MATHEMATICS 0580/0581
IGCSE
FOR EXAMINATION IN 2008

Exclusions

Syllabus **0580** must not be offered in the same session with any of the following syllabuses:

0581 Mathematics (with coursework)
4021 Mathematics A (Mauritius)
4024 Mathematics D (Calculator version)
4026 Mathematics E (Brunei)
4029 Mathematics D (Calculator version) (Mauritius)

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You can find syllabuses and information about CIE teacher training events on the CIE Website (www.cie.org.uk).

Mathematics Syllabus

Syllabus codes: 0580 (without Coursework)
0581 (with Coursework)

CONTENTS

INTRODUCTION

International General Certificate of Secondary Education (IGCSE) syllabuses are designed as two-year courses for examination at age 16-plus.

All IGCSE syllabuses follow a general pattern. The main sections are:

Aims
Assessment Objectives
Assessment
Curriculum Content.

The IGCSE subjects have been categorised into groups, subjects within each group having similar Aims and Assessment Objectives.

Mathematics falls into Group IV, Mathematics, of the International Certificate of Education (ICE) subjects together with Additional Mathematics.

Candidates wishing to offer Coursework **must** be entered for Syllabus 0581. Teachers at Centres offering Syllabus 0581 will be required to undergo training in assessment before entering candidates.

An examination in Additional Mathematics (0582) is available to IGCSE Centres in June and November. The syllabus is published in a separate booklet available from CIE. Results in Additional Mathematics can count towards the ICE, either in place of Mathematics in Group IV or as a seventh subject. Entries for Additional Mathematics may be made on the IGCSE entry form.

AIMS

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

The aims are to enable students 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.

ASSESSMENT OBJECTIVES

The abilities to be assessed in the IGCSE Mathematics examination cover a single assessment objective, technique with application. The examination will test the ability of candidates to:

1. organise, interpret and present information accurately in written, tabular, graphical and diagrammatic forms;
2. perform calculations by suitable methods;
3. use an electronic calculator;
4. understand systems of measurement in everyday use and make use of them in the solution of problems;
5. estimate, approximate and work to degrees of accuracy appropriate to the context;
6. use mathematical and other instruments to measure and to draw to an acceptable degree of accuracy;
7. interpret, transform and make appropriate use of mathematical statements expressed in words or symbols;
8. recognise and use spatial relationships in two and three dimensions, particularly in solving problems;
9. recall, apply and interpret mathematical knowledge in the context of everyday situations;
10. make logical deductions from given mathematical data;
11. recognise patterns and structures in a variety of situations, and form generalisations;
12. respond to a problem relating to a relatively unstructured situation by translating it into an appropriately structured form;
13. analyse a problem, select a suitable strategy and apply an appropriate technique to obtain its solution;
14. apply combinations of mathematical skills and techniques in problem solving;
15. set out mathematical work, including the solution of problems, in a logical and clear form using appropriate symbols and terminology.

SPECIFICATION GRID

Objectives	Short-answer questions	Structured/Longer answer questions	Coursework	Core/Extended
1 to 8	✓	✓	✓	Both
9	✓	✓	✓	Greater emphasis at Core
10	✓	✓		Both
11		✓	✓	Both
12 and 13		✓	✓	Greater emphasis at Extended
14	✓	✓	✓	Both
15		✓	✓	Greater emphasis at Extended

Commentary on specification grid

A rigid association between particular assessment objectives and individual examination components is not appropriate since any of the objectives can be assessed in any question or piece of coursework. Nevertheless, the components of the scheme will differ in the emphasis placed on the various objectives. A difference in emphasis will be apparent between the Core and the Extended papers; for example the assessment of candidates' response to relatively unstructured situations (Objective 12) is particularly important on Paper 4 (Extended). The grid above is for general guidance only and illustrates where particular objectives might receive most emphasis in the various components. Ticks are placed in the grid only where there is likely to be emphasis although the objective will also be met in other components.

The short-answer questions fulfil a particularly important function in ensuring syllabus coverage and allowing the testing of knowledge, understanding and manipulative skills, while greater emphasis is placed on applications to the processes of problem solving in the structured/longer answer papers. For candidates for 0581, the teacher should aim to design coursework tasks which place emphasis on the problem-solving objectives.

ASSESSMENT

Scheme of assessment

Candidates who have followed the Core curriculum and take the relevant papers are eligible for the award of grades C to G only. Candidates who have followed the Extended curriculum are eligible for the award of grades A* to E only.

SYLLABUS 0580 (WITHOUT COURSEWORK)

All candidates will take two written papers as follows:

(i) Short-answer questions (Paper 1 or Paper 2);

(ii) Structured questions (Paper 3 or Paper 4).

Core curriculum Grades available: C-G	*Extended curriculum* Grades available: A*-E
Paper 1 (1 hour) short-answer questions	**Paper 2** ($1\frac{1}{2}$ hours) short-answer questions
Paper 3 (2 hours) structured questions	**Paper 4** ($2\frac{1}{2}$ hours) structured questions

Weighting of papers

Paper	*Weighting*
1 2	*35%* *35%*
3 4	*65%* *65%*

NOTES

1. There will be no choice of question.

2. The syllabus assumes that candidates will be in possession of an electronic calculator for all papers, possibly used in conjunction with four-figure tables for trigonometric functions. Algebraic or graphical calculators are not permitted. Three significant figures will be required in answers except where otherwise stated.

3. Candidates are encouraged to 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.

4. Tracing paper may be used as an optional additional material for each of the written papers.

SYLLABUS 0581 (WITH COURSEWORK)

All candidates will take two written papers as follows:

(i) Short-answer questions (Paper 1 or Paper 2);

(ii) Structured questions (Paper 3 or Paper 4).

In addition candidates will submit Coursework for school-based assessment (Paper 5 or Paper 6).

Core curriculum Grades available: C-G	*Extended curriculum* Grades available: A*-E
Paper 1 (1 hour) short-answer questions	**Paper 2** ($1\frac{1}{2}$ hours) short-answer questions
Paper 3 (2 hours) structured questions	**Paper 4** ($2\frac{1}{2}$ hours) structured questions
Paper 5 Coursework*	**Paper 6** Coursework*

*Teachers may not undertake school-based assessment of Coursework without the written approval of CIE. This will only be given to teachers who satisfy CIE requirements concerning moderation and they will have to undergo special training in assessment before entering candidates.

CIE offers schools such in-service training via Distance Training Packs.

Please note that 0581 is not available to private candidates.

Weighting of papers

Paper	*Weighting*
1 2	*30%* *30%*
3 4	*50%* *50%*
5 6	*20%* *20%*

NOTES

1 There will be no choice of question in any written paper.

2 The syllabus assumes that candidates will be in possession of an electronic calculator for all papers, possibly used in conjunction with four-figure tables for trigonometric functions. Algebraic or graphical calculators are not permitted. Three significant figures will be required in answers except where otherwise stated.

3 Candidates are encouraged to 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.

4 Tracing paper may be used as an additional material for each of the written papers.

5 The school-based components (Paper 5 for the Core curriculum, Paper 6 for the Extended curriculum) consist of Coursework assessed according to the given criteria and will be marked by teachers trained by CIE using guidelines and instructions provided by CIE. The work will be externally moderated by CIE and will be weighted at 20% of the assessment, with a corresponding reduction in the weightings of the written papers (as shown above) for candidates offering Coursework.

6 The award rules are such that a candidate's Coursework grade cannot lower his or her overall result. Candidates entered for Syllabus 0581 are graded first on Components 1+3+5 or 2+4+6 and then graded again on Components 1+3 or 2+4. If the grade achieved on the aggregate of the two written papers alone is higher then this replaces the result achieved when the Coursework component is included. In effect, no candidate is penalised for taking the Coursework component.

CURRICULUM CONTENT

Students may follow either the Core curriculum only or the Extended curriculum which involves both the Core and Supplement. Students aiming for grades A* to C should follow the Extended curriculum.

As well as demonstrating skill in the following techniques, candidates will be expected to apply them in the solution of problems.

THEME OR TOPIC	CORE	SUPPLEMENT
	All students should be able to:	Extended curriculum students, who are aiming for Grades A* to C, should, **in addition** be able to:
1. Number, set notation and language	- 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; continue a given number sequence; recognise patterns in sequences and relationships between different sequences, generalise to simple algebraic statements (including expressions for the *n*th term) relating to such sequences	- use language, notation and Venn diagrams to describe sets and represent relationships between sets as follows: Definition of sets, e.g. $A=\{x:x \text{ is a natural number}\}$ $B=\{(x,y): y=mx+c\}$ $C=\{x:a \leqslant x \leqslant b\}$ $D=\{a,b,c\ldots\}$ Notation Number of elements in set *A* — n(*A*) "…is an element of …" — $\in$ "…is not an element of…" — $\notin$ Complement of set *A* — A' The empty set — $\varnothing$ Universal set — $\mathscr{E}$ *A* is a subset of *B* — $A \subseteq B$ *A* is a proper subset of *B* — $A \subset B$ *A* is not a subset of *B* — $A \nsubseteq B$ *A* is not a proper subset of *B* — $A \not\subset B$ Union of *A* and *B* — $A \cup B$ Intersection of *A* and *B* — $A \cap B$
2. Squares, square roots and cubes	- calculate squares, square roots, cubes and cube roots of numbers	
3. Directed numbers	- use directed numbers in practical situations (e.g. temperature change, flood levels)	
4. Vulgar and decimal fractions and percentages	- use the language and notation of simple vulgar and decimal fractions and percentages in appropriate contexts; recognise equivalence and convert between these forms	
5. Ordering	- order quantities by magnitude and demonstrate familiarity with the symbols $=, \neq, >, <, \geqslant, \leqslant$	
6. Standard form	- use the standard form $A \times 10^n$ where *n* is a positive or negative integer, and $1 \leqslant A < 10$	
7. The four rules	- use the four rules for calculations with whole numbers, decimal fractions and vulgar (and mixed) fractions, including correct ordering of operations and use of brackets	
8. Estimation	- 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	
9. Limits of accuracy	- give appropriate upper and lower bounds for data given to a specified accuracy (e.g. measured lengths)	- obtain appropriate upper and lower bounds to solutions of simple problems (e.g. the calculation of the perimeter or the area of a rectangle) given data to a specified accuracy

THEME OR TOPIC	CORE	SUPPLEMENT
10. Ratio, proportion, rate	- demonstrate an understanding of the elementary ideas and notation of ratio, direct and inverse proportion and common measures of rate; divide a quantity in a given ratio; use scales in practical situations; calculate average speed	- express direct and inverse variation in algebraic terms and use this form of expression to find unknown quantities; increase and decrease a quantity by a given ratio
11. Percentages	- 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
12. Use of an electronic calculator	- use an electronic calculator efficiently; apply appropriate checks of accuracy	
13. Measures	- use current units of mass, length, area, volume and capacity in practical situations and express quantities in terms of larger or smaller units	
14. Time	- calculate times in terms of the 24-hour and 12-hour clock; read clocks, dials and timetables	
15. Money	- calculate using money and convert from one currency to another	
16. Personal and household finance	- use given data to solve problems on personal and household finance involving earnings, simple interest and compound interest (knowledge of compound interest formula is not required), discount, profit and loss; extract data from tables and charts	
17. Graphs in practical situations	- demonstrate familiarity with cartesian co-ordinates in two dimensions, 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
18. Graphs of functions	- construct tables of values for functions of the form $ax + b$, $\pm x^2 + ax + b$, a/x $(x \neq 0)$ where a and b are integral constants; draw and interpret such graphs; find the gradient of a straight line graph; solve linear and quadratic equations approximately by graphical methods	- 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; estimate gradients of curves by drawing tangents; solve associated equations approximately by graphical methods
19. Straight line graphs	- interpret and obtain the equation of a straight line graph in the form $y = mx + c$; determine the equation of a straight line parallel to a given line	- calculate the gradient of a straight line from the co-ordinates of two points on it; calculate the length and the co-ordinates of the midpoint of a straight line segment from the co-ordinates of its end points
20. Algebraic representation and formulae	- 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	- construct and transform more complicated formulae and equations
21. Algebraic manipulation	- manipulate directed numbers; use brackets and extract common factors	- expand products of algebraic expressions; factorise where possible expressions of the form $ax + bx + kay + kby$, $a^2x^2 - b^2y^2$; $a^2 + 2ab + b^2$; $ax^2 + bx + c$; manipulate algebraic fractions, e.g. $\frac{x}{3} + \frac{x-4}{2}$, $\frac{2x}{3} - \frac{3(x-5)}{2}$, $\frac{3a}{4} \times \frac{5ab}{3}$, $\frac{3a}{4} - \frac{9a}{10}$, $\frac{1}{x-2} - \frac{2}{x-3}$ factorise and simplify expressions such as $\frac{x^2 - 2x}{x^2 - 5x + 6}$

THEME OR TOPIC	CORE	SUPPLEMENT
22. Functions		- use function notation, e.g. f (x) = 3x- 5, f:$x \longmapsto$ 3x- 5 to describe simple functions, and the notation $f^{-1}(x)$ to describe their inverses; form composite functions as defined by gf(x) = g(f(x))
23. Indices	- use and interpret positive, negative and zero indices	- use and interpret fractional indices, e.g. solve $32^x = 2$
24. Solutions of equations and inequalities	- solve simple linear equations in one unknown; solve simultaneous linear equations in two unknowns	- solve quadratic equations by factorisation and *either* by use of the formula *or* by completing the square; solve simple linear inequalities
25. Linear programming		- 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)
26. Geometrical terms and relationships	- use and interpret the geometrical terms: point, line, parallel, bearing, right angle, acute, obtuse and reflex angles, perpendicular, similarity, congruence; use and interpret vocabulary of triangles, quadrilaterals, circles, polygons and simple solid figures including nets	- use the relationships between areas of similar triangles, with corresponding results for similar figures and extension to volumes and surface areas of similar solids
27. Geometrical constructions	- measure lines and angles; construct a triangle given the three sides using ruler and compasses only; construct other simple geometrical figures from given data using protractors and set squares as necessary; construct angle bisectors and perpendicular bisectors using straight edges and compasses only; read and make scale drawings	
28. Symmetry	- recognise rotational and line symmetry (including order of rotational symmetry) in two dimensions and properties of triangles, quadrilaterals and circles directly related to their symmetries	- recognise symmetry properties of the prism (including cylinder) and the pyramid (including cone); use the following symmetry properties of circles: (a) equal chords are equidistant from the centre (b) the perpendicular bisector of a chord passes through the centre (c) tangents from an external point are equal in length
29. Angle properties	- calculate unknown angles using the following geometrical properties: (a) angles at a point (b) angles on a straight line and intersecting straight lines (c) angles formed within parallel lines (d) angle properties of triangles and quadrilaterals (e) angle properties of regular polygons (f) angle in a semi-circle (g) angle between tangent and radius of a circle	- use in addition the following geometrical properties: (a) angle properties of irregular polygons (b) angle at the centre of a circle is twice the angle at the circumference (c) angles in the same segment are equal (d) angles in opposite segments are supplementary; cyclic quadrilaterals
30. Locus	- use the following loci and the method of intersecting loci for sets of points in two dimensions: (a) which are at a given distance from a given point (b) which are at a given distance from a given straight line (c) which are equidistant from two given points (d) which are equidistant from two given intersecting straight lines	
31. Mensuration	- carry out calculations involving the perimeter and area of a rectangle and triangle, the circumference and area of a circle, the area of a parallelogram and a trapezium, the volume of a cuboid, prism and cylinder and the surface area of a cuboid and a cylinder	- solve problems involving the arc length and sector area as fractions of the circumference and area of a circle, the surface area and volume of a sphere, pyramid and cone (given formulae for the sphere, pyramid and cone)

THEME OR TOPIC	CORE	SUPPLEMENT
32. Trigonometry	- interpret and use three-figure bearings measured clockwise from the North (i.e. 000°-360°) - apply Pythagoras' theorem and the sine, cosine and tangent ratios for acute angles to the calculation of a side or of an angle of a right-angled triangle (angles will be quoted in, and answers required in, degrees and decimals to one decimal place)	- solve trigonometrical problems in two dimensions involving angles of elevation and depression, extend sine and cosine values to angles between 90° and 180°, solve problems using the sine and cosine rules for any triangle and the formula area of triangle = $\frac{1}{2}ab\sin C$, solve simple trigonometrical problems in three dimensions including angle between a line and a plane
33. Statistics	- collect, classify and tabulate statistical data; read, interpret and draw simple inferences from tables and statistical diagrams; construct and use bar charts, pie charts, pictograms, simple frequency distributions, histograms with equal intervals and scatter diagrams (including drawing a line of best fit by eye); understand what is meant by positive, negative and zero correlation; calculate the mean, median and mode for individual and discrete data and distinguish between the purposes for which they are used; calculate the range	- construct and read histograms with equal and unequal intervals (areas proportional to frequencies and vertical axis labelled 'frequency density'); construct and use cumulative frequency diagrams; estimate and interpret the median, percentiles, quartiles and inter-quartile range; calculate an estimate of the mean for grouped and continuous data; identify the modal class from a grouped frequency distribution
34. Probability	- calculate the probability of a single event as either a fraction or a decimal (not a ratio); understand and use the probability scale from 0 to 1; understand that: *the probability of an event occurring = 1 - the probability of the event not occurring*; understand probability in practice, e.g. relative frequency	- 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)
35. Vectors in two dimensions	- describe a translation by using a vector represented by $\begin{pmatrix} x \\ y \end{pmatrix}$ $\overrightarrow{AB}$ or **a**; add and subtract vectors; multiply a vector by a scalar	- calculate the magnitude of a vector $\begin{pmatrix} x \\ y \end{pmatrix}$ as $\sqrt{x^2 + y^2}$. (Vectors will be printed as $\overrightarrow{AB}$ or **a** and their magnitudes denoted by modulus signs, e.g. $\lvert\overrightarrow{AB}\rvert$ or $\lvert\mathbf{a}\rvert$. 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 $\underline{a}$) - 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
36. Matrices		- 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 x 2 matrices including the zero and identity 2 x 2 matrices; calculate the determinant and inverse $\mathbf{A}^{-1}$ of a non-singular matrix **A**
37. Transformations	- reflect simple plane figures in horizontal or vertical lines; rotate simple plane figures about the origin, vertices or mid points 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	- use the following transformations of the plane: reflection (M); rotation (R); translation (T); enlargement (E); shear (H); stretching (S) and their combinations (if M(a) = b and R(b) = c the notation RM(a) = c will be used; invariants under these transformations may be assumed.) - identify and give precise descriptions of transformations connecting given figures; describe transformations using co-ordinates and matrices (singular matrices are excluded)

GRADE DESCRIPTIONS

A **Grade A** candidate should be able to:

- express any number to 1, 2 or 3 significant figures. Relate a percentage change to a multiplying factor and vice versa, e.g. multiplication by 1.03 results in a 3% increase.
- relate scale factors to situations in both two and three dimensions. Calculate actual lengths, areas and volumes from scale models. Carry out calculations involving the use of right-angled triangles as part of work in three dimensions.
- add, subtract, multiply and divide algebraic fractions. Manipulate algebraic equations - linear, simultaneous and quadratic. Use positive, negative and fractional indices in both numerical and algebraic work. Write down algebraic formulae and equations from a description of a situation.
- process data, discriminating between necessary and redundant information. Make quantitative and qualitative deductions from distance/time and speed/time graphs.
- make clear, concise and accurate mathematical statements, demonstrating ease and confidence in the use of symbolic forms and accuracy in algebraic or arithmetic manipulation.

A **Grade C** candidate should be able to:

- apply the four rules of number to positive and negative integers, and vulgar and decimal fractions. Calculate percentage change. Perform calculations involving several operations. Use a calculator fluently. Give a reasonable approximation to a calculation involving the four rules. Use and understand the standard form of a number.
- use area and volume units. Find the volume and surface area of a prism and a cylinder. Use a scale diagram to solve a two-dimensional problem. Calculate the length of the third side of a right-angled triangle. Find the angle in a right-angled triangle, given two sides. Calculate angles in geometrical figures.
- recognise, and in simple cases formulate, rules for generating a pattern or sequence. Solve simple simultaneous linear equations in two unknowns. Transform simple formulae. Substitute numbers in more difficult formulae and evaluate the remaining term. Use brackets and extract common factors from algebraic expressions.
- construct a pie-chart from simple data. Plot and interpret graphs, including travel graphs, conversion graphs and graphs of linear and simple quadratic functions.

A **Grade F** candidate should be able to:

- perform the four rules on positive integers and decimal fractions (one operation only) using a calculator where necessary. Convert a fraction to a decimal. Calculate a simple percentage. Use metric units of length, mass and capacity. Understand the relationship between mm, cm, m, km, g and kg. Continue a straightforward number sequence.
- recognise and name simple plane figures and common solid shapes. Find the perimeter and area of a rectangle and other rectilinear shapes. Draw a triangle given three sides. Measure a given angle.
- substitute numbers in a simple formula and evaluate the remaining terms. Solve simple linear equations in one unknown.
- extract information from simple timetables. Tabulate numerical data to find the frequency of given scores. Draw a bar chart. Plot given points. Read a travel graph. Calculate the mean of a set of numbers.

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.

COURSEWORK (SCHOOL-BASED ASSESSMENT)

1. Introduction

The Coursework component exists to provide candidates with an additional opportunity to show their ability in Mathematics.

This opportunity is valuable in relation to all Assessment Objectives, but especially to the last five, where an extended piece of work can demonstrate ability more fully than an answer to a written question.

Coursework should aid development of the ability

to solve problems,

to use mathematics in a practical way,

to work independently,

to apply mathematics across the curriculum,

and if suitable assignments are selected, it should enhance interest in, and enjoyment of, the subject.

In view of the above it is recommended that Coursework assignments form an integral part of all IGCSE Mathematics courses. Whether some of this Coursework should be submitted for assessment, or not, is a matter for the teacher and the candidate to decide. The award rules are such that a candidate's Coursework grade cannot lower his or her overall result.

2. **Procedure**

(a) Candidates should submit one Coursework assignment.

(b) Coursework can be undertaken in class, or in the candidates' own time. If the latter, the teacher must be convinced that the piece is the candidate's own unaided work, and must sign a statement to that effect (see also Section 5 Controlled Elements).

(c) A good Coursework assignment is normally between 8 and 15 sides of A4 paper in length. These figures are only for guidance; some projects may need to be longer in order to present all the findings properly, and some investigations might be shorter although all steps should be shown (see Section 4).

(d) The time spent on a Coursework assignment will vary, according to the candidate. As a rough guide, between 10 and 20 hours would seem to be reasonable.

3. **Selection of Coursework Assignments**

(a) The topics for the Coursework assignments may be selected by the teacher, or (with guidance) by the students themselves.

(b) Since individual input is essential for high marks it is preferable that the students work on different topics. However, it is possible for the whole class to work on the same topic, provided that account is taken of this in the final assessment.

(c) Teachers should exercise care in ensuring that each topic selected corresponds to the ability of the student concerned. On the one hand, topics should not restrict the students, and should enable them to show evidence of attainment at the highest level of which they are capable. On the other hand, topics should not be chosen which are clearly beyond the student's ability.

(d) The degree of open-endedness of each topic is at the discretion of the teacher. However, each topic selected should be capable of extension, or development beyond any routine solution, so as to give full rein to the more imaginative student.

(e) The principal consideration in selecting a topic should be the potential for mathematical activity. With that proviso, originality of topics should be encouraged.

(f) Some students may wish to use a computer at various stages of their Coursework assignment. This should be encouraged, but they must realise that their work will be assessed on personal input, and not what the computer does for them. It is also important that all software sources are acknowledged.

4. **Suggested topics for Coursework Assignments**

Good mathematical assignments can be carried out in many different areas. It is an advantage if a suitable area can be found which matches the student's own interests.

Some suggestions for Coursework assignments are:

A mathematical investigation

There are many good investigations available from various sources: books, the Internet, etc. The objective here is to obtain a mathematical generalisation for a given situation. At the highest level, candidates should consider a complex problem which involves the co-ordination of three features or variables.

An application of mathematics

Packaging – how can four tennis balls be packaged so that the least area of card is used?
Designing a swimming pool
Statistical analysis of a survey conducted by the student
Simulation games
Surveying – taking measurements and producing a scale drawing or model

At the highest level, candidates should consider a complex problem which involves mathematics at grade A. See the section on grade descriptions.

Assignments should be discussed with the students to ensure that they have understood what is required and know how to start. Thereafter, teachers should stand back and only give hints if the student is completely stuck.

Computer software packages may be used to enhance presentation, perform repetitive calculations or draw graphs.

5. **Controlled Elements**

(a) The controlled element is included to assist the teacher in checking
(i) the authenticity of the candidate's work,
(ii) the extent of the candidate's learning of Mathematics, and its retention,
(iii) the depth of understanding of the Mathematics involved,
(iv) the ability to apply the learning to a different situation.

(b) The element must be carried out individually by the candidates under controlled conditions, but may take any appropriate form, provided that the results are available for moderation, e.g.
a timed or untimed written test,
an oral exchange between the candidate and the teacher,
a parallel investigation or piece of work,
a parallel piece of practical work, or practical test including a record of the results,
a written summary or account.

6. **Scheme of Assessment for the Coursework Assignments**

(a) The whole range of marks will be available at each level. The five classifications each have a maximum of 4 marks, awarded on a five-point scale, 0, 1, 2, 3, 4. For Coursework as a whole, including the controlled element, a maximum of 20 marks is available. Participating schools should use the forms at the back of the syllabus on which to enter these marks.

(b) Assignments are part of the learning process for the candidates, and it is expected that they will receive help and advice from their teachers. The marks awarded must, however, reflect the personal contributions of the candidates, including the extent to which they are able to use the advice they receive in the development of the assignments.

(c) The way in which the accuracy marks are allocated will vary from one assignment to another. Numerical accuracy, accuracy of manipulation in algebra, accuracy in the use of instruments, care in the construction of graphs and use of the correct units in measuring, are all aspects which may need consideration in particular assignments.

(d) If a candidate changes his or her level of entry during the course, Coursework already completed and assessed by the teacher will have to be reassessed according to the new entry option before moderation. A candidate being re-entered at the higher level (Extended curriculum) must be given the opportunity to extend any assignment already completed before it is re-assessed.

(e) The use of ICT is to be encouraged; however, teachers should not give credit to candidates for the skills needed to use a computer software package. For example, if data is displayed graphically by a spreadsheet, then credit may be given for selecting the most appropriate graph to draw and for its interpretation.

(f) Further information about the assessment of Coursework is given in the Distance Training Pack and at training sessions.

7. Moderation

(a) Internal Moderation

When several teachers in a Centre are involved in internal assessments, arrangements must be made within the Centre for all candidates to be assessed to a common standard.

It is essential that within each Centre the marks for each skill assigned within different teaching groups (e.g. different classes) are moderated internally for the whole Centre entry. The Centre assessments will then be subject to external moderation.

(b) External Moderation

Individual Candidate Record Cards and Coursework Assessment Summary Forms must be received by CIE no later than 30 April for the June examination and 31 October for the November examination along with a sample of the Coursework undertaken by the candidates. The samples should cover the full ability range. For each level, the size of the Coursework sample should be as follows:

Number of candidates entered	Number of candidates in sample
0-10	All candidates
11-50	10
51-100	15
above 100	20

The Centre should select candidates covering the whole mark range, with the marks spaced as evenly as possible from the top mark to the lowest mark. If appropriate the samples should be selected from the classes of different teachers. A further sample of Coursework may subsequently be required. All records and supporting written work should be retained until after the publication of the results.

COURSEWORK ASSESSMENT CRITERIA (SCHOOL-BASED ASSESSMENT)

The following five tables contain detailed criteria for the award of marks from 0 to 4 under the five categories of assessment (overall design and strategy, mathematical content, accuracy, clarity of argument and presentation, controlled element). For the Coursework component as a whole, a maximum of 20 marks is available.

OVERALL DESIGN AND STRATEGY

Assessment Criteria	Core	Extended
Much help has been received. No apparent attempt has been made to plan the work	0	0
Help has been received from the teacher, the peer group or a prescriptive worksheet. Little independent work has been done. Some attempt has been made to solve the problem, but only at a simple level. The work is poorly organised, showing little overall plan.	1	0
Some help has been received from the teacher or the peer group. A strategy has been outlined and an attempt made to follow it. A routine approach, with little evidence of the student's own ideas being used.	2	1
The work has been satisfactorily carried out, with some evidence of forward planning. Appropriate techniques have been used; although some of these may have been suggested by others, the development and use of them is the student's own.	3	2
The work is well planned and organised. The student has worked independently, devising and using techniques appropriate to the task. The student is aware of the wider implications of the task and has attempted to extend it. The outcome of the task is clearly explained.	4	3
The work is methodical and follows a flexible strategy to cope with unforeseen problems. The student has worked independently, the only assistance received being from reference books or by asking questions arising from the student's own ideas. The problem is solved, with generalisations where appropriate. The task has been extended and the student has demonstrated the wider implications.	4	4

MATHEMATICAL CONTENT

Assessment Criteria	Core	Extended
Little or no evidence of any mathematical activity. The work is very largely descriptive or pictorial.	0	0
A few concepts and methods relevant to the task have been employed, but in a superficial and repetitive manner.	1	0
A sufficient range of mathematical concepts which meet the basic needs of the task has been employed. More advanced mathematical methods may have been attempted, but not necessarily appropriately or successfully.	2	1
The concepts and methods usually associated with the task have been used, and the student has shown competence in using them.	3	2
Core The student has used a wide range of Core syllabus mathematics competently and relevantly, plus some mathematics from beyond the Core syllabus. Extended The student has developed the topic mathematically beyond the usual and obvious. Mathematical explanations are concise.	4	3
A substantial amount of work, involving a wide range of mathematical ideas and methods of Extended level standard or beyond. The student has employed, relevantly, some concepts and methods not usually associated with the task in hand. Some mathematical originality has been shown.	4	4

ACCURACY

N.B. The mark for Accuracy should not normally exceed the mark for Mathematical Content.

Assessment Criteria	Core	Extended
Very few calculations have been carried out, and errors have been made in these. Diagrams and tables are poor and mostly inaccurate.	0	0
Either correct work on limited mathematical content **or** calculations performed on a range of Core syllabus topics with some errors. Diagrams and tables are adequate, but units are often omitted or incorrect.	1	0
Calculations have been performed on all Core syllabus topics relevant to the task, with only occasional slips. Diagrams are neat and accurate, but routine; and tables contain information with few errors. The student has shown some idea of the appropriate degree of accuracy for the data used. Units are used correctly.	2	1
All the measurements and calculations associated with the task have been completed accurately. The student has shown an understanding of magnitude and degree of accuracy when making measurements or performing calculations. Accurate diagrams are included, which support the written work.	3	2
Careful, accurate and relevant work throughout. This includes, where appropriate, computation, manipulation, construction and measurement with correct units. Accurate diagrams are included which positively enhance the work, and support the development of the argument. The degree of accuracy is always correct and appropriate.	4	3 or 4*

*According to the mark for mathematical content.

CLARITY OF ARGUMENT AND PRESENTATION

Assessment Criteria	Core	Extended
Haphazard organisation of work, which is difficult to follow. A series of disconnected short pieces of work. Little or no attempt to summarise the results.	0	0
Poorly presented work, lacking logical development. Undue emphasis is given to minor aspects of the task, whilst important aspects are not given adequate attention. The work is presented in the order in which it happened to be completed; no attempt is made to re-organise it into a logical order.	1	0
Adequate presentation which can be followed with some effort. A reasonable summary of the work completed is given, though with some lack of clarity and/or faults of emphasis. The student has made some attempt to organise the work into a logical order.	2	1
A satisfactory standard of presentation has been achieved. The work has been arranged in a logical order. Adequate justification has been given for any generalisations made. The summary is clear, but the student has found some difficulty in linking the various different parts of the task together.	3	2
The presentation is clear, using written, diagrammatic and graphical methods as and when appropriate. Conclusions and generalisations are supported by reasoned statements which refer back to results obtained in the main body of the work. Disparate parts of the task have been brought together in a competent summary.	4	3
The work is clearly expressed and easy to follow. Mathematical and written language has been used to present the argument; good use has been made of symbolic, graphical and diagrammatic evidence in support. The summary is clear and concise, with reference to the original aims; there are also good suggestions of ways in which the work might be extended, or applied in other areas.	4	4

CONTROLLED ELEMENT

Assessment Criteria	Core	Extended
Little or no evidence of understanding the problem. Unable to communicate any sense of having learned something by undertaking the original task.	0	0
Able to reproduce a few of the basic skills associated with the task, but needs considerable prompting to get beyond this.	1	0
Can answer most of the questions correctly in a straightforward test on the project. Can answer questions about the problem and the methods used in its solution.	2	1
Can discuss or write about the problem, in some detail. Shows competence in the mathematical methods used in the work. Little or no evidence of having thought about possible extensions to the work or the application of methods to different situations.	3	2
Can talk or write fluently about the problem and its solution. Has ideas for the extension of the problem, and the applicability of the methods used in its solution to different situations.	4	3 or 4*

* Dependent on the complexity of the problem and the quality of the ideas.

MATHEMATICS
Individual Candidate Record Card
IGCSE 2008

Please read the instructions printed overleaf and the General Coursework Regulations before completing this form.

Centre Number						Centre Name		June/November	2008
Candidate Number						Candidate Name		Teaching Group/Set	

Title(s) of piece(s) of work:			
Classification of Assessment		Use space below for Teacher's comments	Mark awarded
Overall design and strategy	(max 4)		
Mathematical content	(max 4)		
Accuracy	(max 4)		
Clarity of argument and presentation	(max 4)		
Controlled element	(max 4)		
		Mark to be transferred to Coursework Assessment Summary Form	TOTAL (max 20)

INSTRUCTIONS FOR COMPLETING INDIVIDUAL CANDIDATE RECORD CARDS

1. Complete the information at the head of the form.

2. Mark each item of Coursework for each candidate according to instructions given in the Syllabus and Training Manual. If a candidate submits two assignments they should first be assessed separately in each category. The assessments should then be combined by entering the higher of the two marks for each category in the 'marks awarded' column.

3. Enter marks and total marks in the appropriate spaces. Complete any other sections of the form required.

4. The column for teachers' comments is to assist CIE's moderation process and should include a reference to the marks awarded. Comments drawing attention to particular features of the work are especially valuable to the Moderator.

5. Ensure that the addition of marks is independently checked.

6. **It is essential that the marks of candidates from different teaching groups within each Centre are moderated internally.** This means that the marks awarded to all candidates within a Centre must be brought to a common standard by the teacher responsible for co-ordinating the internal assessment (i.e. the internal moderator), and a single valid and reliable set of marks should be produced which reflects the relative attainment of all the candidates in the Coursework component at the Centre.

7. Transfer the marks to the Coursework Assessment Summary Form in accordance with the instructions given on that document.

8. Retain all Individual Candidate Record Cards and Coursework which **will be required for external moderation.** Further detailed instructions about external moderation will be sent in late March of the year of the June Examination and in early October of the year of the November examination. See also the instructions on the Coursework Assessment Summary Form.

Note: These Record Cards are to be used by teachers only for students who have undertaken Coursework as part of their IGCSE.

MATHEMATICS
Coursework Assessment Summary Form
IGCSE 2008

Please read the instructions printed overleaf and the General Coursework Regulations before completing this form.

Centre Number						Centre Name		June/November	2 | 0 | 0 | 8

Candidate Number	Candidate Name	Teaching Group/ Set	Title(s) of piece(s) of work	Total Mark (max 20)	Internally Moderated Mark (max 20)

Name of teacher completing this form		Signature		Date						
Name of internal moderator		Signature		Date						

A. INSTRUCTIONS FOR COMPLETING COURSEWORK ASSESSMENT SUMMARY FORMS

1. Complete the information at the head of the form.

2. List the candidates in an order which will allow ease of transfer of information to a computer-printed Coursework mark sheet MS1 at a later stage (i.e. in candidate index number order, where this is known; see item B.1 below). Show the teaching group or set for each candidate. The initials of the teacher may be used to indicate group or set.

3. Transfer each candidate's marks from his or her Individual Candidate Record Card to this form as follows:

   (a) Where there are columns for individual skills or assignments, enter the marks initially awarded (i.e. before internal moderation took place).
   (b) In the column headed 'Total Mark', enter the total mark awarded before internal moderation took place.
   (c) In the column headed 'Internally Moderated Mark', enter the total mark awarded *after* internal moderation took place.

4. Both the teacher completing the form and the internal moderator (or moderators) should check the form and complete and sign the bottom portion.

B. PROCEDURES FOR EXTERNAL MODERATION

1. University of Cambridge International Examinations (CIE) sends a computer-printed Coursework mark sheet MS1 to each centre (in late March for the June examination and in early October for the November examination) showing the names and index numbers of each candidate. Transfer the total internally moderated mark for each candidate from the Coursework Assessment Summary Form to the computer-printed Coursework mark sheet MS1.

2. The top copy of the computer-printed Coursework mark sheet MS1 must be despatched in the specially provided envelope to arrive as soon as possible at CIE but no later than 30 April for the June examination and 31 October for the November examination.

3. Send samples of the candidates' work covering the full ability range with the corresponding Individual Candidate Record Cards, this summary form and the second copy of MS1, to reach CIE by 30 April for the June examination and 31 October for the November examination.

4. Indicate the candidates who are in the sample by means of an asterisk (*) against the candidates' names overleaf. The size of the coursework sample should be as follows:

number of candidates entered	number of candidates in sample
0-10	all candidates
11-50	10
51-100	15
above 100	20

5. Where more than one teacher is involved in marking the work, the sample must include candidates marked by all teachers. Candidates must be selected so that the whole range is covered, with marks spaced as evenly as possible from the top mark to the lowest mark. This should include work from core candidates and extended candidates in similar proportions.

6. CIE reserves the right to ask for further samples of Coursework.

7. If the Coursework involves three-dimensional work then clear photographs should be submitted in place of the actual models.