  $32^x = 2$   
e.g. simplify  
 $3x^{-4} \times \frac{2}{3}x^{\frac{1}{2}}, \frac{2}{5}x^{\frac{1}{3}} \div 2x^{-2}, \left(\frac{2x^5}{3}\right)^3$
- E2.5 Derive and solve linear equations in one unknown. Derive and solve simultaneous linear equations in two unknowns. Derive and solve simultaneous equations, involving one linear and one quadratic. Derive and solve quadratic equations by factorisation, completing the square and by use of the formula. Derive and solve linear inequalities.
- Including representing and interpreting inequalities on a number line. Interpretation of results may be required.

C2 Algebra and graphs		
	Core curriculum continued	Notes/Examples
C2.6	<i>Extended curriculum only.</i>	
C2.7	Continue a given number sequence. Recognise patterns in sequences including the term to term rule and relationships between different sequences. Find and use the $n$ th term of sequences.	Recognise sequences of square, cube and triangular numbers.  Linear, simple quadratic and cubic sequences.
C2.8	<i>Extended curriculum only.</i>	
C2.9	<i>Extended curriculum only.</i>	
C2.10	Interpret and use graphs in practical situations including travel graphs and conversion graphs. Draw graphs from given data.	e.g. interpret the gradient of a straight line graph as a rate of change.
C2.11	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 these graphs. Solve linear and quadratic equations approximately, including finding and interpreting roots by graphical methods. Recognise, sketch and interpret graphs of functions	Linear and quadratic only. Knowledge of turning points is <b>not</b> required.

E2 Algebra and graphs		
	Extended curriculum continued	Notes/Examples
E2.6	Represent inequalities graphically and use this representation to solve 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 including the term to term rule and relationships between different sequences. Find and use the $n$ th term of sequences.	Subscript notation may be used.  Linear, quadratic, cubic and exponential sequences and simple combinations of these.
E2.8	Express direct and inverse proportion in algebraic terms and use this form of expression to find unknown quantities.	
E2.9	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 $gf(x) = g(f(x))$ .	
E2.10	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 simple kinematics involving distance–time and speed–time graphs, acceleration and deceleration. Calculate distance travelled as area under a speed–time graph.	May include estimation and interpretation of the gradient of a tangent at a point.
E2.11	Construct tables of values and draw graphs for functions of the form $ax^n$ (and simple sums of these) and functions of the form $ab^x + c$ .  Solve associated equations approximately, including finding and interpreting roots by graphical methods. Draw and interpret graphs representing exponential growth and decay problems. Recognise, sketch and interpret graphs of functions.	$a$ and $c$ are rational constants, $b$ is a positive integer, and $n = -2, -1, 0, 1, 2, 3$ . Sums would not include more than three functions. Find turning points of quadratics by completing the square.  Linear, quadratic, cubic, reciprocal and exponential. Knowledge of turning points and asymptotes is required.

## C2 Algebra and graphs

Core curriculum continued

Notes/Examples

C2.12 *Extended curriculum only.*

C2.13 *Extended curriculum only.*

**E2 Algebra and graphs**

## Extended curriculum continued

## Notes/Examples

E2.12 Estimate gradients of curves by drawing tangents.

E2.13 Understand the idea of a derived function.

Use the derivatives of functions of the form  $ax^n$ , and simple sums of not more than three of these.

Apply differentiation to gradients and turning points (stationary points).

Discriminate between maxima and minima by any method.

$a$  is a rational constant and  $n$  is a positive integer or 0.

e.g.  $2x^3 + x - 7$

**C3 Coordinate geometry**

## Core curriculum

## Notes/Examples

C3.1 Demonstrate familiarity with Cartesian coordinates in two dimensions.

C3.2 Find the gradient of a straight line.

C3.3 *Extended curriculum only.*

C3.4 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.

C3.5 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  $(0, -3)$ .

C3.6 *Extended curriculum only.*

E3 Coordinate geometry		
	Extended curriculum	Notes/Examples
E3.1	Demonstrate familiarity with Cartesian coordinates in two dimensions.	
E3.2	Find the gradient of a straight line. Calculate the gradient of a straight line from the coordinates of two points on it.	
E3.3	Calculate the length and the coordinates of the midpoint of a straight line from the coordinates of its end points.	
E3.4	Interpret and obtain the equation of a straight line graph.	
E3.5	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 $(0, -3)$ .
E3.6	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 coordinates $(1, 3)$ and $(-2, -9)$ .

<b>C4 Geometry</b>		
	<b>Core curriculum</b>	<b>Notes/Examples</b>
C4.1	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.	
C4.2	Measure and draw lines and angles.  Construct a triangle given the three sides using a ruler and a pair of compasses only.	
C4.3	Read and make scale drawings.	
C4.4	Calculate lengths of similar figures.	
C4.5	Recognise congruent shapes.	
C4.6	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.



E4 Geometry		
	Extended curriculum	Notes/Examples
E4.1	<p>Use and interpret the geometrical terms: point, line, parallel, bearing, right angle, acute, obtuse and reflex angles, perpendicular, similarity and congruence.</p> <p>Use and interpret vocabulary of triangles, quadrilaterals, circles, polygons and simple solid figures including nets.</p>	
E4.2	<p>Measure and draw lines and angles.</p> <p>Construct a triangle given the three sides using a ruler and a pair of compasses only.</p>	
E4.3	<p>Read and make scale drawings.</p>	
E4.4	<p>Calculate lengths of similar figures.</p> <p>Use the relationships between areas of similar triangles, with corresponding results for similar figures and extension to volumes and surface areas of similar solids.</p>	
E4.5	<p>Use the basic congruence criteria for triangles (SSS, ASA, SAS, RHS).</p>	
E4.6	<p>Recognise rotational and line symmetry (including order of rotational symmetry) in two dimensions.</p> <p>Recognise symmetry properties of the prism (including cylinder) and the pyramid (including cone).</p> <p>Use the following symmetry properties of circles:</p> <ul style="list-style-type: none"> <li>• equal chords are equidistant from the centre</li> <li>• the perpendicular bisector of a chord passes through the centre</li> <li>• tangents from an external point are equal in length.</li> </ul>	<p>Includes properties of triangles, quadrilaterals and circles directly related to their symmetries.</p>

## C4 Geometry

### Core curriculum continued

C4.7 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 semicircle
- angle between tangent and radius of a circle.

### Notes/Examples

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

**E4 Geometry****Extended curriculum continued**

E4.7 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 semicircle
- 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
- alternate segment theorem.

**Notes/Examples**

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

C5 Mensuration		
	Core curriculum	Notes/Examples
C5.1	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.
C5.2	Carry out calculations involving the perimeter and area of a rectangle, triangle, parallelogram and trapezium and compound shapes derived from these.	
C5.3	Carry out calculations involving the circumference and area of a circle. Solve simple problems involving the arc length and sector area as fractions of the circumference and area of a circle.	Answers may be asked for in multiples of $\pi$ . Where the sector angle is a factor of 360.
C5.4	Carry out calculations involving the surface area and volume of a cuboid, prism and cylinder. Carry out calculations involving the surface area and volume of a sphere, pyramid and cone.	Answers may be asked for in multiples of $\pi$ . Formulae will be given for the surface area and volume of the sphere, pyramid and cone in the question.
C5.5	Carry out calculations involving the areas and volumes of compound shapes.	Answers may be asked for in multiples of $\pi$ .

<b>E5 Mensuration</b>		
	<b>Extended curriculum</b>	<b>Notes/Examples</b>
E5.1	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.
E5.2	Carry out calculations involving the perimeter and area of a rectangle, triangle, parallelogram and trapezium and compound shapes derived from these.	
E5.3	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.	Answers may be asked for in multiples of $\pi$ .
E5.4	Carry out calculations involving the surface area and volume of a cuboid, prism and cylinder. Carry out calculations involving the surface area and volume of a sphere, pyramid and cone.	Answers may be asked for in multiples of $\pi$ . Formulae will be given for the surface area and volume of the sphere, pyramid and cone in the question.
E5.5	Carry out calculations involving the areas and volumes of compound shapes.	Answers may be asked for in multiples of $\pi$ .

**C6 Trigonometry****Core curriculum**

C6.1 Interpret and use three-figure bearings.

**Notes/Examples**

Measured clockwise from the North, i.e.  $000^\circ$ – $360^\circ$ .

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 degrees. Answers should be written in degrees and decimals to one decimal place.

C6.3 *Extended curriculum only.*

C6.4 *Extended curriculum only.*

C6.5 *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 trigonometric problems in two dimensions involving angles of elevation and depression.  Know that the perpendicular distance from a point to a line is the shortest distance to the line.	Angles will be quoted in degrees. Answers should be written in degrees and decimals to one decimal place.
E6.3	Recognise, sketch and interpret graphs of simple trigonometric functions.  Graph and know the properties of trigonometric functions.  Solve simple trigonometric equations for values between 0° and 360°.	e.g. $\sin x = \frac{\sqrt{3}}{2}$ for values of $x$ between 0° and 360°.
E6.4	Solve problems using the sine and cosine rules for any triangle and the formula $\text{area of triangle} = \frac{1}{2} ab \sin C$ .	Includes problems involving obtuse angles.
E6.5	Solve simple trigonometrical problems in three dimensions including angle between a line and a plane.	

**C7 Vectors 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  $\mathbf{a}$ .

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  $90^\circ$ .

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.*



**E7 Vectors 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  $90^\circ$ .

Construct given translations and enlargements of simple plane figures.

Recognise and describe reflections, rotations, translations and enlargements.

Positive, fractional and negative scale factors for enlargements.

Positive, fractional and negative scale factors for enlargements.

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

Represent vectors by directed line segments.

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

Use position vectors.

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

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

**C8 Probability****Core curriculum**

- C8.1 Calculate the probability of a single event as either a fraction, decimal or percentage.
- 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.  
Expected frequency of occurrences.
- C8.5 Calculate the probability of simple combined events, using possibility diagrams, tree diagrams and Venn diagrams.
- C8.6 *Extended curriculum only.*

**Notes/Examples**

Problems could be set involving extracting information from tables or graphs.

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.

Venn diagrams will be limited to two sets.

<b>E8 Probability</b>		
	<b>Extended curriculum</b>	<b>Notes/Examples</b>
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. Expected frequency of occurrences.	
E8.5	Calculate the probability of simple combined events, using possibility diagrams, tree diagrams and Venn diagrams.	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.
E8.6	Calculate conditional probability using Venn diagrams, tree diagrams and tables.	e.g. Two dice are rolled. Given that the total showing on the two dice is 7, find the probability that one of the dice shows the number 2.

**C9 Statistics**

## Core curriculum

## Notes/Examples

- C9.1 Collect, classify and tabulate statistical data.
- C9.2 Read, interpret and draw simple inferences from tables and statistical diagrams.  
Compare sets of data using tables, graphs and statistical measures.  
Appreciate restrictions on drawing conclusions from given data.
- C9.3 Construct and interpret bar charts, pie charts, pictograms, stem-and-leaf diagrams, simple frequency distributions, histograms with equal intervals and scatter diagrams.
- C9.4 Calculate the mean, median, mode and range for individual and discrete data and distinguish between the purposes for which they are used.
- C9.5 *Extended curriculum only.*
- C9.6 *Extended curriculum only.*
- C9.7 Understand what is meant by positive, negative and zero correlation with reference to a scatter diagram.
- C9.8 Draw, interpret and use lines of best fit by eye.

E9 Statistics		
	Extended curriculum	Notes/Examples
E9.1	Collect, classify and tabulate statistical data.	
E9.2	Read, interpret and draw inferences from tables and statistical diagrams. Compare sets of data using tables, graphs and statistical measures. Appreciate restrictions on drawing conclusions from given data.	
E9.3	Construct and interpret bar charts, pie charts, pictograms, stem-and-leaf diagrams, 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'.
E9.4	Calculate the mean, median, mode and range for individual and discrete data and distinguish between the purposes for which they are used.	
E9.5	Calculate an estimate of the mean for grouped and continuous data. Identify the modal class from a grouped frequency distribution.	
E9.6	Construct and use cumulative frequency diagrams. Estimate and interpret the median, percentiles, quartiles and interquartile range. Construct and interpret box-and-whisker plots.	
E9.7	Understand what is meant by positive, negative and zero correlation with reference to a scatter diagram.	
E9.8	Draw, interpret and use lines of best fit by eye.	

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## 4 Details of the assessment

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### 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 International.

#### 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 International.

### 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 International.

#### 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 International.

## Command words

The table below includes command words used in the assessment for this syllabus. The use of the command word will relate to the subject context.

Command word	What it means
<b>Calculate</b>	work out from given facts, figures or information, generally using a calculator
<b>Construct</b>	make an accurate drawing
<b>Describe</b>	state the points of a topic/give characteristics and main features
<b>Determine</b>	establish with certainty
<b>Explain</b>	set out purposes or reasons/ make the relationships between things evident/ provide why and/or how and support with relevant evidence
<b>Give</b>	produce an answer from a given source or recall/memory
<b>Plot</b>	mark point(s) on a graph
<b>Show (that)</b>	provide structured evidence that leads to a given result
<b>Sketch</b>	make a simple freehand drawing showing the key features
<b>Work out</b>	calculate from given facts, figures or information with or without the use of a calculator
<b>Write</b>	give an answer in a specific form
<b>Write down</b>	give an answer without significant working

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## 5 What else you need to know

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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.cambridgeinternational.org/examsofficers](http://www.cambridgeinternational.org/examsofficers)

### Before you start

#### Previous study

We recommend that learners starting this course should have studied a mathematics curriculum such as the Cambridge Lower Secondary programme or equivalent national educational framework such as the Key Stage 3 programme of study within the National Curriculum for England.

#### Guided learning hours

We design Cambridge IGCSE syllabuses based on learners having about 130 guided learning hours for each subject during the course but this is for guidance only. The number of hours a learner needs to achieve the qualification may 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.cambridgeinternational.org/timetables](http://www.cambridgeinternational.org/timetables)

Private candidates can enter for this syllabus.

#### Combining with other syllabuses

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

- Cambridge IGCSE (9–1) Mathematics (0980)
- Cambridge IGCSE International Mathematics (0607)
- Cambridge O Level Mathematics (4024)

Cambridge IGCSE, Cambridge IGCSE (9–1) 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.cambridgeinternational.org/cambridgeice](http://www.cambridgeinternational.org/cambridgeice)



## Making entries

Exams officers are responsible for submitting entries to Cambridge International. 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.

### Exam administration

To keep our exams secure, we produce question papers for different areas of the world, known as 'administrative zones'. We allocate all Cambridge schools to one administrative zone determined by their location. Each zone has a specific timetable. Some of our syllabuses offer candidates different assessment options. An entry option code is used to identify the components the candidate will take relevant to the administrative zone and the available assessment options.

### 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.cambridgeinternational.org/examsofficers](http://www.cambridgeinternational.org/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.cambridgeinternational.org/examsofficers](http://www.cambridgeinternational.org/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.

## How students and teachers can use the grades

Assessment at Cambridge IGCSE has two purposes.

- To measure learning and achievement.  
The assessment:
  - confirms achievement and performance in relation to the knowledge, understanding and skills specified in the syllabus, to the levels described in the grade descriptions.
- To show likely future success.  
The outcomes:
  - help predict which students are well prepared for a particular course or career and/or which students are more likely to be successful
  - help students choose the most suitable course or career.

## 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.

Grade descriptions for Cambridge IGCSE Mathematics will be published after the first assessment of the IGCSE in 2020. Find more information at [www.cambridgeinternational.org/igcse](http://www.cambridgeinternational.org/igcse)

## Changes to this syllabus for 2020, 2021 and 2022

The syllabus has been reviewed and revised for first examination in 2020.

<b>Changes to syllabus content</b>	<ul style="list-style-type: none"> <li>• The key benefits and information on progression have been updated.</li> <li>• The syllabus aims have been updated to reflect current best practice.</li> <li>• The syllabus sections have been updated. We have provided clarification for some topics.</li> <li>• We have removed matrices, some construction, and loci from the syllabus content.</li> <li>• Topic 7 has been renamed 'Vectors and transformations'.</li> <li>• We have added a small number of topics. The following topics are new:               <ul style="list-style-type: none"> <li>– C1.2</li> <li>– E2.13</li> <li>– C4.5, E4.5</li> <li>– E6.3</li> <li>– C8.5</li> <li>– E8.6.</li> </ul> </li> <li>• The following sections have been updated with additional content:               <ul style="list-style-type: none"> <li>– 1.1, 1.3, C1.16</li> <li>– E2.5, 2.11</li> <li>– E4.7</li> <li>– C5.3, C5.4</li> <li>– E6.2</li> <li>– 9.2, 9.3, E9.6.</li> </ul> </li> </ul>
<b>Changes to assessment (including changes to specimen papers)</b>	<ul style="list-style-type: none"> <li>• The assessment objectives have been updated.</li> <li>• In Core Papers 1 and 3, the weighting of AO2 has been increased to 30–40%.</li> <li>• No other changes have been made to the assessment model.</li> </ul>

In addition to reading the syllabus, teachers should refer to the updated specimen assessment materials.

The syllabus and specimen papers use our new name, Cambridge Assessment International Education.

**You are strongly advised to read the whole syllabus before planning your teaching programme.**

Any textbooks endorsed to support the syllabus for examination from 2020 are 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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