Cambridge Assessment

GCSE

Mathematics

Session: 2000
Type: Syllabus
Code: 1662

Mathematics Syllabus A

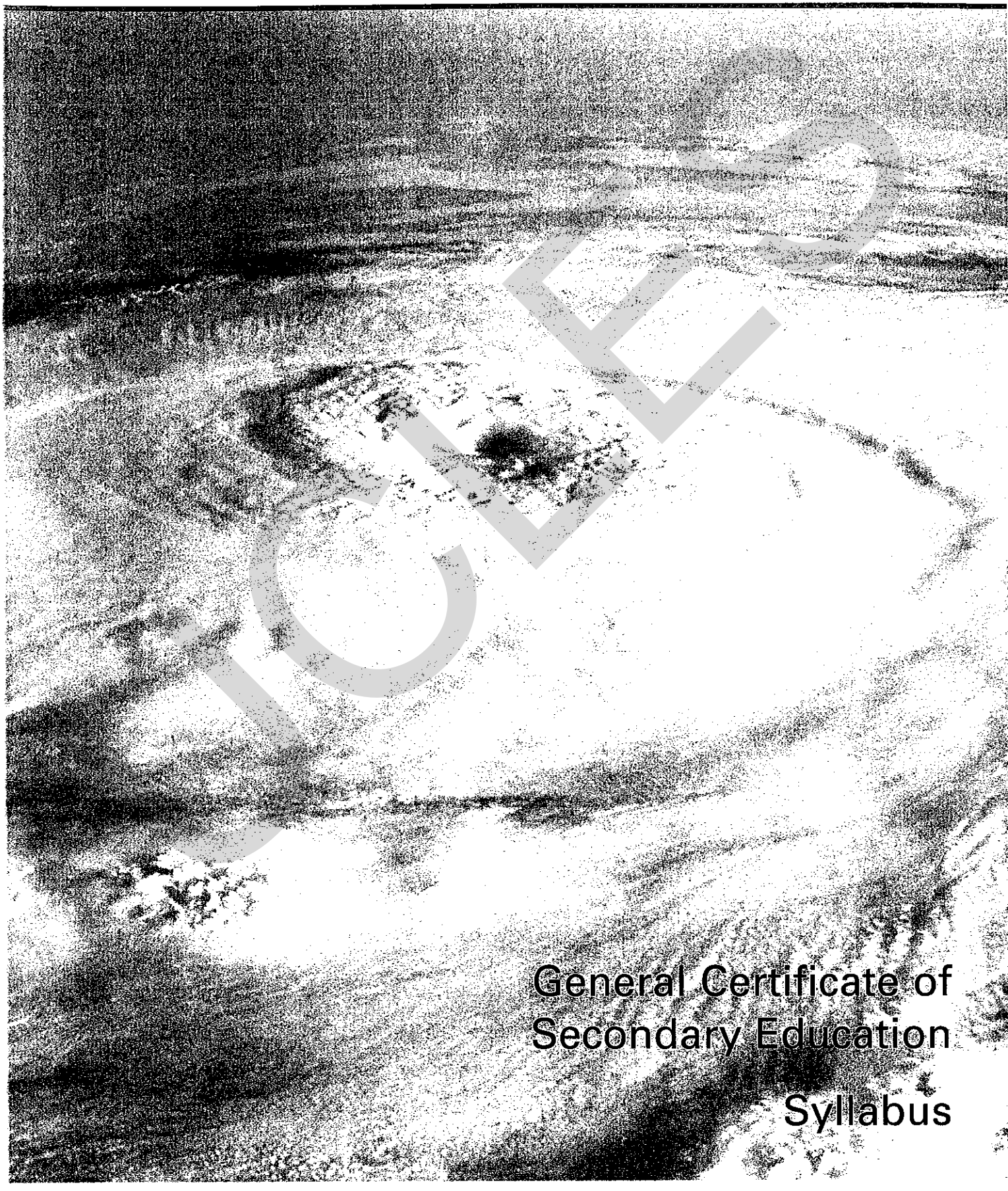
1662

2000

former MEG syllabus

OCR

RECOGNISING ACHIEVEMENT



General Certificate of Secondary Education

Syllabus

OCR is a unitary examining body, established by the University of Cambridge Local Examinations Syndicate and the RSA Examinations Board in January 1998. OCR provides a full range of GCSE, A level, GNVQ, Key Skills and other qualifications for schools and colleges in the United Kingdom, including those previously provided by MEG and OCEAC.

GENERAL INFORMATION

AVAILABILITY
This syllabus will be examined by OCR in the Summer of the year(s) shown on the cover.

Details of the provision of Autumn examinations are given in the GCSE Syllabus Synopses booklet.

EXCLUSIONS
In any one examination series, candidates entering for this syllabus may not in addition enter for any other OCR GCSE examination with the same certification title.

Details of any other exclusions are given in the syllabus.

ENTRIES
All candidates, including private candidates, must be entered by a Centre registered with OCR.

All candidates must meet the full requirements of this syllabus and must therefore have any coursework/assessed practical work authenticated and assessed by an approved Centre.

RESULTS
Results will be reported on the 8-point scale of grades A*, A, B, C, D, E, F and G.

SPELLING, PUNCTUATION AND GRAMMAR
The assessment of spelling, punctuation and grammar is a requirement of most syllabuses. Where components are affected, details are given in an appendix to the syllabus.

COURSEWORK ASSESSMENT
Where the syllabus includes assessment of coursework, in accordance with the GCSE & A/AS Code of Practice, teachers are required to show how the marks have been awarded in relation to the marking criteria defined in the syllabus.

OTHER PUBLICATIONS
Other publications such as past papers and mark schemes can be purchased from OCR. A copy of the publications order form is available on request.

MATHEMATICS SYLLABUS A

SYLLABUS CODE 1662

CONTENTS

RECOGNISING ACHIEVEMENT

MATHEMATICS SYLLABUS A (1662)

SYLLABUS SUMMARY

This syllabus meets the requirements of the National Curriculum Orders for Key Stage 4 Mathematics. The syllabus promotes and encourages flexibility and variety in teaching and learning styles. It has been designed so that Centres may use a wide range of textbooks and other teaching materials. The syllabus aims to assess positive achievement at every level of ability specified for GCSE. Candidates will be assessed within a range of attainment so that they can show what they know, understand and can do.

Scheme of Assessment

<table>
<tr><th>Grades</th><th>Foundation Tier
G - D</th><th>Intermediate Tier
E - B</th><th>Higher Tier
C - A*</th></tr>
<tr><td>A*
A</td><td rowspan="2"></td><td></td><td rowspan="2">Candidates take Components 5, 6 and 7</td></tr>
<tr><td>B
C</td><td rowspan="2">Candidates take Components 3, 4 and 7</td></tr>
<tr><td>D
E</td><td rowspan="2">Candidates take Components 1, 2 and 7</td><td rowspan="2"></td></tr>
<tr><td>F
G</td><td></td></tr>
</table>

Candidates are entered for either Foundation Tier, Intermediate Tier or Higher Tier.

Syllabus Components

Component	Name	Duration	Weighting
1	Paper 1	1 hour 30 mins	40%
2	Paper 2	1 hour 30 mins	40%
3	Paper 3	2 hours	40%
4	Paper 4	2 hours	40%
5	Paper 5	2 hours	40%
6	Paper 6	2 hours	40%
7	OCR-marked Tasks	Two tasks - up to 3 hours to be spent on writing up each task	20%

Subject Content

The Subject Content for the syllabus assessed by the question papers is shown below.

Number	Algebra	Shape, Space and Measures	Handling Data
Understanding place value and extending the number system	Understanding and using functional relationships	Understanding and using properties of shape	Processing and interpreting data
Understanding and using relationships between numbers and developing methods of computation	Understanding and using equations and formulae	Understanding and using properties of position, movement and transformation	Estimating and calculating the probabilities of events
Solving numerical problems		Understanding and using measures	

The Key Stage 4 Further Material for Number, Algebra, Shape Space and Measures, and Handling Data will be assessed only by the Higher Tier question papers.

Question Papers

All papers will consist of questions of varying lengths. Candidates must attempt all questions. In the first paper in each tier (Papers 1, 3 and 5), candidates will not be allowed to use a calculator. In the second paper in each tier (Papers 2, 4 and 6), candidates will be expected to use a calculator.

OCR-marked Tasks

Component 7, OCR-marked Tasks, assesses **Using and Applying Mathematics**, which covers

Making and monitoring decisions to solve problems

Communicating mathematically

Developing skills of mathematical reasoning

Candidates will submit two tasks which will be carried out under teacher supervision during a period from September of the calendar year before the examination to April of the year of the examination. Candidates will be allowed to spend a maximum of three hours' supervised time for the writing up of each task. The tasks will be set and marked by OCR. Two pairs of tasks will be provided: one pair will be suitable for Foundation/Intermediate Tier candidates; the other pair will be suitable for Intermediate/Higher Tier candidates.

MATHEMATICS SYLLABUS A
Syllabus Code 1662

1 INTRODUCTION

This syllabus has been devised in accordance with the requirements of the National Curriculum Orders for Key Stage 4 (KS4) Mathematics, the School Curriculum and Assessment Authority Regulations for GCSE syllabuses and the Subject Criteria for Mathematics.

Attainment for the subject will be reported as a single GCSE grade on the scale G - A*.

The syllabus has been designed so that Centres may successfully use a wide variety of textbooks and other teaching materials. It thus promotes and encourages flexibility and variety in teaching and learning styles in the classroom and will facilitate the effective and efficient use of resources.

Assessment is provided by a combination of two question papers (40% each) and OCR-marked Tasks (20%). In the first paper in each tier candidates will not be allowed to use a calculator. In the second paper in each tier candidates will be expected to use a calculator.
The papers assess Number and Algebra, Space Shape and Measures, and Handling Data. The OCR-marked Tasks assess Using and Applying Mathematics, will be set and marked by OCR and will be carried out towards the end of the course. The scheme of assessment for the OCR-marked Tasks has been developed by OCR in association with the "Mathematics in Education and Industry" (MEI) project.

The syllabus is designed to assess positive achievement at every level of ability specified for the GCSE. Candidates will be assessed within a range of attainment so that they can show what they know, understand and can do.

The syllabus will encourage and support the provision and development of worthwhile and interesting courses.

This subject will be shown on the GCSE certificate as MATHEMATICS.

In any one examination series, candidates entering for this subject may not in addition enter for any other OCR examination with the same certification title.

Approval for use in Northern Ireland

This syllabus has been designed to meet the requirements of the Northern Ireland GCSE Regulations and criteria for Mathematics.

It also meets the requirements of the Northern Ireland Programme of Study for Mathematics at Key Stage 4.

In developing schemes of work for a course based on this syllabus teachers in Northern Ireland are encouraged to address the statutory objectives of the educational (cross-curricular) themes.

Supporting Materials and Services

- a full programme of In-Service Training (INSET) meetings
- specimen question papers and marking guidelines
- OCR-marked Tasks specimen materials
- a dedicated subject-specific telephone number
- past question papers after each examination session
- past mark schemes after each Summer examination session
- a Report on the Examination, compiled by Principal Examiners, after each Summer examination session

2 SYLLABUS AIMS

This syllabus aims to enable candidates to:

- develop a positive attitude to Mathematics
- consolidate basic skills and meet appropriately challenging work
- apply mathematical knowledge and understanding to solve problems
- think and communicate mathematically - precisely, logically and creatively
- appreciate the place and use of Mathematics in society
- apply mathematical concepts to situations arising in their own lives
- understand the interdependence of different branches of Mathematics
- work cooperatively, independently, practically and investigationally
- acquire a firm foundation for further study

The above aims are consistent with National Curriculum requirements.

Most of the aims are reflected in the assessment objectives; others are not because they cannot be readily translated into assessment objectives.

3 ASSESSMENT OBJECTIVES

3.1 Using and Applying Mathematics.

Candidates are required to demonstrate their ability to:

- make and monitor decisions to solve problems
- communicate mathematically
- develop skills of mathematical reasoning

3.2 Number and Algebra

Candidates are required to demonstrate their ability to:

- understand place value and the decimal number system
- understand and use relationships between numbers and develop methods of computation
- solve numerical problems
- understand and use functional relationships
- understand and use equations and formulae

3.3 Shape, Space and Measures

Candidates are required to demonstrate their ability to:

- understand and use properties of shape
- understand and use properties of position, movement and transformation
- understand and use measures

3.4 Handling Data

Candidates are required to demonstrate their ability to:

- collect, process, represent and interpret data
- estimate and calculate the probabilities of events

Assessment Objective **3.1** will be assessed in contexts provided by the other assessment objectives.

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

COMPONENTS	ASSESSMENT OBJECTIVES			
	Using and Applying Mathematics	**Number and Algebra**	**Shape, Space and Measures**	**Handling Data**
PAPERS 1 AND 2		40%	20%	20%
PAPERS 3 AND 4		40%	20%	20%
PAPERS 5 AND 6		40%	20%	20%
OCR-MARKED TASKS (COMPONENT 7)	20%			

4 SCHEME OF ASSESSMENT

4.1 Tiering

The scheme of assessment consists of three tiers: Foundation Tier, Intermediate Tier and Higher Tier.

Each tier consists of two papers (40% each) and OCR-marked Tasks (20%).

In the first paper in each tier (Papers 1, 3 and 5), candidates will not be allowed to use a calculator. In the second paper in each tier (Papers 2, 4 and 6), candidates will be expected to use a calculator.

The components for each tier and the grades available are shown in the following table.

TIER	COMPONENTS			GRADES AVAILABLE AT TIER
Foundation	Paper 1	Paper 2	OCR-marked Tasks (Component 7)	G, F, E, D
Intermediate	Paper 3	Paper 4	OCR-marked Tasks (Component 7)	E, D, C, B
Higher	Paper 5	Paper 6	OCR-marked Tasks (Component 7)	C, B, A, A*

Candidates will be entered for either the Foundation Tier, the Intermediate Tier or the Higher Tier.

Under no circumstances will a candidate entered for the Foundation Tier be awarded a grade higher than D. Similarly under no circumstances will a candidate entered for the Intermediate Tier be awarded a grade higher than B.

Candidates achieving less than the minimum mark for grade C on the Higher Tier or grade E on the Intermediate Tier will be ungraded.

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4.2 Question Papers

Detailed subject content for the question papers is given in Section 5. The content is cumulative; that is to say, the content for Foundation Tier Papers 1 and 2 is included in that for Intermediate Tier Papers 3 and 4, which in turn is included in that for Higher Tier Papers 5 and 6. The overall content for each tier is matched to the National Curriculum Programme of Study.

The grades assessed and the time allowed for each paper are shown in the following table.

Component	Grades assessed	Time allowed
Paper 1	G, F, E, D	1 hour 30 minutes
Paper 2	G, F, E, D	1 hour 30 minutes
Paper 3	E, D, C, B	2 hours
Paper 4	E, D, C, B	2 hours
Paper 5	C, B, A, A*	2 hours
Paper 6	C, B, A, A*	2 hours

The difficulty of the questions in the question papers at each tier will reflect the grades assessed at that tier, with about half the marks in the Intermediate and Higher Tier papers addressing the top two grades in the tier. Material related to grades below the range of grades assessed at the tier will not normally be the focus of assessment.

All papers will consist of questions of varying lengths. On each paper, candidates will be required to attempt all questions. The responses to each paper will be written on the question paper. Common questions or parts of questions will be set on papers in adjacent tiers to aid consistency in awarding. The papers will be designed to be as free as possible from bias and prejudice.

In the first paper in each tier (Papers 1, 3 and 5), candidates will not be allowed to use a calculator. Candidates will also not be allowed to use slide rules, mathematical tables or any other calculating aid in these papers.

In the second paper in each tier (Papers 2, 4 and 6), candidates will be expected to use a calculator with at least the four functions +, −, ×, ÷ and a square root key. In Paper 4 (Intermediate Tier) and Paper 6 (Higher Tier), candidates will be expected to use calculators with a constant function, memory, brackets, trigonometric functions and an x^y key.

The non-calculator paper in each tier may assess any topic in the subject content for that tier, except those topics within Number 3e and 4d which expressly require the use of a calculator. The with-calculator paper in each tier may assess any topic in the subject content for that tier, except those topics within Number 3b which expressly prohibit the use of a calculator.

Papers 1, 3 and 5 will be taken at one timetable session and Papers 2, 4 and 6 at a second session.

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4.3 OCR-marked Tasks

Candidates will submit two tasks which will be carried out under teacher supervision during a period from September of the calendar year before the examination to April of the year of the examination. The tasks will assess Using and Applying Mathematics and will be set and marked by OCR. Candidates may need to do some preparatory work. Candidates will be allowed a **maximum** of 3 hours supervised time for the writing up of each task.

Two pairs of tasks will be provided: one pair will be suitable for Foundation/Intermediate Tier candidates; the other pair will be suitable for Intermediate/Higher Tier candidates.

Each candidate will be required to submit

either the pair of tasks suitable for Foundation/Intermediate Tier candidates,

or the pair of tasks suitable for Intermediate/Higher Tier candidates.

The grades available for OCR-marked Tasks are shown in the following table.

Component	Grades available
Component 7, OCR-marked Tasks	G - A*

Details of the requirements and arrangements for OCR-marked Tasks are given in Appendix A.

4.4 Differentiation

In the question papers (Papers 1, 2, 3, 4, 5 and 6), differentiation will be achieved by setting questions which are designed to assess candidates at the appropriate levels of ability and which are intended to allow all candidates to demonstrate what they know, understand and can do. The differentiated papers enable candidates entered at the appropriate tier to display positive achievement. If candidates are to benefit from taking assessment designed to meet their particular needs, Centres must take care to ensure that each candidate is entered at the tier for which they are most suited.

In OCR-marked Tasks, differentiation will be by task and by outcome. Candidates should undertake tasks which enable them to display positive achievement. The Foundation/Intermediate Tier tasks may not allow more able candidates to show evidence of attainment at the highest levels of which they are capable while the Intermediate/Higher Tier tasks may prove inaccessible to less able candidates. It is therefore important that the pair of tasks chosen is appropriate to the ability of the candidate.

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4.5 Awarding of Grades

The two question papers will have a weighting of 40% each and the OCR-marked Tasks a weighting of 20%.

A candidate's marks for the two papers will be combined with the mark for the OCR-marked Tasks in the above weightings to give the candidate's total mark for the syllabus. The candidate's grade will be determined by this total mark. Candidates achieving less than the minimum mark for grade C on the Higher Tier or grade E on the Intermediate Tier will be ungraded.

5 SUBJECT CONTENT

The subject content for the syllabus assessed by the question papers is listed on the following pages.

The content is cumulative; that is to say, the content for Foundation Tier Papers 1 and 2 is included in that for Intermediate Tier Papers 3 and 4, which in turn is included in that for Higher Tier Papers 5 and 6.

The Key Stage 4 Programme of Study for Number, Algebra, Shape Space and Measures, and Handling Data is listed in the left hand column with the corresponding notes in the remaining columns specifying the content for the papers in each tier. The parts of the Programme of Study relating to the Intermediate Tier are shown in **bold** type.

During the course candidates should be given opportunities for mental calculation, estimation, understanding of 3-D shape, use of computers and data collection.

During the course candidates should be given opportunities to:

NUMBER

- **a** use calculators and computer software, *e.g. spreadsheets;*
- **b** develop and use flexibly a range of methods of computation, and apply these to a range of problems.

ALGEBRA

- **a** explore a variety of situations that lead to the expression of relationships;
- **b** consider how relationships between number operations underpin the techniques for manipulating algebraic expressions;
- **c** consider how algebra can be used to model real-life situations and solve problems.

SHAPE, SPACE AND MEASURE

- **a** use a variety of different representations;
- **b** explore shape and space through drawing and practical work using a wide range of materials;
- **c** use computers to generate and transform graphic images and to solve problems.

HANDLING DATA

- **a** formulate questions that can be considered using statistical methods;
- **b** undertake purposeful enquiries based on data analysis;
- **c** use computers as a source of large samples, a tool for exploring graphical representations, and as a means to simulate events;
- **d** engage in practical and experimental work in order to appreciate some of the principles which govern random events;
- **e** look critically at some of the ways in which representations of data can be misleading and conclusions can be uncertain.

KEY STAGE 4 FURTHER MATERIAL

- **a** apply their knowledge, understanding and skills to solving problems of increasing complexity in a wider range of context.

NUMBER	FOUNDATION TIER PAPERS 1 AND 2 content		INTERMEDIATE TIER PAPERS 3 AND 4 Extra content	HIGHER TIER PAPERS 5 AND 6 Extra content
2 Understanding place value and extending the number system				
a Understand and use the concept of place value in whole numbers and decimals; relating this to computation and the metric system of measurement.	N.1 Understand and use place value in whole numbers and decimals. Read and write whole numbers of any magnitude given in words or in figures. N.2 Write numbers to the nearest 10, 100, 1000, etc N.3 Order decimals and understand place values.		N.50 Round decimals to the nearest whole number or to a given number of decimal places. N.51 Round numbers to a given number of significant figures. N.52 Order whole numbers, decimals and fractions.	
b Understand and use decimals, ratios, fractions and percentages, and the interrelationships between them; understand and use negative numbers.	N.4 Understand fraction notation and the representation of fractions in diagrams, e.g. partly shaded rectangles. N.5 Understand and use decimal notation. N.6 Recognise and use percentages to describe situations. N.7 Understand and use directed numbers in practical situations. N.8 Order directed numbers. N.9 Add and subtract negative numbers in context, e.g. tide level, temperature.	N.31 Understand and use the notation '*m* parts to *n* parts' for ratios. N.32 Understand and use equivalences between decimals, fractions, ratios and percentages.	N.53 Understand the terms 'integer' and 'integral value'. N.54 Understand and use the notation *m*:*n* for ratios. N.55 Multiply and divide negative numbers.	
c Understand and use index notation, **leading to standard form.**		N.33 Understand and use index notation for a positive integral index. Know the words 'square' and 'cube'. N.34 Understand the meaning of $a \times 10^n$ where $1 \leq a < 10$ and n is a positive integer, in the context of a calculator display.	N.56 Use the rules of indices for numbers involving zero, positive and negative whole number indices. N.57 Express and use numbers in standard form with positive and negative powers of ten.	
3 Understanding and using relationships between numbers and developing methods of computation				
a Consolidate knowledge of number facts including multiplication to 10 x 10, developing use of methods for finding quickly from known facts those which they cannot recall; use some common properties of numbers, including multiples, factors and primes, and leading to powers and roots.	N.10 Use number facts including multiplication up to 10 x 10. N.11 Understand and use the terms 'odd', 'even', 'multiple', 'factor', 'prime', 'square' and 'cube'. N.12 Understand and use the term 'square root' and the symbol '√'.		N.58 Understand the relationship between powers and roots, e.g. cube and cube root. N.59 Understand the term 'reciprocal'.	

3 Understanding and using relationships between numbers and developing methods of computation

b	Extend mental methods of computation, to consolidate a range of non-calculator methods of addition and subtraction of whole numbers and multiplication and division of whole numbers by whole numbers, understanding and using accurately the methods that they choose.	N.13 Understand and use a non-calculator method to add and subtract whole numbers and to multiply and divide whole numbers up to and including the case of multiplication and division of a three digit number by a two digit number. N.14 Understand and use place values in multiplying and dividing whole numbers and decimals by 10, 100, 1000, etc.		N.60 Multiply and divide mentally single digit multiples of any power of 10.	
c	Calculate with negative numbers, decimals, fractions, percentages and ratio, understanding the effects of operations, e.g. squaring, multiplying and dividing by numbers between 0 and 1, and selecting an appropriate non-calculator or calculator method.	N.15 Add, subtract, multiply and divide decimals. N.16 Calculate a fraction of a quantity. N.17 Calculate a percentage of a quantity. N.18 Add and subtract fractions and mixed numbers involving halves, quarters, eighths and sixteenths.	N.35 Change a fraction to a decimal. N.36 Change a fraction to a percentage. N.37 Express a number as a percentage of another number. N.38 Calculate using ratios in a variety of situations in context. N.39 Understand the effects of operations.	N.61 Add, subtract, multiply and divide negative numbers. N.62 Add, subtract, multiply and divide fractions. N.63 Express a number as a fraction of another number. N.64 Do calculations involving simple proportional division.	
d	Understand when and how to use fractions and percentages to make proportional comparisons.	N.19 Increase or decrease a quantity by a given percentage or fraction.	N.40 Use fractions and percentages to solve problems involving proportional comparisons. N.41 Work out fractional and percentage changes and do related calculations. Increase and decrease, profit and loss, VAT.	N.65 Use fractions or percentages to solve problems involving repeated proportional changes. N.66 Given the result of a proportional change, calculate the original quantity. (Includes reverse percentage problems.)	
e	Understand and use the facilities of a calculator, **including the use of the constant function, memory and brackets**, to plan a calculation and evaluate expressions.	N.20 Use a calculator to add, subtract, multiply, divide and square whole numbers and decimals, and to find the square root of a number. N.21 Know how the calculator may order its operations. N.22 Round an amount of money to the nearest penny, etc.		N.67 Understand and use the facilities of a calculator, including the use of the constant function, memory and brackets, to plan a calculation and evaluate expressions. N.68 Use a calculator to evaluate powers, roots and trigonometrical and statistical expressions.	

3 Understanding and using relationships between numbers and developing methods of computation				
f Mentally estimate and approximate solutions to numerical calculations, **leading to multiplication and division with numbers of any size rounded to one significant figure.**	N.23 Use estimation in multiplication and division problems with whole numbers to obtain approximate answers.	N.42 Multiply and divide mentally numbers which are single digit multiples of powers of 10, resulting in whole number answers.	N.69 Check results of numerical calculations by rounding numbers to one significant figure.	
4 Solving numerical problems				
a Develop an understanding of the four operations and the relationship between them, and apply them to solving problems, including those that involve ratios, proportions and compound measures, using metric or common Imperial units where appropriate.	N.24 Interpret and use mathematical information presented in written or visual form when solving problems, e.g. TV programme schedules, timetables, distance charts, holiday booking information, etc. N.25 Solve problems involving addition, subtraction, multiplication and division of whole numbers and decimals. N.26 Understand the basic principles of personal and household finance, including hire purchase, simple interest, VAT, discount, wages/ salaries.	N.43 Solve problems involving ratio in a variety of contexts, e.g. 'best buy' problems. N.44 Solve problems concerned with taxation. N.45 Solve money problems. (Includes foreign currencies and exchange rates.)	N.70 Solve problems concerned with compound interest and insurance. N.71 Understand and use compound measures expressed in the form miles per hour, population/km^2, etc. N.72 Work out average speed (distance/ time) and density (mass/volume).	
b Select suitable sequences of operations and methods of computation, including trial and improvement methods to solve problems involving integers, decimals, fractions, ratios and percentages; *e.g. using a spreadsheet to consider sets of numbers that have a given sum and find the set that has the maximum product.*		N.46 Select suitable sequences of operations and methods of computation to solve problems involving whole numbers, decimals, fractions, ratios and percentages. N.47 Obtain by a trial and improvement method an approximate solution to a problem. N.48 Give approximate answers to a specified number of decimal places.		
c Use a variety of checking strategies and apply them appropriately to calculations; use estimation and inverse operations and confirm that results are of the right order of magnitude.	N.27 Check solutions by applying inverse operations or by estimating using approximations. N.28 Check the reasonableness of numerical calculations by reference to knowledge of the context or size of the numbers.	N.49 Check that the result of a calculation is of the right order of magnitude.		

NUMBER	FOUNDATION TIER PAPERS 1 AND 2 content	INTERMEDIATE TIER PAPERS 3 AND 4 Extra content	HIGHER TIER PAPERS 5 AND 6 Extra content
4 Solving numerical problems			
d Give solutions in the context of the problem, **selecting an appropriate degree of accuracy**, interpreting the display on a calculator, **and recognising limitations on the accuracy of data and measurements.**	N.29 Interpret a calculator display in the context of the problem; e.g. in a money problem involving £, understand that a calculator display of 3.6 has to be interpreted as £3.60. N.30 Apply given degrees of accuracy; knowing whether to round up or down as appropriate.	N.73 Round off an answer to a reasonable degree of accuracy in the light of the context.	
Further Material			
a Understand and use direct and inverse proportion.			N.74 Understand and use direct proportion: $y \propto x$, $y \propto x^2$, $y \propto x^3$. N.75 Understand and use inverse proportion: $y \propto \frac{1}{x}$, $y \propto \frac{1}{x^2}$. N.76 Recognise and use the equivalence of '$Q \propto P$' and '$Q = kP$ where k is a constant'.
b Distinguish between rational and irrational numbers, and appreciate that irrational numbers complete the real number system.			N.77 Distinguish between rational and irrational numbers. N.78 Appreciate that irrational numbers complete the real number system. N.79 Convert a recurring decimal to fractional form. N.80 Simplify numerical expressions involving surds. (Excludes rationalisation of denominator in expressions such as $\frac{1}{(2-\sqrt{3})}$.)
c Understand and calculate the upper and lower bounds of numerical solutions, particularly in the context of measurement.			N.81 Be aware of the upper and lower bounds of numbers expressed to a given degree of accuracy. Find the upper and lower bounds for addition, subtraction, multiplication and division of numbers expressed to a given degree of accuracy.
d Simplify numerical expressions involving roots; understand and use roots and reciprocals expressed in index form.			N.82 Understand the meaning of fractional indices. N.83 Understand and use roots and reciprocals expressed in index form. N.84 Use the rules of indices for numbers involving negative and fractional indices.

	FOUNDATION TIER PAPERS 1 AND 2 content	INTERMEDIATE TIER PAPERS 3 AND 4 Extra content	HIGHER TIER PAPERS 5 AND 6 Extra content
2 Understanding and using functional relationships			
a Appreciate the use of letters to represent variables.	A.1 Appreciate the use of letters to represent variables.		
b Explore number patterns arising from a variety of situations, using computers where appropriate; interpret, generalise and use simple relationships, and generate rules for number sequences; express simple functions initially in words and then symbolically, representing them in graphical or tabular form.	A.2 Recognise, describe, continue and explain simple number patterns. A.3 Express simple functions in words and represent them in graphical or tabular form. A.9 Find and describe in words the rule for the next term in a sequence. A.10 Find the *n*th term of a sequence where the rule is linear. A.11 Express simple functions in symbolic form.	A.19 Find and describe in symbols the rule for the next term or the *n*th term of a sequence where the rule is quadratic.	A.42 Express general laws in symbolic form.
c Interpret graphs that describe real life situations.	A.4 Read values off a graph. A.5 Construct and interpret travel graphs and conversion graphs.	A.20 Construct and interpret graphs that model real life situations.	A.43 Approximation to linear laws. Drawing line of best fit and obtaining its equation.
d Explore the properties of standard mathematical functions, including linear and square, **reciprocal and other polynomial functions**; make and interpret tables and graphs of functions, **sketch their graphs, and use graphical calculators and computers to understand their behaviour.**	A.6 Use and interpret Cartesian coordinates in the first quadrant. A.12 Use and interpret Cartesian coordinates in all four quadrants. A.13 Construct tables of values, draw and interpret graphs of $y = ax + b$, $y = x^2 + a$, $y = b$, where a and b are integers.	A.21 Construct tables of values, draw and interpret graphs of functions of the forms $y = ax^3 + bx^2 + cx + d$ (where at least one of a, b, c, d is zero), $y = \frac{k}{x}$ and $y = \frac{k}{x^2}$. A.22 Know the shapes of and sketch the graphs of $y = ax$, $y = ax + b$, $y = ax^2$, $y = ax^3$, $y = \frac{k}{x}$. A.23 Calculate the gradient of a straight line.	
3 Understanding and using equations and formulae			
a Appreciate the use of letters to represent unknowns.	A.14 Appreciate the use of letters to represent unknowns.		

3 Understanding and using equations and formulae

	FOUNDATION TIER PAPERS 1 AND 2 content	INTERMEDIATE TIER PAPERS 3 AND 4 Extra content	HIGHER TIER PAPERS 5 AND 6 Extra content
b Construct, interpret and evaluate formulae and expressions, given in words or symbols, related to mathematics or other subjects, or real life situations, using computers and calculators where appropriate.	A.7 Construct, interpret and evaluate formulae given in words or symbols. A.8 Substitute positive and negative whole numbers, fractions and decimals into a simple formula expressed in words or symbols.	A.24 Substitute positive and negative whole numbers, fractions and decimals into an algebraic formula.	
c Manipulate algebraic expressions; form and manipulate equations **or inequalities** in order to solve problems.		A.15 Understand and use basic algebraic conventions such as $a + a + a = 3a$, $a \times a \times a = a^3$, $a \times b \times 2 = 2ab$. A.16 Understand and use removal of brackets in simple cases, e.g. multiply out $a(bx + c)$ where a, b, c are integers. A.17 Form and manipulate linear equations to solve problems	A.25 Simplify an expression by collecting like terms. A.26 Multiply out the brackets in expressions of the form $(ax \pm by)(cx \pm dy)$, $(ax \pm by)^2$ where a, b, c, d are integers. A.27 Use the rules of indices (positive integer values) to simplify algebraic expressions. A.28 Simplify algebraic expressions involving sums, differences, products and powers. A.29 Simplify expressions such as $6x^5 \div 3x^2$, $2x^2 \times 3x^3$ and $(3x^2)^3$. A.30 Extract common factors in algebraic expressions and factorise $x^2 + ax + b$. A.31 Re-arrange an algebraic formula in which the new subject appears in one term only. A.32 Form and manipulate equations to solve problems. A.33 Form and manipulate inequalities to solve problems.	

3 Understanding and using equations and formulae

d Solve a range of linear equations, **simple linear simultaneous equations, inequalities, and quadratic and higher-order polynomial equations**, selecting the most appropriate method for the problem concerned, **including trial and improvement methods.**		A.18 Solve linear equations with integer coefficients, e.g. $3x = 15$, $2x + 1 = 10$, $3x - 7 = x + 5$, $2(x - 3) = 21$.	A.34 Formulate linear equations and solve such equations, e.g. $2(x - 2) = 3x$, $\frac{400}{x} = 8$, $3.6x = 8.7$. A.35 Use an algebraic method to solve simultaneous linear equations in two variables. A.36 Use a graphical method to solve simultaneous linear equations in two variables. A.37 Solve by factorisation quadratic equations of the form $x^2 + ax + b = 0$. A.38 Solve cubic equations by a trial and improvement method. A.39 Solve quadratic and cubic equations by a graphical method. A.40 Solve simple inequalities, e.g. $3n + 4 > 17$, $x^2 \leq 16$. A.41 Indicate the region containing the points whose coordinates satisfy one or more inequalities of the form $ax + by < c$, $ax + by \leq c$, $ax + by > c$, $ax + by \geq c$.	

Further Material

	FOUNDATION TIER PAPERS 1 AND 2 content	INTERMEDIATE TIER PAPERS 3 AND 4 Extra content	HIGHER TIER PAPERS 5 AND 6 Extra content
a Simplify algebraic expressions; solve equations and inequalities by algebraic and graphical methods, selecting the most appropriate method for the problem concerned.			A.44 Use the rules of indices to simplify algebraic expressions. A.45 Factorise quadratic expressions (simple cases only). A.46 Solve quadratic equations including cases where the solutions are irrational. A.47 Solve equations by algebraic and graphical methods e.g. use the graph of $y = x^2 + 5x$ to solve $x^2 + 5x = 7$ and $y = x^3$ to solve $x^3 = x^2 + 5x$. A.48 Solve inequalities by algebraic and graphical methods. A.49 Manipulate algebraic expressions, including simple algebraic fractions. A.50 Re-arrange more complex formulae, e.g. formulae in which the new subject appears in more than one term.
b Construct and use tangents to curves to estimate rates of change for non-linear functions, and use appropriate compound measures to express results.			A.51 Draw and use tangents to curves to estimate rates of change of non-linear functions, e.g. to find velocity from a distance-time graph.
c Interpret the meaning of the area under a graph and apply this to the solution of numerical and statistical problems.			A.52 Use an appropriate method to estimate the area between a curve and the horizontal axis between two limits. A.53 Use the trapezium rule. A.54 Interpret the meaning of the area between a curve and the horizontal axis between two limits, e.g. know that the area under a velocity-time graph represents distance travelled.
d Intepret and apply the transformation of functions in the context of their graphical representation, including $y = f(x + a)$, $y = f(kx)$ and $y = f(x) + a$, applied to $y = f(x)$.			A.55 Interpret and apply transformations of functions in the context of their graphical representation, including $y = f(x + a)$, $y = f(kx)$, $y = f(x) + a$ applied to $y = f(x)$.

ALGEBRA

Further Material

	FOUNDATION TIER PAPERS 1 AND 2 content	INTERMEDIATE TIER PAPERS 3 AND 4 Extra content	HIGHER TIER PAPERS 5 AND 6 Extra content
e Select mathematical functions, *e.g. exponential or trigonometric functions*, to fit sets of data that model increasingly complex situations, and use them to solve problems.			A.56 Apply a simple transformation to give a relationship a linear form, and use the result to solve problems, e.g. plot the graph of q against p^2 when it is thought that $q = ap^2 + b$, and use the graph to find the values of a and b. A.57 Select mathematical functions (e.g. exponential or trigonometrical) to fit sets of data that model increasingly complex situations and use them to solve problems.

SHAPE, SPACE AND MEASURES

2 Understanding and using properties of shape

	FOUNDATION TIER PAPERS 1 AND 2 content	INTERMEDIATE TIER PAPERS 3 AND 4 Extra content	HIGHER TIER PAPERS 5 AND 6 Extra content
a Visualise, describe and represent shapes, including 2-D representations of 3-D objects, using geometrical language with increasing precision.	S.1 Understand and use: 'point', 'line', 'parallel', 'right-angle', 'at right-angles to', 'acute angle', 'obtuse angle', 'reflex angle', 'perpendicular', 'plane', 'horizontal', 'vertical'. S.2 Understand and use: 'cube', 'cuboid', 'prism', 'sphere', 'cylinder', 'pyramid', 'cone', 'net', 'face', 'edge', 'vertex'. S.3 Interpret and draw nets for a cube, cuboid, prism and pyramid. S.4 Visualise, describe and represent shapes, including 2-D representations of 3-D objects.	S.35 Interpret and draw 2-D representations of 3-D objects on isometric paper.	S.59 Understand and use the term 'tetrahedron'.	
b Construct 2-D and 3-D shapes from given information; understand the congruence of simple shapes and classify triangles, quadrilaterals, polygons and other shapes knowing and using their properties.	S.5 Understand and use: 'isosceles triangle', 'equilateral triangle', 'scalene triangle', 'right-angled triangle', 'interior angle', 'exterior angle'. S.6 Understand and use: 'radius', 'diameter', 'circle', 'arc', 'circumference', 'chord', 'tangent'. S.7 Understand and use: 'square', 'rectangle', 'quadrilateral', 'parallelogram', 'kite', 'rhombus', 'trapezium', 'pentagon', 'hexagon', 'octagon', 'polygon', 'diagonal'. S.8 Understand the term 'congruent' and identify congruent shapes. S.9 Classify triangles, quadrilaterals, polygons and other shapes knowing and using their properties.	S.36 Draw full size, or to scale, 2-D rectilinear shapes using a ruler and a protractor or set-square, e.g. draw a triangle given two sides and the included angle, or one side and two angles. S.37 Draw a circle given its radius or diameter.	S.60 Draw full size, or to scale, 2-D rectilinear shapes using compasses, e.g. draw a triangle given three sides, or two sides and a non-included angle (ambiguous case excluded).	

SHAPE, SPACE AND MEASURES	FOUNDATION TIER PAPERS 1 AND 2 content		INTERMEDIATE TIER PAPERS 3 AND 4 Extra content	HIGHER TIER PAPERS 5 AND 6 Extra content
2 Understanding and using properties of shape				
c Understand the symmetry properties of 2-D and 3-D shapes and use these to solve problems in two and three dimensions.	S.10 Know and use the simple properties of isosceles triangles, equilateral triangles, squares, rectangles. S.11 Identify lines of reflective symmetry of a 2-D shape or pattern. S.12 Complete a simple shape or pattern given one or two lines of reflective symmetry. S.13 Recognise whether a 2-D shape or pattern has rotational symmetry and state the order of rotational symmetry.	S.38 Understand the terms 'regular' and 'irregular' in relation to polygons. S.39 Use the symmetry properties of regular polygons. S.40 Understand and use the symmetry properties of a cube, cuboid and sphere.		
d Measure angles, and use the language associated with them; explain and use the angle properties of polygons and other 2-D configurations, including those associated with parallel and intersecting lines.	S.14 Measure angles in turns, fractions of a turn, degrees.	S.41 Know and use the relationships between angles associated with parallel lines and intersecting lines. S.42 Know and use the facts about the sum of angles on a line, around a point, of a triangle, of a quadrilateral. S.43 Explain and use the angle properties of irregular and regular polygons. S.44 Calculate the interior angle and the exterior angle of a regular polygon.	S.61 Use the property of a triangle: exterior angle = sum of the two opposite interior angles. S.62 Given the interior angle of a regular polygon, calculate the number of sides. S.63 Know and use the fact that the angle in a semicircle is a right-angle.	
e **Understand and use Pythagoras' theorem.**			S.64 Understand and use Pythagoras' theorem in 2-D contexts. (Includes inverse problems)	S.92 Understand and use Pythagoras' theorem in 3-D contexts. (Includes inverse problems)
f **Understand the trigonometrical relationships in right angled triangles and use these to solve problems, including those involving bearings.**			S.65 Understand and use the trigonometrical ratios sin, cos, tan and their inverses to calculate sides and angles of right-angled triangles in 2-D contexts, including those involving bearings.	
3 Understanding and using properties of position, movement and transformation				
a Use co-ordinate systems to specify location, initially using rectangular Cartesian coordinates in the first quadrant.	S.15 Understand and use Cartesian coordinates in the first quadrant. S.16 Understand compass directions N, S, E, W, NE, NW, SE, SW.	S.45 Use and interpret Cartesian coordinates in all four quadrants. S.46 Understand and use 3 figure bearings.		S.93 Use polar coordinates (r, θ) when $r \geq 0$ and $0 \leq \theta < 360°$.

3 Understanding and using properties of position, movement and transformation

	FOUNDATION TIER PAPERS 1 AND 2 content	INTERMEDIATE TIER PAPERS 3 AND 4 Extra content	HIGHER TIER PAPERS 5 AND 6 Extra content
b Recognise and visualise the transformations of translation, reflection, rotation and enlargement **and their combination in two dimensions; understand the notations used to describe them.**	S.17 Draw the reflection of a simple shape in a horizontal or vertical mirror line. S.47 Recognise and draw the reflection of a simple shape in any mirror line or the axes. S.48 Recognise and draw a positive whole number enlargement of a simple shape. S.49 Recognise and draw an enlargement of a simple shape using a positive whole number scale factor and a given centre. S.50 Rotate a simple shape about its centre or the origin through ¼ turn or ½ turn or ¾ turn. S.51 Carry out and recognise a translation of a simple shape.	S.66 Recognise and draw an enlargement of a simple shape using a positive rational scale factor and a given centre. S.67 Recognise and draw the reflection of a simple shape in $y = x$, $y = -x$, $y = c$ and $x = c$. S.68 Rotate a simple shape about any point through ¼ turn or ½ turn or ¾ turn. S.69 Given a simple shape and its image under a rotation, find the angle of rotation and the centre of rotation where this can be done by inspection. S.70 Understand and give descriptions of translations. S.71 Understand and use a column vector to describe a translation. S.72 Describe a single transformation which is equivalent to a combination of transformations in simple cases, e.g. a rotation and a reflection, two reflections, two translations.	S.94 Rotate a shape about any point through any angle. S.95 Enlarge shapes using a negative scale factor.
c Understand and use the properties of transformations to create **and analyse** patterns, to investigate the properties of shapes **and to derive results, including congruence.**	S.52 Understand and use the properties of transformations to create patterns and to investigate the properties of shapes. S.53 Draw tessellations with simple shapes.	S.73 Understand and use the properties of transformations to analyse patterns and to derive results. S.74 Establish the congruence of two shapes by considering a transformation which maps one shape onto the other. S.75 Determine whether a tessellation of a given shape is possible.	S.96 Know and use the conditions for congruent triangles.
d Develop an understanding of scale including using and interpreting maps and drawings, and enlarging shapes by different scale factors; **develop an understanding of and use mathematical similarity.**	S.18 Show an understanding of scale drawings using a whole number scale factor. S.19 Use and interpret maps and scale drawings.	S.76 Make and interpret scale drawings with a fractional scale factor. S.77 Show an understanding of and use mathematical similarity. S.78 Find lengths and angles in similar plane shapes.	

	FOUNDATION TIER PAPERS 1 AND 2 content	INTERMEDIATE TIER PAPERS 3 AND 4 Extra content	HIGHER TIER PAPERS 5 AND 6 Extra content
3 Understanding and using properties of position, movement and transformation			
e **Determine the locus of an object moving according to a given rule including, where appropriate, using practical methods and the devising of instructions for a computer to produce desired shapes and paths.**		S.79 Determine the locus of an object moving in a 2-D plane according to a given rule, which may involve inequalities. S.80 Solve problems involving intersecting loci in a 2-D plane. S.81 Solve practical problems based on simple locus properties. S.82 Know how to construct the perpendicular bisector of a line segment and the bisector of an angle.	
4 Understanding and using measures			
a Choose appropriate instruments and standard units of length, mass, capacity and time and make sensible estimates in everyday situations, **extending to less familiar contexts**; develop an understanding of the relationship between units, converting one metric unit to another; know Imperial units in daily use and their approximate metric equivalents.	S.20 Know and choose appropriate instruments and standard units of length, mass, capacity and time. S.21 Use mm, cm, m, km, inch, foot, yard, mile. S.22 Use g, kg, ounce, pound. S.23 Use litre, cl, ml, pint, gallon. S.24 Use cm^2, m^2, km^2. S.25 Use cm^3, m^3. S.26 Develop an understanding of the relationship between units, converting one metric unit to another. S.27 Know the rough metric equivalents of Imperial units still in use: 1km = $\frac{5}{8}$ mile, 1m = 39.37 inches, 1 foot = 30.5 cm, 1kg = 2.2lb, 1 litre = 1¾ pints, 1 gallon = 4.5 litres. S.28 Make sensible estimates of a range of measures in relation to everyday objects or situations, e.g. length of a car, time to complete a task, capacity of a tea cup.	S.83 Make sensible estimates of a range of measures in relation to less familiar contexts.	
b **Develop an understanding of the difference between discrete and continuous measures**; read and interpret scales, including decimal scales, **and understand the degree of accuracy that is possible, or appropriate, for a given purpose.**	S.29 Read, interpret and mark a scale or dial whose divisions represent 0.1, 1, 2, 5, 10, etc.	S.84 Understand the difference between discrete and continuous measures. S.85 Understand the degree of accuracy that is possible, or appropriate, for a given purpose. S.86 Understand that a measurement given to the nearest unit may be inaccurate by up to one half of the unit in either direction, e.g. a time measured as 9.57 seconds may be between 9.565 seconds and 9.575 seconds.	

	FOUNDATION TIER PAPERS 1 AND 2 content	INTERMEDIATE TIER PAPERS 3 AND 4 Extra content	HIGHER TIER PAPERS 5 AND 6 Extra content
4 Understanding and using measures			
c Understand and use compound measures, including speed **and density.**	S.54 Understand and use units of speed, e.g. metres per second, miles per hour.	S.87 Understand and use compound units, e.g. km/h, g/cm^3, population/km^2.	
d Find perimeters, areas and volumes of common shapes, including circles **and cylinders**, by counting and dissection methods, **progressing to the derivation** and use of standard formulae; **distinguish between formulae by considering dimensions** ***e.g. recognise that*** $\frac{4}{3}\pi r^2$ ***cannot represent the volume of a sphere.***	S.30 Understand and use the terms: 'perimeter', 'area', 'volume', 'capacity'. S.31 Find the perimeter of a shape with straight sides. S.32 Measure or estimate, as appropriate, the area of a shape drawn on a grid of squares each of which is, or represents, 1 square unit, e.g. 1cm^2, 1km^2. S.33 Calculate the area of a rectangle (including a square) given the lengths of its sides. S.34 Find the volume of a cuboid by counting cubes.	S.55 Calculate the area of a triangle from base and height measurements. S.56 Calculate the area and circumference of a circle given its radius or diameter. S.57 Calculate the volume of a cuboid (including cube) given the lengths of its edges. S.58 Calculate the perimeter and area of a simple shape made up of triangles and rectangles.	S.88 Calculate the area of a parallelogram from base and height measurements. S.89 Calculate the area of a trapezium. S.90 Calculate the volume of a prism (including a cylinder). S.91 Distinguish between formulae for perimeter, area and volume by considering dimensions.	S.97 Understand and use the terms: 'major arc', 'minor arc', 'sector', 'segment'.
Further Material			
a Extend measurement, including distances and angles, to more complex plane shapes and solids, including circular arcs, cylinders, cones and spheres; understand and use relationships between similar figures and solids.			S.98 Calculate the length of an arc and the area of a sector of a circle. S.99 Solve problems that involve the calculation of surface areas and volumes of prisms, pyramids, cylinders, cones and spheres. S.100 Solve problems connected with more complex shapes and solids, e.g. segment of a circle, frustum of a cone. S.101 Understand and use the effect of enlargement on area and volume.
b Apply simple vector methods to the solution of problems.			S.102 Understand and use the notation $\overrightarrow{AB}$, a and $\begin{pmatrix} x \\ y \end{pmatrix}$ to denote displacement vectors. S.103 Calculate and represent graphically the sum of two vectors, the difference of two vectors and a scalar multiple of a vector. S.104 Know what is meant by the 'resultant' of two vectors. S.105 Know and use the commutative and associative properties of vector addition. S.106 Apply vector methods to the solution of simple geometrical problems in two dimensions.

FOUNDATION TIER PAPERS 1 AND 2 content	INTERMEDIATE TIER PAPERS 3 AND 4 Extra content	HIGHER TIER PAPERS 5 AND 6 Extra content

Further Material

c	Extend their understanding of trigonometry to angles of any size, the graphs and behaviour of trigonometric functions, and the application of these to the solution of problems in two or three dimensions, including appropriate use of sine and cosine rules.		S.107 Calculate the area of a triangle using $\frac{1}{2}ab\sin C$. S.108 Use the trigonometry of the right-angled triangle in 3-D contexts, including finding the angle between a line and a plane but not the angle between two planes or the angle between two skew lines. S.109 Draw and sketch graphs of $\sin x^\circ$, $\cos x^\circ$, $\tan x^\circ$ for any angle. S.110 Use the sine and cosine rules to solve problems in 2-D and 3-D contexts. S.111 Draw and sketch the graphs of $y = a\sin bx^\circ$ and $y = a\cos bx^\circ$.
d	Use angle and tangent properties of circles.		S.112 Know and use the following properties of a circle: (i) the angle subtended by an arc at the centre is twice the angle subtended at any point on the remaining part of the circumference, (ii) angles in the same segment are equal, (iii) opposite angles of a cyclic quadrilateral sum to 180°. S.113 Know and use the following tangent properties of a circle: (i) tangents from an external point are equal in length, (ii) the angle between a tangent and the radius through the point of contact is 90°, (iii) the angle between a tangent and a chord through the point of contact is equal to the angle in the alternate segment.

2 Processing and interpreting data

	FOUNDATION TIER PAPERS 1 AND 2 content			INTERMEDIATE TIER PAPERS 3 AND 4 Extra content		HIGHER TIER PAPERS 5 AND 6 Extra content
a	Design and use data collection sheets, access required information from tables, lists and computer databases, and make frequency tables for grouped data, where appropriate.	D.1 Design and use a data collection sheet. D.2 Understand and use tallying methods. D.3 Sort, classify and tabulate qualitative (categorical) data and discrete or continuous quantitative data. Make frequency tables (groupings given where needed). D.4 Extract information from tables, graphs and lists.	D.21 Group data (may be discrete or continuous) into class intervals of equal width.			
b	Design a questionnaire or an experiment to capture the data needed to follow lines of enquiry **and to test hypotheses, taking possible bias into account.**	D.5 Design and criticise experiments (e.g. tossing a coin, rolling a dice) to capture the data needed to follow lines of enquiry. (Includes simple notion of 'fairness'). D.6 Design and criticise questions for a questionnaire to be used in following lines of enquiry.		D.36 Design a questionnaire or an experiment to test a hypothesis taking possible bias into account.		
c	Construct appropriate diagrams and graphs to represent discrete and continuous data, including bar charts, line graphs, pie charts, frequency polygons, scatter diagrams **and cumulative frequency diagrams.**	D.7 Represent qualitative data in pictograms and bar charts. D.8 Construct simple line graphs. Know that intermediate values in a line graph may or may not have a meaning.	D.22 Construct pie charts for qualitative data. D.23 Construct frequency polygons for grouped discrete data. D.24 Make a scatter diagram for a set of data (variables may be discrete or continuous).	D.37 Construct cumulative frequency tables and diagrams (using the upper boundaries of the class intervals). D.38 Construct histograms for grouped continuous data (equal intervals).		
d	Calculate or estimate, and use appropriate measures of central tendency, i.e. mode, median and mean, initially with discrete data, **progressing to grouped and continuous data.**	D.9 Find the mode, median and mean of a set of data (individual readings given).	D.25 Find the modal category for qualitative data. D.26 Identify the modal class for grouped discrete data. D.27 Find the mode, median and mean of a discrete (ungrouped) frequency distribution.	D.39 Calculate the mean of grouped data (discrete and continuous variables). D.40 Understand and identify the 'modal class' for continuous data. D.41 Select and use an appropriate measure of central tendency. D.42 Use a cumulative frequency diagram to estimate the median of a distribution.		
e	**Select and** calculate or estimate **appropriate measures of spread, including** the range **and interquartile range** applied to discrete, **grouped and continuous** data.	D.10 Find the range of a set of data (individual readings given).	D.28 Find the range of a discrete (ungrouped) frequency distribution.	D.43 Calculate or estimate the range of a distribution (discrete, grouped and continuous data). D.44 Use a cumulative frequency diagram to estimate the interquartile range of a distribution.		

	FOUNDATION TIER PAPERS 1 AND 2 content		INTERMEDIATE TIER PAPERS 3 AND 4 Extra content	HIGHER TIER PAPERS 5 AND 6 Extra content
2 Processing and interpreting data				
f Interpret a wide range of graphs and diagrams; draw inferences based on the shapes of graphs and simple statistics for a single distribution, **the comparative distribution of sets of data**, and the relationships between two sets of data, including correlation **and lines of best fit.**	D.11 Interpret a wide range of graphs and diagrams, including pictograms, bar charts, pie charts, line graphs and scatter diagrams. D.12 Recognise that graphs can be misleading.	D.29 Compare two simple distributions by reference to range and one of the measures of central tendency. D.30 Draw conclusions from scatter diagrams using terms such as positive correlation, negative correlation, no correlation.	D.45 Use one measure of central tendency and one measure of spread to describe a distribution. D.46 Compare two distributions using one measure of central tendency and/or one measure of spread. D.47 Draw 'by eye', and use, a line of best fit on a scatter diagram. D.48 Draw conclusions from scatter diagrams using terms such as strong positive correlation, moderate negative correlation, little or no correlation.	
g Evaluate results critically, **and develop an understanding of the reliability of results.**	D.13 Evaluate results critically.		D.49 Show an understanding of the reliability of results.	
h **Recognise that inferences drawn from data analysis of an experiment or enquiry may suggest further questions.**			D.50 Recognise that inferences drawn from data analysis of an experiment or enquiry may suggest further questions for investigation.	
3 Estimating and calculating the probabilities of events.				
a Understand and use the vocabulary of probability, through experience, experiment and theory, leading to understanding and using the probability scale from 0 to 1.	D.14 Understand and use simple vocabulary associated with probability, e.g. 'fair', 'evens', 'certain', 'likely', 'unlikely', 'impossible'. D.15 Understand and use the probability scale from 0 to 1. D.16 Understand and use probabilities expressed as fractions, decimals and percentages.	D.31 Understand and use P (event does not occur) = 1 - P (event occurs). D.32 Understand and use the fact that the sum of the probabilities of mutually exclusive events which include all possible outcomes is 1.		
b Give and justify estimates of probability to an appropriate degree of accuracy.	D.17 Give and justify estimates of probability to an appropriate degree of accuracy by selecting and using a method based on equally likely outcomes or experimental evidence, as appropriate.			
c Understand and use relative frequency as an estimate of probability and finding when sufficient trials have been carried out.		D.33 Understand and use relative frequency as an estimate of probability. D.34 Compare the estimated probability from experimental results with the theoretical probability.	D.51 When using relative frequency as an estimate of probability judge whether sufficient trials have been carried out. Use of graphical representation of relative frequency against number of trials.	

3 Estimating and calculating the probabilities of events

d Recognise situations where probabilities can be based on equally likely outcomes, and others where estimates must be based on experimental evidence, and make these estimates.	D.18 Recognise situations where probabilities can be based on equally likely outcomes and situations where estimates must be based on experimental evidence. D.19 Find a theoretical probability in simple cases involving equally likely outcomes: if, out of n equally likely outcomes, x are 'favourable', then P (favourable event) = $\frac{x}{n}$ D.20 Estimate a probability based on experimental evidence.			
e Identify all the outcomes of two experiments, *e.g. throwing two dice*; use tabulation **tree diagrams** or other diagrammatic representations of compound events.		D.35 Identify all the possible outcomes of two experiments, e.g. throwing two dice, using tabulation or other diagrammatic representation to show the result.	D.52 Use a tree diagram to represent outcomes of events. D.53 Use tabulation, a possibility space or other diagrammatic representation to enumerate equally likely outcomes for the purpose of calculating probabilities, e.g. show on a grid all the possible outcomes from throwing two dice together.	
f **Recognise the conditions when the addition of probabilities for mutually exclusive events, and the multiplication of probabilities for two independent events, apply, and make the appropriate calculations.**			D.54 From the probabilities of mutually exclusive events, *A*, *B*, *C*, ..., use the addition law to calculate the probability that *A* or *B* (or *C* ...) will occur. D.55 From the probabilities of independent events, *A*, *B*, *C*, ..., use the multiplication law to calculate the probability that *A* and *B* (and *C* ...) will occur.	

Further Material

a Use sampling methods, considering their reliability.				D.56 Show an understanding of how different methods of sampling and different sample sizes may affect the reliability of conclusions drawn. D.57 Select and justify a sample and a method to investigate a population. (Includes random and stratified sampling).
b Extend skills in handling data into constructing and interpreting histograms.				D.58 Construct histograms (may have equal or unequal class intervals) showing an understanding of frequency density. D.59 Interpret histograms (may have equal or unequal class intervals) with reference to mean and dispersion.

FOUNDATION TIER PAPERS 1 AND 2 content		INTERMEDIATE TIER PAPERS 3 AND 4 Extra content	HIGHER TIER PAPERS 5 AND 6 Extra content
Further Material			
c Describe the dispersion of a set of data; find and interpret the standard deviation of a set of data.			D.60 Find the standard deviation of a set of data. (Data may be individual readings or in the form of a grouped frequency table for a discrete or continuous variable). Use of the statistical functions on a calculator is expected. D.61 Interpret the standard deviation of a set of data. D.62 Use the mean and standard deviation to compare distributions and draw conclusions.
d Understand when and how to estimate conditional probabilities.			D.63 Understand when and how to use conditional probability. Use tree diagrams, where appropriate, and use the multiplication law for dependent events.

6 GRADE DESCRIPTIONS

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

Grade F

In order to carry through tasks and solve mathematical problems, candidates identify and obtain necessary information; they check their results, considering whether these are sensible. Candidates show understanding of situations by describing them mathematically using symbols, words and diagrams. They make general statements of their own, based on evidence they have produced, and give an explanation of their reasoning.

Candidates use their understanding of place value to multiply and divide whole numbers and decimals by 10, 100 and 1000. They order, add and subtract negative numbers in context. They use all four operations with decimals to two places. They calculate fractional or percentage parts of quantities and measurements, using a calculator where necessary. Candidates understand and use an appropriate non-calculator method for solving problems involving multiplying and dividing any three-digit by any two-digit number. In solving problems with or without a calculator, candidates check the reasonableness of their results by reference to their knowledge of the context or to the size of the numbers, by applying inverse operations or by estimating using approximations. Candidates explore and describe number patterns and relationships including multiple, factor and square. They construct, express in symbolic form, and use simple formulae involving one or two operations.

When constructing models and when drawing, or using shapes, candidates measure and draw angles as accurately as practicable, and use language associated with angle. They identify all the symmetries of 2-D shapes. They know the rough metric equivalents of Imperial units still in daily use and convert one metric unit to another. They make sensible estimates of a range of measures in relation to everyday situations.

Candidates understand and use the mean of discrete data. They compare two simple distributions using the range and one of the measures of average. They interpret graphs and diagrams, including pie-charts, and draw conclusions. They understand and use the probability scale from 0 to 1. Candidates make and justify estimates of probability by selecting and using a method based on equally likely outcomes or on experimental evidence as appropriate. They understand that different outcomes may result from repeating an experiment.

Grade C

Starting from problems or contexts that have been presented to them, candidates introduce questions of their own which generate a fuller solution. They examine critically and justify their choice of mathematical presentation, considering alternative approaches and explaining improvements they have made. Candidates justify their generalisations or solutions, showing some insight into the mathematical structure of the situation being investigated. They appreciate the difference between mathematical explanation and experimental evidence.

In making estimates candidates round to one significant figure and multiply and divide mentally. They solve numerical problems involving multiplication and division with numbers of any size using a calculator efficiently and appropriately. They understand the effects of multiplying and dividing by numbers between 0 and 1. Candidates evaluate one number as a fraction or percentage of another. They understand and use the equivalencies between fractions, decimals and percentages and calculate using ratios in appropriate situations. They understand and use proportional changes. Candidates find and describe in symbols the next term or the *n*th term of a sequence, where the rule is quadratic. They solve simple polynomial equations by trial and improvement and represent inequalities using a number line. They formulate and solve linear equations with whole number coefficients. They manipulate simple algebraic formulae, equations and expressions.

Candidates solve problems using angle and symmetry properties of polygons and properties of intersecting and parallel lines. They understand and apply Pythagoras' theorem when solving problems in two-dimensions. Candidates find areas and circumferences of circles. They calculate lengths, areas and volumes in plane shapes and right prisms. Candidates enlarge shapes by a positive whole number or fractional scale factor. They appreciate the continuous nature of measurement and recognise that a measurement given to the nearest whole number may be inaccurate by up to one half in either direction. They understand and use compound measures such as speed. They use sine, cosine and tangent in right-angled triangles when solving problems in two dimensions.

Candidates construct and interpret frequency diagrams. They specify hypotheses and test them. They determine the modal class and estimate the mean, median and range of a set of grouped data, selecting the statistic most appropriate to their line of enquiry. They use measures of average and range with associated frequency polygons, as appropriate, to compare distributions. They draw a line of best fit on a scatter diagram by inspection. Candidates understand relative frequency as an estimate of probability and use this to compare outcomes of experiments.

Grade A

Candidates give reasons for the choices they make when investigating within Mathematics itself or when using Mathematics to analyse tasks: these reasons explain why particular lines of enquiry are followed and others rejected. Candidates apply the Mathematics they know in familiar and unfamiliar contexts. Candidates use mathematical language and symbols effectively in presenting a convincing reasoned argument. Their reports include mathematical justifications, explaining their solutions to problems involving a number of features or variables.

Candidates understand and use rational and irrational numbers. They determine the bounds of intervals. Candidates understand and use direct and inverse proportion. They manipulate algebraic formulae, equations and expressions, finding common factors and multiplying two linear expressions. In simplifying algebraic expressions, they use rules of indices for negative and fractional values. In finding formulae which approximately connect data, candidates express general laws in symbolic form. Candidates use algebraic and graphical methods to solve simultaneous linear equations in two variables. They solve problems using intersections and gradients of graphs.

Candidates sketch the graphs of sine, cosine and tangent functions for any angle and generate and interpret graphs based on these functions. Candidates use sine, cosine and tangent of angles of any size, Pythagoras' theorem, and the conditions for congruent triangles when solving problems in two and three dimensions. They calculate lengths of circular arcs and areas of sectors, and calculate the surface area of cylinders and volumes of cones and spheres.

Candidates interpret and construct histograms. They understand how different methods of sampling and different sample sizes may affect the reliability of conclusions drawn; they select and justify a sample and method, to investigate a population. They recognise when and how to use conditional probability.

7 FURTHER INFORMATION

In support of this syllabus, the following materials and services are available to teachers:

- a full programme of In-Service Training (INSET) meetings
- specimen question papers and marking guidelines
- OCR-marked Tasks specimen materials
- a dedicated subject-specific telephone number
- past question papers after each examination session
- past mark schemes after each Summer examination session
- a Report on the Examination, compiled by Principal Examiners, after each Summer examination session

If you would like further information about this syllabus, please contact OCR. The address is given on the back cover of this syllabus booklet.

OCR-MARKED TASKS

1 INTRODUCTION

1.1 Candidates will submit two specified tasks appropriate to their level of ability. The tasks will assess Using and Applying Mathematics and be set and marked by OCR. Candidates will be allowed a **maximum** of 3 hours supervised time for the writing up of each task. Further details are given in sections **2**, **3** and **4**. Specimen tasks will be provided in the teacher support material.

1.2 The OCR-marked Tasks scheme is designed to allow assessment of candidates' ability to use and apply mathematics in practical, real-life tasks and within mathematics itself. Candidates should be offered opportunities to carry out both types of task during the course and need to be able to make decisions, and to communicate and reason mathematically. The scheme has been designed to translate the requirements of the National Curriculum and its Programme of Study into good classroom practice for candidates across the whole ability range, and at the same time to avoid making excessive demands of teachers. The scheme provides opportunities for candidates to use information technology where appropriate.

1.3 Work on Attainment Target 1 (Using and Applying Mathematics) should be integral to the course of study, not incidental to it. It is hoped that classroom work on Attainment Target 1 will permeate the whole course, supporting the development of the skills and processes of Attainment Targets 2, 3 and 4. Indeed, candidates are not likely to score as highly in their OCR-marked Tasks as they could if their only experiences of investigative or practical work are those occasions when their OCR-marked Tasks are being carried out. In particular candidates preparing for assessment are advised to practice answering investigative and practical questions.

1.4 Tasks give candidates opportunities to use and apply their mathematical skills in practical and real-life situations, or within mathematics itself. In their responses candidates will have to make decisions, about how to tackle the problem, what resources they need, where to collect relevant data, what analysis is (or is not) appropriate, and how to display results and conclusions, communicating those decisions and the reasoning behind them.

1.5 The OCR-marked Tasks will be assessed using task-specific marking guides generated from the generic marking guide shown on page 40.

2 ARRANGEMENTS FOR OCR-MARKED TASKS

2.1 Each year OCR will set and mark tasks of a practical and/or investigative nature. Candidates will be required to attempt two tasks. The tasks (together with information about preparatory work needed, if any) will be sent to Centres during September of the calendar year before the examination. On receipt of the tasks, Centres should open them and check whether teachers or candidates need to do any preparation before candidates start work on the tasks. It is quite possible that candidates may be required to collect data for use later. Centres should check that candidates are familiar with the mathematics required for the task.

2.2 Two pairs of tasks will be provided. One pair of tasks will be suitable for Foundation/Intermediate Tier candidates; the other pair will be suitable for Intermediate/Higher Tier candidates.

Each candidate will be required to submit

either the pair of tasks suitable for Foundation/Intermediate Tier candidates,
or the pair of tasks suitable for Intermediate/Higher Tier candidates.

The Foundation/Intermediate Tier tasks may not allow more able candidates to show evidence of attainment at the highest levels of which they are capable while the Intermediate/Higher Tier tasks may prove inaccessible to less able candidates. It is therefore important that the pair of tasks chosen is appropriate to the ability of the candidate.

2.3 Candidates are required to work on their tasks **under their teachers' direct supervision** during a period from September of the calendar year before the examination to April of the year of the examination. A **maximum** of **3 hours supervised time** should be allowed for the writing up of each task. This time may be arranged in any way convenient for the Centre.

2.4 These supervised sessions will be conducted under normal classroom conditions. **Candidates write up their work on official OCR stationery, and all this writing up must take place during these timed sessions**, though notes, rough work and computer printout made at other times may be attached as an appendix. **All official stationery (including the statement of the task itself) must be collected in at the end of each session, and kept secure until it is handed out again at the beginning of the next session**. Candidates may bring notes into these timed sessions, and may refer to books, or discuss ideas with each other or the teacher. The final write-up must be hand-written, and not word-processed or typewritten, unless OCR has approved an application for Special Arrangements.

2.5 Between timed sessions candidates may, of course, continue to think about the task in hand. They may discuss it with others, and may prepare notes, etc which will be helpful to them in their next timed session.

2.6 Teachers need to be satisfied that the work submitted is that of the candidate. If a teacher possesses information likely to affect the assessment it should be conveyed to the External Examiner by the teacher writing comments on the cover sheet and, if appropriate, the candidate's work. Some examples are

- Ephemeral evidence e.g. the award of C1 which could depend on an oral statement of the candidate
- Plagiarism
- Excessive guidance by the teacher.

2.7 At the end of the time allowed for a task all the sheets of a candidate's write-up (on official OCR stationery) should be securely fastened together with a treasury tag, along with any appendices, and stored securely at the Centre. It is not appropriate for candidates to present their work in bulky folders.

2.8 Each candidate will attempt two tasks. Following completion of the second task, the Centre attaches together the two scripts from a candidate, one script from each task attempted, plus a cover sheet (see page 40), again using a treasury tag. All the scripts from the Centre should be arranged in candidate number order, packed securely, and (around the end of April) sent to the External Examiner, whose name and address will have been supplied by OCR.

2.9 Following marking the scripts will be retained by OCR.

3 OCR-MARKED TASKS PLANNER FOR TEACHERS

OCR sends copies of tasks during September of the calendar year before the examination. The tasks should be opened immediately. There could be preliminary work for teachers and pupils e.g. collection of data.

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Candidates attempt the tasks on official OCR stationery.

↓

If the time is spread over more than one session then work is collected in after each session and kept securely.

↓

On completion, work is tagged and filed.

↓

Repeat process with second task.

↓

The two tasks and a cover sheet for each candidate are attached together with a treasury tag and arranged in candidate number order.

↓

Send all work to Examiner by the specified date.

4 ASSESSMENT OF OCR-MARKED TASKS

4.1 Introduction

The tasks will be externally marked by OCR. The method of marking the tasks is described below to inform teachers in preparing their candidates for assessment.

4.2 The Marking of the Tasks

The tasks will be marked using task-specific marking guides generated from the generic marking guide shown on page 40. These task-specific marking guides will give examples of particular indicators or benchmarks that commonly occur in the work, helping to standardise marking. Where a candidate's response to a task is not covered by the task-specific marking guide a mark will be awarded by making reference to the assessment criteria in the generic marking guide.

Candidates carrying out past or specimen tasks in preparation for the examination should be made aware of the criteria in the generic marking guide against which they will be assessed, but **task-specific marking guides should not be shown to candidates until the tasks have been completed.**

The assessment criteria in the generic marking guide are based on the Attainment Target 1 Level Descriptions and the corresponding Programmes of Study in the National Curriculum. These criteria have been grouped under three headings or 'strands' of assessment, namely Strategy (S), Communication (C), and Reasoning (R). Assessors will assess a candidate's best performance within each strand across the two tasks submitted.

4.3 Arrival at Strand Marks

Mark descriptions comprising a number of statements are provided for each strand. Each description within a strand is assigned one of the marks between 1 and 8. A candidate who fails to satisfy the description for a mark of 1 in a strand should be awarded a mark of 0 (zero) for that strand.

Whenever assessments are made, the mark descriptions should be used to judge the mark within each strand which **best fits** the candidate's performance. The statements within a description should not be taken as discrete and literal hurdles, all of which must be fulfilled for a mark to be awarded.

The mark descriptions within a strand are designed to be broadly hierarchical. This means that, in general, a description at a particular mark subsumes those at lower marks. Therefore the mark awarded may not be supported by direct evidence of achievement of lower marks in each strand.

It is assumed that tasks which access higher marks will involve a more sophisticated approach and/or a more complex treatment.

The professional judgement of the assessor in awarding marks is important.

4.4 Arrival at Overall Total Mark

Assessors are required to award a mark between 1 and 8 for each of the three strands. Each of these marks should represent a candidate's best performance within a strand across the tasks submitted.

These three marks should be totalled to give a mark out of 24.

4.5 Recording the assessments

- For each task, the assessor assesses the mark between 1 and 8 for each strand which **best fits** the candidate's performance, and marks the script accordingly, normally by writing and ringing, for example, "R6" at the point on the script where there is evidence that the candidate has attained a mark of 6 in strand R. The mark awarded may not be supported by direct evidence of achievement of lower marks in each strand: for example, where a mark of 6 best fits the candidate's performance in strand R, then that candidate is assumed to be competent at marks 1 to 5 in strand R, and R6 will be awarded.

- The assessor also records, using A for the first task and B for the second task, the marks for each strand on a copy of the generic marking guide on page 40 which has been designed to form a cover sheet for the candidate's work.

- The assessor rings, in each strand, the highest mark achieved across the two tasks.

- The assessor adds together the three ringed marks to give an overall total mark out of 24.

An example of a completed cover sheet/generic marking guide is shown on page 41. The final version of the cover sheet/generic marking guide may show some typographical changes to the sample shown on page 40 but any changes made will not affect the assessment scheme.

OCR
RECOGNISING ACHIEVEMENT

COVER SHEET

MATHEMATICS (1662)
OCR-MARKED TASKS GENERIC MARKING GUIDE

Centre Number	| | | | |	Centre Name	
Candidate Number	| | | |	Candidate Name	

Tasks done: (Please tick)	FOUNDATION/INTERMEDIATE	
	INTERMEDIATE/HIGHER	

Within each of the three strands the assessor assesses the highest mark achieved across the two tasks. Since the criteria are broadly hierarchical within a strand, a mark description at a particular mark subsumes those at lower marks - the mark awarded may not be supported by direct evidence of achievement of lower marks in each strand.

MARK FOR EACH STRAND	Strand S STRATEGY **Making and monitoring decisions to solve problems**	Strand C COMMUNICATION **Communicating mathematically**	Strand R REASONING **Developing skills of mathematical reasoning**
1	• Candidates try different approaches and find ways of overcoming difficulties that arise when they are solving problems. They are beginning to organise their work and check results.	• Candidates discuss their mathematical work and are beginning to explain their thinking. They use and interpret mathematical symbols and diagrams.	• Candidates show that they understand a general statement by finding particular examples that match it.
2	• Candidates are developing their own strategies for solving problems and are using these strategies both in working within mathematics and in applying mathematics to practical contexts.	• Candidates present information and results in a clear and organised way, explaining the reasons for their presentation.	• Candidates search for a pattern by trying out ideas of their own.
3	• In order to carry through tasks and solve mathematical problems, candidates identify and obtain necessary information; they check their results, considering whether these are sensible.	• Candidates show understanding of situations by describing them mathematically using symbols, words and diagrams.	• Candidates make general statements of their own, based on evidence they have produced, and give an explanation of their reasoning.
4	• Candidates carry through substantial tasks and solve quite complex problems by breaking them down into smaller, more manageable tasks.	• Candidates interpret, discuss and synthesise information presented in a variety of mathematical forms. Their writing explains and informs their use of diagrams.	• Candidates are beginning to give a mathematical justification for their generalisations; they test them by checking particular cases.
5	• Starting from problems or contexts that have been presented to them, candidates introduce questions of their own, which generate fuller solutions.	• Candidates examine critically and justify their choice of mathematical presentation, considering alternative approaches and explaining improvements they have made.	• Candidates justify their generalisations or solutions, showing some insight into the mathematical structure of the situation being investigated. They appreciate the difference between mathematical explanation and experimental evidence.
6	• Candidates develop and follow alternative approaches. They reflect on their own lines of enquiry when exploring mathematical tasks; in doing so they introduce and use a range of mathematical techniques.	• Candidates convey mathematical meaning through consistent use of symbols.	• Candidates examine generalisations or solutions reached in an activity, commenting constructively on the reasoning and logic employed, and make further progress in the activity as a result.
7	• Candidates analyse alternative approaches to problems involving a number of features or variables. They give detailed reasons for following or rejecting particular lines of enquiry.	• Candidates use mathematical language and symbols accurately in presenting a convincing reasoned argument.	• Candidates' reports include mathematical justifications, explaining their solutions to problems involving a number of features or variables.
8	• Candidates consider and evaluate a number of approaches to a substantial task. They explore extensively a context or area of mathematics with which they are unfamiliar. They apply independently a range of appropriate mathematical techniques.	• Candidates use mathematical language and symbols efficiently in presenting a concise reasoned argument.	• Candidates provide a mathematically rigorous justification or proof of their solution to a complex problem, considering the conditions under which it remains valid.

Record overleaf any information which is likely to affect the assessment and should be conveyed to the External Examiner.

FINAL MARK	

OCR
RECOGNISING ACHIEVEMENT

COVER SHEET

MATHEMATICS (1662)
OCR-MARKED TASKS GENERIC MARKING GUIDE

Centre Number	0 0 0 0 0	Centre Name	OCRTOWN SCHOOL
Candidate Number	9 9 9 9	Candidate Name	KIM GREEN

Tasks done: (Please tick)	FOUNDATION/INTERMEDIATE	✓
	INTERMEDIATE/HIGHER	

Within each of the three strands the assessor assesses the highest mark achieved across the two tasks. Since the criteria are broadly hierarchical within a strand, a mark description at a particular mark subsumes those at lower marks - the mark awarded may not be supported by direct evidence of achievement of lower marks in each strand.

MARK FOR EACH STRAND	Strand S STRATEGY **Making and monitoring decisions to solve problems**	Strand C COMMUNICATION **Communicating mathematically**	Strand R REASONING **Developing skills of mathematical reasoning**
1	• Candidates try different approaches and find ways of overcoming difficulties that arise when they are solving problems. They are beginning to organise their work and check results.	• Candidates discuss their mathematical work and are beginning to explain their thinking. They use and interpret mathematical symbols and diagrams.	• Candidates show that they understand a general statement by finding particular examples that match it.
2	• Candidates are developing their own strategies for solving problems and are using these strategies both in working within mathematics and in applying mathematics to practical contexts. B	• Candidates present information and results in a clear and organised way, explaining the reasons for their presentation.	• Candidates search for a pattern by trying out ideas of their own.
3	• In order to carry through tasks and solve mathematical problems, candidates identify and obtain necessary information; they check their results, considering whether these are sensible.	• Candidates show understanding of situations by describing them mathematically using symbols, words and diagrams. A	• Candidates make general statements of their own, based on evidence they have produced, and give an explanation of their reasoning. (A) (B)
4	• Candidates carry through substantial tasks and solve quite complex problems by breaking them down into smaller, more manageable tasks. (A)	• Candidates interpret, discuss and synthesise information presented in a variety of mathematical forms. Their writing explains and informs their use of diagrams. (B)	• Candidates are beginning to give a mathematical justification for their generalisations; they test them by checking particular cases.
5	• Starting from problems or contexts that have been presented to them, candidates introduce questions of their own, which generate fuller solutions.	• Candidates examine critically and justify their choice of mathematical presentation, considering alternative approaches and explaining improvements they have made.	• Candidates justify their generalisations or solutions, showing some insight into the mathematical structure of the situation being investigated. They appreciate the difference between mathematical explanation and experimental evidence.
6	• Candidates develop and follow alternative approaches. They reflect on their own lines of enquiry when exploring mathematical tasks; in doing so they introduce and use a range of mathematical techniques.	• Candidates convey mathematical meaning through consistent use of symbols.	• Candidates examine generalisations or solutions reached in an activity, commenting constructively on the reasoning and logic employed, and make further progress in the activity as a result.
7	• Candidates analyse alternative approaches to problems involving a number of features or variables. They give detailed reasons for following or rejecting particular lines of enquiry.	• Candidates use mathematical language and symbols accurately in presenting a convincing reasoned argument.	• Candidates' reports include mathematical justifications, explaining their solutions to problems involving a number of features or variables.
8	• Candidates consider and evaluate a number of approaches to a substantial task. They explore extensively a context or area of mathematics with which they are unfamiliar. They apply independently a range of appropriate mathematical techniques.	• Candidates use mathematical language and symbols efficiently in presenting a concise reasoned argument.	• Candidates provide a mathematically rigorous justification or proof of their solution to a complex problem, considering the conditions under which it remains valid.

Record overleaf any information which is likely to affect the assessment and should be conveyed to the External Examiner.

FINAL MARK	11

The OCR-marked Tasks assess 'Using and Applying Mathematics'.

The Key Stage 4 Programme of Study for 'Using and Applying Mathematics' is listed below.

USING AND APPLYING MATHEMATICS

During the course candidates should be given opportunities to:

a use and apply mathematics in practical tasks, in real life problems and within mathematics itself;
b work on problems that pose a challenge;
c encounter and consider different lines of mathematical argument.

Making and monitoring decisions to solve problems

a Find ways of overcoming difficulties that arise; develop and use their own strategies.
b Select, trial and evaluate a variety of possible approaches; identify what further information may be required in order to pursue a particular line of enquiry; break complex problems into a series of tasks.
c Select and organise mathematics and resources; extend their work to related tasks; select, follow and reflect on alternative approaches of their own.
d Review progress whilst engaging in work, and check and evaluate solutions.

Communicating mathematically

a Understand and use mathematical language and notation.
b Use mathematical forms of communication, including diagrams, tables, graphs and computer print-outs.
c Present work clearly, using diagrams, graphs and symbols appropriately, to convey meaning.
d Interpret mathematics presented in a variety of forms; evaluate forms of presentation.
e Examine critically, improve and justify their choice of mathematical presentation.

Developing skills of mathematical reasoning

a Explain and justify how they arrived at a conclusion or solution to a problem.
b Make conjectures and hypotheses, designing methods to test them, and analysing results to see whether they are valid.
c Understand general statements, leading to making and testing generalisations; recognise particular examples, and appreciate the difference between mathematical explanation and experimental evidence.
d Appreciate and use 'if ... then ... ' lines of argument in number, algebra and geometry, and draw inferences from statistics.
e Use mathematical reasoning, initially when explaining, and then when following a line of argument, recognising inconsistencies.

Further material

a Explain and evaluate their choice of approach to solving problems set in contexts or areas of mathematics that are new to them.
b Express mathematical ideas unambiguously through the efficient use of conventional mathematical notations.
c Understand the necessary and sufficient conditions under which generalisations, inferences and solutions to problems remain valid.
d Extend their mathematical reasoning into understanding and using more rigorous argument, leading to notions of proof.

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