Oxford Cambridge and RSA Examinations

RECOGNISING ACHIEVEMENT

OCR GCSE IN MATHEMATICS A 1962

Key Features

- A clear progression route to the revised OCR AS/A Level Mathematics specifications.
- A 'standard' syllabus – two written papers and 'coursework'.
- New textbooks written specifically for the scheme.
- Coursework can be OCR marked, or Centre marked and OCR standardised.
- New specimen papers and coursework guidance material.
- INSET on coursework requirements.

Support and In-service Training for Teachers

- A full programme of In-Service training meetings arranged by the Training and Customer Support Division (telephone 01223 552950).
- Specimen question papers and mark schemes, available from the Publications Department (telephone 0870 870 6622; fax 0870 870 6621).
- Past question papers and mark schemes, available from the Publications Department (telephone 0870 870 6622; fax 0870 870 6621).
- Internal Assessment guidance materials.
- Examples of marked work.
- A report on the examination, compiled by senior examining personnel after each examination session.
- Individual feedback to each Centre on the moderation of internally assessed work (Option A).
- Direct access to a Maths Subject Officer.

CONTENTS

Throughout the specification the following icons are used to signpost teaching and learning opportunities in:

 Citizenship

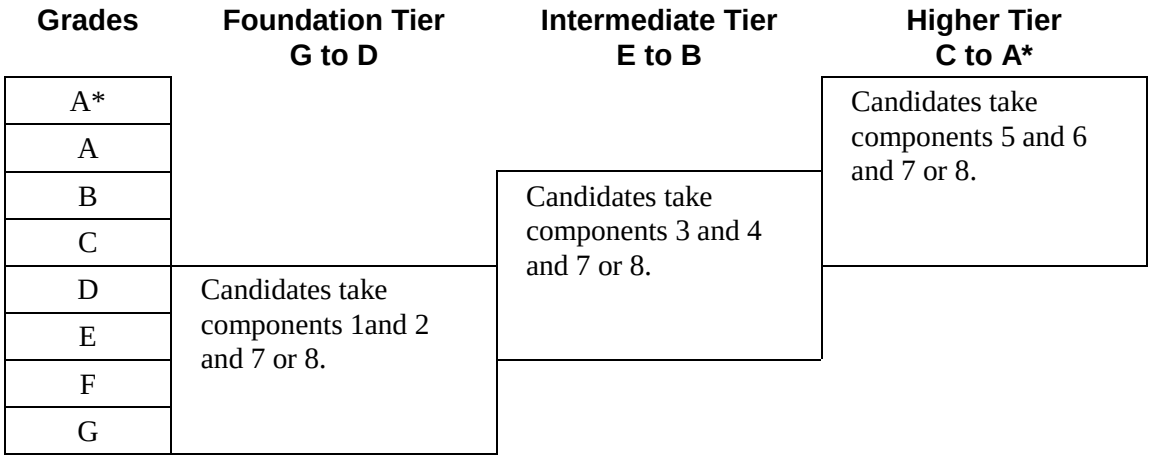
 ICT

 Key Skills

OCR GCSE IN MATHEMATICS A (1962)

SECTION A: SPECIFICATION SUMMARY

TIERS



COMPONENTS

Component	Title	Duration	Weighting
1	Paper 1 (Foundation Tier)	1 hour 30 minutes	40%
2	Paper 2 (Foundation Tier)	1 hour 30 minutes	40%
3	Paper 3 (Intermediate Tier)	2 hours	40%
4	Paper 4 (Intermediate Tier)	2 hours	40%
5	Paper 5 (Higher Tier)	2 hours	40%
6	Paper 6 (Higher Tier)	2 hours	40%
7	Internal assessment (Centre Marked)	---------	20%
8	Internal assessment (OCR Marked)	---------	20%
87	Internal Assessment Carried Forward	---------	20%

QUESTION PAPERS

- In the first paper in each tier candidates will not be allowed to use a calculator. In the second paper, however, there will be questions designed to test the effective use of the calculator.
- The difficulty of the questions at each tier will reflect the grades at that tier, with 25% of the marks in the Intermediate and Higher tiers addressing each grade in the tier. At Foundation level, one third of the marks in each paper will address grade G and the remaining marks will be divided equally between grades F, E and D.
- Using and Applying Mathematics (UAM) will be assessed in the question papers as an integral part of questions set on AO2, AO3 and AO4 content.
- At each tier there will be a proportion of questions demanding the unprompted solution of multi-step problems.
- Manipulative algebra will be given the required weighting at Intermediate and Higher tiers.
- At each tier there will be at least one question where candidates will be expected to supply the units of the answer and at least one question where candidates will be asked to give the answer to an appropriate degree of accuracy.

ENTRY OPTIONS

All candidates should be entered for 1962 with one of the following option codes:

Option Code	Title	Components	Sessions
FA	Foundation Tier with Centre Marked Internal Assessment	1, 2, 7	June
FB	Foundation Tier with OCR Marked Internal Assessment	1, 2, 8	June
IA	Intermediate Tier with Centre Marked Internal Assessment	3, 4, 7	June
IB	Intermediate Tier with OCR Marked Internal Assessment	3, 4, 8	June
HA	Higher Tier with Centre Marked Internal Assessment	5, 6, 7	June
HB	Higher Tier with OCR Marked Internal Assessment	5, 6, 8	June
FC	Foundation Tier with Internal Assessment Carried Forward	1, 2, 87	June
IC	Intermediate Tier with Internal Assessment Carried Forward	3, 4, 87	January and June
HC	Higher Tier with Internal Assessment Carried Forward	5, 6, 87	June

INTERNAL ASSESSMENT (COURSEWORK)

Candidates will submit two types of task, **both** of which will count towards the mark for Component 7 or Component 8. One type of task (which may be more than 1 piece of work) will assess Using and Applying Mathematics (AO1) and the other (which must be a single piece of work) will assess Handling Data (AO4). Each type of task will be marked using the relevant, nationally agreed, assessment criteria found in Section 7.

SECTION B: GENERAL INFORMATION

1 Introduction

1.1 RATIONALE

The aim in preparing this GCSE specification has been to promote the teaching and learning of Mathematics at Key Stage 4 in schools and to provide a suitable one-year post-16 course. The specification meets the requirements of the National Curriculum Orders for Key Stage 4 Mathematics, the Qualifications and Curriculum Authority Regulations (QCA, 1999) for GCSE specifications and the Subject Criteria for GCSE Mathematics.

The broad objectives in designing the scheme have been to retain as far as possible those features which have proved popular in the previous 1662 syllabus whilst offering a further choice to those Centres which prefer to design and moderate their own Internal Assessments. The two options for Internal Assessment are designed to suit the requirements of a broad range of candidates while, at the same time, avoiding administrative complexity .

Candidates who successfully complete courses based on these specifications will have a suitable basis for progression to further study in mathematics or related subjects or directly into employment.

OCR has taken great care in the preparation of this specification and assessment material to avoid bias of any kind.

1.2 CERTIFICATION TITLE

This specification will be shown on a certificate as:

OCR GCSE in Mathematics A

1.3 LEVEL OF QUALIFICATION

This qualification is approved by the regulatory authorities (QCA, ACCAC and CCEA) as part of the National Qualifications Framework.

Candidates who gain grades G to D will have achieved an award at Foundation Level.

Candidates who gain grades C to A* will have achieved an award at Intermediate Level.

Two GCSEs at grade G to D and two GCSEs at grade C to A* are equivalent to one three-unit GNVQ at Foundation and Intermediate Level respectively.

Four GCSEs at grade G to D and four GCSEs at grade C to A* are equivalent to one six-unit GNVQ at Foundation and Intermediate Level respectively.

1.4 RECOMMENDED PRIOR LEARNING

Candidates who are taking courses leading to this qualification at Key Stage 4 should normally have followed the corresponding Key Stage 3 programme of study within the National Curriculum.

Candidates entering this course should have achieved a general educational level equivalent to National Curriculum Level 3, or a distinction at Entry Level within the National Qualifications Framework.

1.5 PROGRESSION

GCSE qualifications are general qualifications which enable candidates to progress either directly to employment, or to proceed to further qualifications.

Many candidates who enter employment with one or more GCSEs would undertake training or further part-time study with the support of their employer.

Progression to further study from GCSE will depend upon the number and nature of the grades achieved. Broadly, candidates who are awarded mainly grades G to D at GCSE could either strengthen their base through further study of qualifications at Foundation Level within the National Qualifications Framework or could proceed to Intermediate level. Candidates who are awarded mainly grades C to A* at GCSE would be well prepared for study at Advanced Level within the National Qualifications Framework.

This specification provides progression from the Certificate of Achievement Mathematics Syllabus A (3910).

1.6 OVERLAP WITH OTHER QUALIFICATIONS

This specification satisfies completely the requirements for qualification for the KS4 award of GCSE Mathematics. It is identical in content, but different in structure, to the OCR GCSE Mathematics syllabuses 1966 Mathematics (Graduated Assessment) and 1968 Mathematics (MEI). The content of this Programme of Study is partly contained in:

- GCSE Statistics
- Free-Standing Mathematics units at Foundation and Intermediate Levels.

1.7 KEY SKILLS PROXY

A grade in the range of G to D in GCSE Mathematics provides exemption for the external test for the Application of Numbers Key Skill at Level 1.

A grade in the range of C to A* in GCSE Mathematics provides exemption for the external test for the Application of Numbers Key Skill at Level 2.

1.8 RESTRICTIONS ON CANDIDATE ENTRIES

Candidates who enter for this GCSE specification **may not** also enter for any other GCSE specification with the certification title Mathematics in the same examination series.

Candidates who enter for this GCSE **may** however also enter for any GNVQ specification with the certification title Mathematics in the same examination series. They may also enter for any Entry Level Certificate or NVQ qualification.

Every specification is assigned to a national classification code indicating the subject area to which it belongs.

Centres should be aware that candidates who enter for more than one GCSE qualification with the same classification code will have only one grade (the highest) counted for the purpose of the School and College Performance Tables.

The classification code for this specification is 2210.

1.9 CODE OF PRACTICE REQUIREMENTS

These specifications will comply in every respect with the revised Code of Practice requirements for courses starting in September 2001.

1.10 STATUS IN WALES AND NORTHERN IRELAND

This specification has been approved by ACCAC for use by Centres in Wales and by CCEA for use by Centres in Northern Ireland.

This specification has been written against the Key Stage 4 Programme of Study for England. Candidates entering for this GCSE in Wales/Northern Ireland must be taught all the material required in the National Curriculum in their own country.

Candidates in Wales and Northern Ireland should not be disadvantaged by terms, legislation or aspects of government that are different from those in England. Where such situations might occur, including in the external assessment, the terms used have been selected as neutral, so that candidates may apply whatever is appropriate to their own situation.

OCR will provide specifications, assessments and supporting documentation only in English.

Further information on the provision of assessment materials in Welsh and Irish may be obtained from the OCR Information Bureau (telephone 01223 553998).

2 Specification Aims

The aims of this GCSE specification are to encourage 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;
- acquire the skills needed to use technology such as calculators and computers effectively;
- work cooperatively, independently, practically and investigationally;
- acquire a firm foundation for further study.

3 Assessment Objectives

A course based on this specification requires candidates to demonstrate their knowledge, understanding and skills in the following assessment objectives. These relate to the knowledge, skills and understanding in the KS4 Programmes of Study.

Using and Applying Mathematics (AO1)

Number and Algebra (AO2)

Shape, Space and Measures (AO3)

Handling Data (AO4)

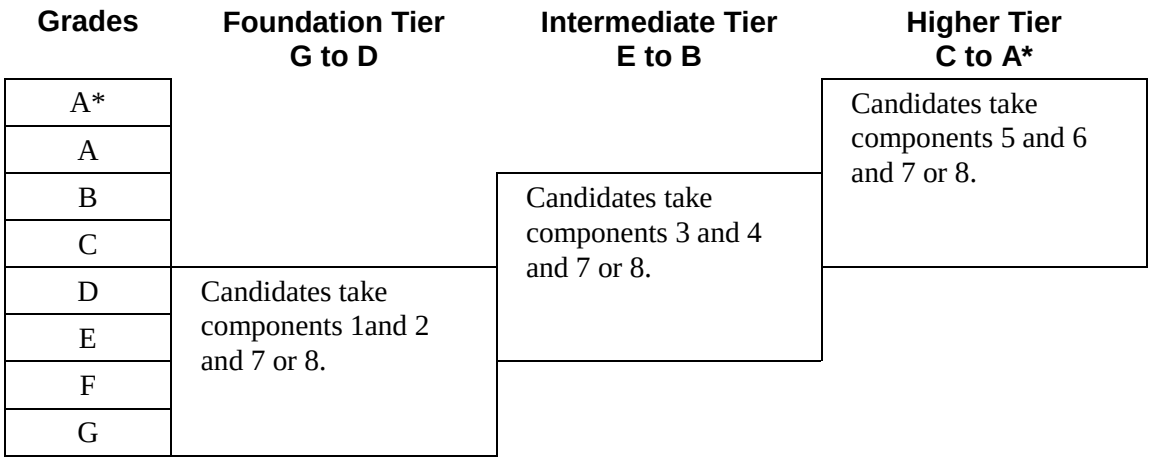
The Assessment Objective AO1, Using and Applying Mathematics, will be assessed through Internal Assessment provided by Assessment Objectives AO2 and AO3 and in the written papers as an integral part of questions assessing the content of AO2, AO3 and AO4.

4 Scheme of Assessment

4.1 TIERS

The scheme of assessment consists of three tiers: Foundation Tier, Intermediate Tier and Higher Tier. Foundation Tier assesses grades G to D, Intermediate Tier assesses grades E to B and Higher Tier assesses grades C to A*. Candidates will be entered for one of 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 grade D or a candidate entered for the Intermediate Tier be awarded a grade higher than grade 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.



4.2 COMPONENTS

Component	Title	Duration	Weighting
1	Paper 1 (Foundation Tier)	1 hour 30 minutes	40%
2	Paper 2 (Foundation Tier)	1 hour 30 minutes	40%
3	Paper 3 (Intermediate Tier)	2 hours	40%
4	Paper 4 (Intermediate Tier)	2 hours	40%
5	Paper 5 (Higher Tier)	2 hours	40%
6	Paper 6 (Higher Tier)	2 hours	40%
7	Internal Assessment (Centre Marked)	---------	20%
8	Internal Assessment (OCR Marked)	---------	20%
87	Internal Assessment carried forward	---------	20%

4.3 QUESTION PAPERS

- In the first paper in each tier candidates will not be allowed to use a calculator. In the second paper, however, there will be questions designed to test the effective use of the calculator.
- The difficulty of the questions at each tier will reflect the grades at that tier, with 25% of the marks in the Intermediate and Higher tiers addressing each grade in the tier. At Foundation level, one third of the marks in each paper will address grade G and the remaining marks will be divided equally between grades F, E and D.
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- Manipulative algebra will be given the required weighting at Intermediate and Higher tiers.
- At each tier there will be at least one question where candidates will be expected to supply the units of the answer and at least one question where candidates will be asked to give the answer to an appropriate degree of accuracy.

4.4 WEIGHTING OF ASSESSMENT OBJECTIVES

The relationship between the components and the assessment objectives of the scheme of assessment is shown in the following grid.

All Tiers

Tier/Paper			AO1: Using and Applying Mathematics	AO2: Number and Algebra	AO3: Shape, Space and Measures	AO4: Handling Data	Total
F	I	H					
1	**3**	**5**	5%	20%	10%	5%	**40%**
2	**4**	**6**	5%	20%	10%	5%	**40%**
Internal Assessment			10%			10%	**20%**
Overall			**20%**	**40%**	**20%**	**20%**	**100%**

4.5 ENTRY OPTIONS

All candidates should be entered for 1962 with one of the following option codes:

Option Code	Title	Components	Sessions
FA	Foundation Tier with Centre Marked Internal Assessment	1, 2, 7	June
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HC	Higher Tier with Internal Assessment Carried Forward	5, 6, 87	June

Options FC, IC and HC are available for candidates re-sitting the qualification who wish to carry forward their coursework. This may be done once only and within a year of original entry.

4.6 INTERNAL ASSESSMENT (COURSEWORK)

Candidates will submit two types of task, **both** of which will count towards the mark for Component 7 or Component 8. One type of task will assess Using and Applying Mathematics (AO1) and the other will assess Handling Data (AO4). Each type of task will be marked using the relevant, nationally agreed, assessment criteria found in Section 7.

Assessment Objective	Type of task	Weighting	Assessment Strands	Max. Mark
AO1	A task, or tasks, involving the skills and concepts outlined in AO2 and/or AO3.	10%	Strategy Communication Reasoning	8 8 8
AO4	A single task involving the skills and concepts outlined in AO4.	10%	Specify and Plan Collect, Process and Represent Interpret and Discuss	8 8 8

Two assessment options are available within the specification; assessment by the Centre which will be externally moderated (Option A), and assessment by OCR (Option B).

Option	A	B
Selection of Tasks	Centre-set Centres may design suitable open-ended tasks or the tasks may be drawn from a bank provided by OCR.	OCR-set Tasks suitable for Foundation/Intermediate Tier candidates **OR** Tasks suitable for Intermediate/Higher Tier candidates will be provided.
Time for Each Task	One to two weeks of mathematics lessons and homework time.	One to two weeks of mathematics lessons and homework time.
Marking Arrangements	Marked by the class teacher and internally standardised by the Centre.	OCR-marked.
External Standardisation	By post using OCR procedures.	Not applicable.
Deadline	Submitted for external standardisation in April of the year of the examination.	Submitted for marking in April of the year of the examination.

For either option, candidates may undertake work outside the classroom, but they must complete some part of the work under circumstances in which a teacher can directly supervise them. The teacher must be able to verify that the work submitted for assessment is the candidate's own work.

Examples of appropriate tasks are given in Section D and in the Support Materials.

Full details of internal assessment can be found in Section D and in the Support Materials.

4.7 ASSESSMENT OF WRITTEN COMMUNICATION AND ICT

Candidates are expected to:

- present relevant information in a form that suits its purpose;
- ensure text is legible and that spelling, punctuation and grammar are accurate, so that meaning is clear.

Marks are not awarded specifically for the above points but clear presentation of work will enable identification of work that would earn marks for method and accuracy of Mathematics.

Candidates are also expected to:

- use calculators effectively, know how to enter complex calculations and use function keys for reciprocals, squares and powers (Foundation Tier: F2.3o);
- use calculators effectively and efficiently, know how to enter complex calculations; use an extended range of function keys, including trigonometrical and statistical functions relevant to the Programme of Study (Intermediate and Higher Tiers: H2.3o).

Questions will be set on Papers 2, 4 and 6 that will specifically test the use of calculators.

In addition, it is expected that candidates should be given the opportunity to:

- use spreadsheets to construct formulae to model situations;
- use databases or spreadsheets to present their findings and to display their data;
- use graphics software for simple curve-fitting techniques and to explore transformations;
- retrieve data from the Internet for use in Handling Data projects.

4.8 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 an assessment designed to meet their particular needs, Centres must take care that each candidate is entered at the tier for which they are most suited.

In internal assessment differentiation will be by task and by outcome. Candidates should undertake tasks which enable them to display positive achievement. Candidates entered for Option B (OCR-set and OCR-marked tasks) will have two sets of tasks available. The Foundation/Intermediate tasks may not allow more able candidates to show attainment at the highest levels of which they are capable while the Intermediate/Higher tasks may prove inaccessible to less able candidates. It is therefore important that the set of tasks chosen is appropriate to the level of the candidate.

4.9 AWARDING OF GRADES

The written papers will have a total weighting of 80% and internal assessment a weighting of 20%.

A candidate's mark for each of the components taken will be combined in the appropriate weighting to give the candidate's total mark for the specification. The candidate's grade will be determined by this total mark.

In Foundation Tier candidates achieving less than the minimum mark for grade G will be ungraded. Candidates on the Intermediate Tier who fail to achieve the minimum mark for the award of a grade E will be ungraded. Candidates on the Higher Tier who fail to achieve the minimum mark for the award of a grade C will be ungraded.

4.10 GRADE DESCRIPTIONS

Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by the candidates awarded particular grades. The descriptions must be interpreted in relation to the content specified in Section 5; they are not designed to define that content. 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 the assessment may be balanced by better performance 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 draw simple conclusions of their own 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 reduce a fraction to its simplest form by cancelling common factors and solve simple problems involving ratio and direct proportion. 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 know the angle sum of a triangle and that of angles at a point. 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 calculate areas of rectangles and right-angled triangles, and volumes of cuboids.

Candidates understand and use the mean of discrete data. They compare two simple distributions using the range and one of the mode, median or mean. 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 refine or extend the mathematics used to generate fuller solutions. They give a reason for their choice of mathematical presentation, explaining features they have selected. Candidates justify their generalisations, arguments or solutions, showing some insight into the mathematical structure of the problem. 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. They understand and use the equivalences 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 nth term of a sequence, where the rule is quadratic; they multiply two expressions of the form $(x + n)$; they simplify the corresponding quadratic expressions. 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 use algebraic and graphical methods to solve simultaneous linear equations in two variables.

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 imprecision 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.

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 and make inferences. 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 or procedures 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 that approximately connect data, candidates express general laws in symbolic form. 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, and Pythagoras' theorem when solving problems in two and three dimensions. They use the conditions for congruent triangles in formal geometric proofs. 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 work with probabilities associated with independent and mutually exclusive events.

SECTION C: SPECIFICATION CONTENT

5 Specification Content

The specification content is based on the National Curriculum Programmes of Study (PoS) for KS4 published in 1999. There is a Foundation PoS and a Higher PoS.

- The Foundation PoS, with the grade C material excluded, forms the content of the Foundation Tier.
- The Higher PoS, with the grade A and A* material excluded, forms the content of the Intermediate Tier.
- The Higher PoS, with the grade D and lower material excluded, forms the content of the Higher Tier.

National Curriculum references (NC ref) have been included.
Those prefaced **F** refer to the Foundation PoS [e.g. **F3.2f** refers to AO**3** (Shape, space and measures), section **2** (Geometrical reasoning) statement **f** (explore the geometry of cuboids...)]
Those prefaced **H** refer to the Higher PoS.

Any statements which duplicate completely that statement in a lower tier are denoted by .....

In general, the Intermediate Tier content subsumes the Foundation Tier content. However, it is not appropriate for Intermediate Tier questions to focus directly on material that is outside the grade range of the tier. Similarly, the Higher Tier content subsumes the Foundation and Intermediate Tier content, but questions will not focus directly directly on material that is outside the grade range of the tier.

AO2 Number and Algebra	NC ref	Foundation Tier	NC ref	Intermediate Tier
1. Using and applying Number and Algebra				
		pupils should be taught to:		pupils should be taught to:
Problem Solving	F2.1a	select and use suitable problem-solving strategies and efficient techniques to solve numerical and algebraic problems	H2.1a	select and use appropriate and efficient techniques and strategies to solve problems of increasing complexity, involving numerical and algebraic manipulation
			H2.1b	identify what further information may be required in order to pursue a particular line of enquiry and give reasons for following or rejecting particular approaches
	F2.1b	break down a complex calculation into simpler steps before attempting to solve it	H2.1c	..... and justify their choice of methods
	F2.1c	use algebra to formulate and solve a simple problem - identifying the variable, setting up an equation, solving the equation and interpreting the solution in the context of the problem		
	F2.1d	make mental estimates of the answers to calculations; use checking procedures, including use of inverse operations; work to stated levels of accuracy	H2.1d	make mental estimates of the answers to calculations; present answers to sensible levels of accuracy; understand how errors are compounded in certain calculations
Communicating	F2.1e	interpret and discuss numerical and algebraic information presented in a variety of forms	H2.1e	discuss their work and explain their reasoning using an increasing range of mathematical language and notation
	F2.1f	use notation and symbols correctly and consistently within a given problem	H2.1h	.....
	F2.1g	use a range of strategies to create numerical, algebraic or graphical representations of a problem and its solution	H2.1f	use a variety of strategies and diagrams for establishing algebraic or graphical representations of a problem and its solution; move from one form of representation to another to get different perspectives on the problem
	F2.1h	present and interpret solutions in the context of the original problem	H2.1g	.....
			H2.1i	examine critically, improve, then justify their choice of mathematical presentation
Reasoning	F2.1j	explore, identify, and use pattern and symmetry in algebraic contexts, investigating whether particular cases can be generalised further, and understanding the importance of a counter-example (1)	H2.1j	..... identify exceptional cases when solving problems
			H2.1k	understand the difference between a practical demonstration and a proof
	F2.1k	show step-by-step deduction in solving a problem	H2.1l	.....
			H2.1m	recognise the significance of stating constraints and assumptions when deducing results; recognise the limitations of any assumptions that are made and the effect that varying the assumptions may have on the solution to a problem
2. Numbers and the number system				
Integers	F2.2a	use their previous understanding of integers and place value to deal with arbitrarily large positive numbers and round them to a given power of 10; understand and use positive numbers, both as positions and translations on a number line; order integers; use the concepts and vocabulary of factor (divisor), multiple and common factor	H2.2a	use their previous understanding of integers and place value to deal with arbitrarily large positive numbers and round them to a given power of 10; understand and use negative integers both as positions and translations on a number line; order integers; use the concepts and vocabulary of factor (divisor), multiple, common factor, highest common factor, least common multiple, prime number and prime factor decomposition
Powers and roots	F2.2b	use the terms square, positive square root, cube; use index notation for squares, cubes and powers of 10	H2.2b	..... use the terms negative square root, cube and cube root; use index notation (1) and index laws for multiplication and division of integer powers; use standard index form, expressed in conventional notation and on a calculator display

NC ref	Higher Tier		Key Skills and notes
	1. Using and applying Number and Algebra		
	pupils should be taught to:		
H2.1a	.....		PS1.1, PS2.1
H2.1b	.....		PS1.2, PS2.2
H2.1e	.....		
H2.1f	move from one form of representation to another to get different perspectives on the problem		N1.3, PS1.1,
			C1.3, N1.3, PS1.3
H2.1i	..... present a concise, reasoned argument		PS1.1, PS2.3, C1.3
H2.1j	understand the importance of a counter-example; identify exceptional cases when solving problems		Foundation: (1)[for example, using simple codes that substitute numbers for letters]
H2.1k	.....		
H2.1l	derive proofs using short chains of deductive reasoning		
H2.1m	.....		
	2. Numbers and the number system		
H2.2a	use the concepts and vocabulary of highest common factor, least common multiple, prime number and prime factor decomposition		
H2.2b	use index laws for multiplication and division of integer powers; use standard index form, expressed in conventional notation and on a calculator display		Intermediate : (1)[for example, 8^2, $8^{-2/3}$]

AO2 Number and Algebra	NC ref	Foundation Tier	NC ref	Intermediate Tier
		pupils should be taught to:		pupils should be taught to:
Fractions	F2.2c	understand equivalent fractions, simplifying a fraction by cancelling all common factors; order fractions by rewriting them with a common denominator	H2.2c	.....
Decimals	F2.2d	use decimal notation and recognise that each terminating decimal is a fraction (1); order decimals	H2.2d	..... ; recognise that recurring decimals are exact fractions, and that some exact fractions are recurring decimals (2)
Percentages	F2.2e	understand that 'percentage' means 'number of parts per 100' and use this to compare proportions; interpret percentage as the operator 'so many hundredths of' (1); use percentage in real-life situations (2)	H2.2e	understand that 'percentage' means 'number of parts per 100' and interpret percentage as the operator 'so many hundredths of' (1)
Ratio	F2.2f	use ratio notation, including reduction to its simplest form and its various links to fraction notation (1)	H2.2f	.....
3. Calculations				
Number operations and the relationships between them	F2.3a	add, subtract, multiply and divide integers and then any number; multiply or divide any number by powers of 10, and any positive number by a number between 0 and 1	H2.3a	multiply or divide any number by powers of 10, and any positive number by a number between 0 and 1; find the prime factor decomposition of positive integers; understand 'reciprocal' as multiplicative inverse, knowing that any non-zero number multiplied by its reciprocal is 1 (and that zero has no reciprocal, because division by zero is not defined); multiply and divide by a negative number; use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of integer powers; use inverse operations
	F2.3b	use brackets and hierarchy of operations	H2.3b	.....
	F2.3c	calculate a given fraction of a given quantity, (1) expressing the answer as a fraction; express a given number as a fraction of another; add and subtract fractions by writing them with a common denominator; perform short division to convert a simple fraction to a decimal	H2.3c	..... ; distinguish between fractions with denominators that have only prime factors of 2 and 5 (which are represented by terminating decimals), and other fractions (which are represented by recurring decimals)
	F2.3d	understand and use unit fractions as multiplicative inverses (1)(2); multiply and divide a fraction by an integer, and multiply a fraction by a unit fraction	H2.3d	..... , and by a general fraction
	F2.3e	convert simple fractions of a whole to percentages of the whole and vice versa (1)	H2.3e	..... understand the multiplicative nature of percentages as operators (2); calculate an original amount when given the transformed amount after a percentage change; reverse percentage problems (3)
	F2.3f	divide a quantity in a given ratio (1)	H2.3f	.....
Mental methods	F2.3g	recall all positive integer complements to 100 (1); recall all multiplication facts to 10×10, and use them to derive quickly the corresponding division facts; recall the cubes of 2, 3, 4, 5 and 10, and the fraction-to-decimal conversion of familiar simple fractions (2)	H2.3g	recall integer squares from 2×2 to 15×15 and the corresponding square roots, the cubes of 2, 3, 4, 5 and 10

NC ref	Higher Tier		Key Skills and notes
	pupils should be taught to:		
H2.2d	recognise that recurring decimals are exact fractions, and that some exact fractions are recurring decimals (2)		Foundation and Intermediate: (1)[for example, 0.137= 137/1000] Intermediate and Higher : (2)[for example, 1/7 = 0.142857142857...]
			Foundation and Intermediate: (1)[for example, 10% means 10 parts per 100 and 15% of Y means 15/100 ×Y] Foundation : (2)[for example, commerce and business, including rate of inflation, VAT and interest rates] Foundation Tier : Financial capability
H2.2f	.....		Foundation: (1) [for example, in maps and scale drawings, paper size and gears]
3. Calculations			
H2.3a	multiply or divide any number by a number between 0 and 1; find the prime factor decomposition of positive integers; understand 'reciprocal' as multiplicative inverse, knowing that any non-zero number multiplied by its reciprocal is 1 (and that zero has no reciprocal, because division by zero is not defined); multiply and divide by a negative number; use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of integer, fractional and negative powers; use inverse operations, understanding that the inverse operation of raising a positive number to power n is raising the result of this operation to power $1/n$		N1.2, N2.2
H2.3c	distinguish between fractions with denominators that have only prime factors of 2 and 5 (which are represented by recurring decimals); convert a recurring decimal to a fraction (2)		Foundation :(1) [for example, for scale drawings and construction of models, down payments, discounts] Higher : (2)[for example, 0.142857142857… = 1/7]
H2.3d	multiply and divide a given fraction by a unit fraction and by a general fraction (2)		Foundation and Intermediate :(1) [for example, by thinking of multiplication by 1/5 as division by 5] Foundation , Intermediate and Higher :(2) for example, by thinking of multiplication by 6/7 as multiplication by 6 followed by division by 7 (or vice versa)]
H2.3e	understand the multiplicative nature of percentages as operators (2); calculate an original amount when given the transformed amount after a percentage change; reverse percentage problems (3)		Foundation : (1)[for example, analysing diets, budgets or the costs of running, maintaining and owning a car] Intermediate and Higher : (2)[for example, a 15% increase in value Y, followed by a 15% decrease is calculated as $1.15 \times 0.85 \times Y$]; (3)[for example, given that a meal in a restaurant costs £36 with VAT at 17.5%, its price before VAT is calculated as £36/1.175]
H2.3f	.....		Foundation : (1)[for example, share £15 in the ratio of 1:2]
H2.3g	..... the fact that $n^0 = 1$ and $n^{-1} = 1/n$ for positive integers n (2), the corresponding rule for negative numbers (3), $n^{½} = \sqrt{n}$ and $n^{1/3} = \sqrt[3]{n}$ for any positive number n (4)		Foundation : (1)[for example, 37 + 63 = 100]; (2)[for example, 1/2, 1/4, 1/5, 1/10, 1/100, 1/3, 2/3, 1/8] Higher : (2) [for example, $10^0 = 1$; $9^{-1} = 1/9$], (3)[for example, $5^{-2} = 1/5^2 = 1/25$], (4)[for example, $25^{½} = 5$ and $64^{1/3} = 4$]

AO2 Number and Algebra	NC ref	Foundation Tier	NC ref	Intermediate Tier
		pupils should be taught to:		pupils should be taught to:
	F2.3h	round to the nearest integer and to one significant figure; estimate answers to problems involving decimals	H2.3h	round to a given number of significant figures; develop a range of strategies for mental calculation; derive unknown facts from those they know; convert between ordinary and standard index form representations (1), converting to standard index form to make sensible estimates for calculations involving multiplication and/or division
	F2.3i	develop a range of strategies for mental calculation; derive unknown facts from those they know (1) ; add and subtract mentally numbers with up to two decimal places (2); multiply and divide numbers with no more than one decimal digit (3), using the commutative, associative, and distributive laws and factorisation where possible, or place value adjustments		
Written methods	F2.3j	use standard column procedures for addition and subtraction of integers and decimals		
	F2.3k	use standard column procedures for multiplication of integers and decimals, understand where to position the decimal point by considering what happens if they multiply equivalent fractions		
	F2.3l	use efficient methods to calculate with fractions, including cancelling common factors before carrying out the calculation, recognising that, in many cases, only a fraction can express the exact answer	H2.3i	.....
	F2.3m	solve simple percentage problems, including increase and decrease (1)	H2.3j	solve percentage problems, including percentage increase and decrease (2); and reverse percentages
	F2.3n	solve word problems about ratio and proportion, including using informal strategies and the unitary method of solution (1)	H2.3k	represent repeated proportional change using a multiplier raised to a power (2)
			H2.3l	calculate an unknown quantity from quantities that vary in direct proportion
			H2.3m	calculate with standard index form (1)
			H2.3n	use surds and π in exact calculations, without a calculator
Calculator methods	F2.3o	use calculators effectively: know how to enter complex calculations and use function keys for reciprocals, squares and powers	H2.3o	use calculators effectively and efficiently, knowing how to enter complex calculations; use an extended range of function keys, including trigonometrical and statistical functions relevant across this programme of study
	F2.3p	enter a range of calculations, including those involving measures (1)	H2.3p	understand the calculator display, knowing when to interpret the display, when the display has been rounded by the calculator, and not to round during the intermediate steps of a calculation
	F2.3q	understand the calculator display (1), interpreting it correctly and knowing not to round during the intermediate steps of a calculation		
			H2.3r	use standard index form display and know how to enter numbers in standard index form
			H2.3s	use calculators for reverse percentage calculations by doing an appropriate division

NC ref	Higher Tier		Key Skills and notes
	pupils should be taught to:		
H2.3h	round to a given number of significant figures; convert between ordinary and standard index form representations, converting to standard index form to make sensible estimates for calculations involving multiplication and/or division		Intermediate/Higher : (1)[for example, $0.1234 = 1.234 \times 10^{-1}$] N1.2, N2.2
			Foundation : (1)[for example, estimate $\sqrt{85}$]; (2)[for example, 13.76 – 5.21, 20.08 + 12.4]; (3)[for example, 14.3×4, $56.7 \div 7$]
H2.3j	solve percentage problems; and reverse percentages		Foundation : (1)[for example, VAT, annual rate of inflation, income tax, discounts] Intermediate/Higher : (2)[for example, simple interest, VAT, annual rate of inflation] All tiers: Financial capability
H2.3k	.....		Foundation : (1)[for example, given that m identical items cost £y, then one item costs £y/m and n items cost £$(n \times y/m)$, the number of items that can be bought for £z is $z \times m/y$] Intermediate/Higher : (2)[for example, compound interest] N1.2, N2.2
H2.3l	calculate an unknown quantity from quantities that vary in direct or inverse proportion		N1.2, N2.2
H2.3m	.....		Intermediate/Higher :(1) [for example, $2.4 \times 10^7 \times 5 \times 10^3 = 12 \times 10^{10} = 1.2 \times 10^{11}$; $(2.4 \times 10^7) \div (5 \times 10^3) = 4.8 \times 10^3$]
H2.3n	..... rationalise a denominator such as $1/\sqrt{3} = \sqrt{3}/3$		
H2.3o	.....		
			Foundation : (1)[for example, time calculations in which fractions of an hour must be entered as fractions or as decimals]
H2.3q	use calculators, or written methods, to calculate the upper and lower bounds of calculations, particularly when working with measurements		Foundation :(1) [for example, in money calculations, or when the display has been rounded by the calculator]
H2.3r	.....		
H2.3s	.....		

AO2 Number and Algebra	NC ref	Foundation Tier	NC ref	Intermediate Tier
		pupils should be taught to:		pupils should be taught to:
4. Solving numerical problems				
	F2.4a	draw on their knowledge of the operations and the relationships between them, and of simple integer powers and their corresponding roots, to solve problems involving ratio and proportion, a range of measures, including speed, metric units, and conversion between metric and common imperial units, set in a variety of contexts	H2.4a	draw on their knowledge of operations and inverse operations (including powers and roots), and of methods of simplification (including factorisation and the use of the commutative, associative and distributive laws of addition, multiplication and factorisation) in order to select and use suitable strategies and techniques to solve problems and word problems, including those involving ratio and proportion, repeated proportional change, fractions, percentages and reverse percentages, surds, measures and conversion between measures, and compound measures defined within a particular situation
	F2.4b	select appropriate operations, methods and strategies to solve number problems, including trial and improvement where a more efficient method to find the solution is not obvious		
	F2.4c	use a variety of checking procedures, including working the problem backwards, and considering whether a result is of the right order of magnitude		
	F2.4d	give solutions in the context of the problem to an appropriate degree of accuracy, interpreting the solution shown on a calculator display, and recognising limitations on the accuracy of data and measurements	H2.4b	check and estimate answers to problems; select and justify appropriate degrees of accuracy for answers to problems; recognise limitations on the accuracy of data and measurements
5. Equations, formulae and identities				
Use of symbols	F2.5a	distinguish the different roles played by letter symbols in algebra, knowing that letter symbols represent definite unknown numbers in equation (1), defined quantities or variables in formulae (2) , general, unspecified and independent numbers in identities (3) and in functions they define new expressions or quantities by referring to known quantities (4)	H2.5a	distinguish the different roles played by letter symbols in algebra, using the correct notational conventions for multiplying or dividing by a given number, and knowing that letter symbols represent definite unknown numbers in equations (5), defined quantities or variables in formula (6) , general, unspecified and independent numbers in identities (7), and in functions they define new expressions or quantities by referring to known quantities (8)
	F2.5b	understand that the transformation of algebraic expressions obeys and generalises the rules of arithmetic; manipulate algebraic expressions by collecting like terms, by multiplying a single term over a bracket, and by taking out single term common factors (1)	H2.5b	understand that the transformation of algebraic entities obeys and generalises the well-defined rules of generalised arithmetic (2) expand the product of two linear expressions (3); manipulate algebraic expressions by collecting like terms, multiplying a single term over a bracket, taking out common factors (4), factorising quadratic expressions including the difference of two squares (5) and cancelling common factors in rational expressions (6)
			H2.5c	know the meaning of and use the words ‘equation’, ‘formula’, ‘identity’ and ‘expression’

NC ref	Higher Tier		Key Skills and notes
	pupils should be taught to:		
H2.3t	use calculators to explore exponential growth and decay (1), using a multiplier and the power key		Higher : (1)[for example, in science or geography]
4. Solving numerical problems			
H2.4a	..... (solve problems and word problems involving) inverse proportion		N1.2, N2.2
			N1.2, N2.2
H2.4b	.....		N1.2, N2.2
5. Equations, formulae and identities			
H2.5a	.....		Foundation : (1)[for example, $5x + 1 = 16$] ;(2)[for example, $V = IR$], (3)[for example, $3x + 2x = 5x$ for all values of x] ; (4)[for example, $y = 2x$] Intermediate/Higher : (5)[for example, $x^2 + 1 = 82$], (6)[for example, $V = IR$], (7)[for example, $(x + 1)^2 = x^2 + 2x + 1$ for all values of x], (8)[for example, $y = 2 – 7x$; $f(x) = x^3$; $y = 1/x$ with $x \neq 0$]
H2.5b	.....		Foundation : (1)[for example, $x + 5 - 2x - 1 = 4 - x$; $5(2x + 3) = 10x + 15$; $x^2 + 3x = x(x + 3)$] Intermediate/Higher : (2) [for example, $a(b + c) = ab + ac$]; (3)[for example, $(x + 1)(x + 2) = x^2 + 3x + 2$]; (4)[for example, $9x – 3 = 3(3x – 1)$]; (5)[for example, $x^2 – 9 = (x + 3)(x – 3)$] ; (6)[for example, $2(x + 1)^2/(x + 1) = 2(x + 1)$]
H2.5c	.....		

AO2 Number and Algebra	NC ref	Foundation Tier	NC ref	Intermediate Tier
		pupils should be taught to:		pupils should be taught to:
Index notation	F2.5c	use index notation for simple integer powers, and substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$	H2.5d	use index notation for simple integer powers, and simple instances of index laws (1); substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$
Equations			H2.5e	set up simple equations (1); solve simple equations (2) by using inverse operation or by transforming both sides in the same way
Linear equations	F2.5e	solve linear equations, with integer coefficients, in which the unknown appears on either side or on both sides of the equation; solve linear equations that require prior simplification of brackets, including those that have negative signs occurring anywhere in the equation, and those with a negative solution	H2.5f	solve linear equations in one unknown, with integer or fractional coefficients, in which the unknown appears on either side or on both sides of the equation; solve linear equations that required prior simplification of brackets, including those that have negative signs occurring anywhere in the equation, and those with a negative solution
Formulae	F2.5f	use formulae from mathematics and other subjects expressed initially in words and then using letters and symbols (1); substitute numbers into a formula; derive a formula (2)	H2.5g	use formulae from mathematics and other subjects (3); substitute numbers into a formula; change the subject of a formula, including cases where the subject occurs twice, or where a power of the subject appears (4); generate a formula (5)
Direct and Inverse Proportion				
Simultaneous linear equations			H2.5i	find the exact solution of two simultaneous equations in two unknowns by eliminating a variable, and interpret the equations as lines and their common solution as the point of intersection
Inequalities	F2.5d	solve simple linear inequalities in one variable, and represent the solution set on a number line	H2.5j	..... solve several linear inequalities in two variables and find the solution set
Quadratic equations			H2.5k	solve quadratic equations by factorisation
Simultaneous linear and quadratic equations				
Numerical methods			H2.5m	use systematic trial and improvement to find approximate solutions of equations where there is no simple analytical method of solving them (1)

NC ref	Higher Tier		Key Skills and notes
	pupils should be taught to:		
H2.5d	use simple instances of index laws (1)		Intermediate/Higher : (1)[for example, $x^2 \times x^3 = x^5$; $x^2 \div x^3 = x^{-1}$; $(x^2)^3 = x^6$];
H2.5e	.....		Intermediate/Higher : (1)[for example, find the angle a in a triangle with angles a, $a + 10$, $a + 20$]; (2)[for example, $5x = 7$; $11 - 4x = 2$; $3(2x + 1) = 8$; $2(1 - x) = 6(2 + x)$; $4x^2 = 49$; $3 = 12/x$]
H2.5f	solve linear equations in one unknown, with integer or fractional coefficients, in which the unknown appears on either side or on both sides of the equation		
H2.5g	.....		Foundation : (1)[for example, formulae for the area of a triangle, the area enclosed by a circle, wage earned = hours worked × rate per hour]; (2)[for example, convert temperatures between degrees Fahrenheit and degrees Celsius, find the perimeter of a rectangle given its area A and length l of one side] Intermediate/Higher : (3)[for example, for area of a triangle or a parallelogram, area enclosed by a circle, volume of a prism, volume of a cone]; (4)[for example, find r given that $A = \pi r^2$, find x given $y = mx + c$]; (5)[for example, find the perimeter of a rectangle given its area A and the length l of one side] N2.2, IT1.2, IT2.2 Foundation Tier : Pupils could use a spreadsheet to construct formulae to model situations. Intermediate/Higher Tiers: Pupils could use a spreadsheet or graphic calculator to construct and use formulae.
H2.5h	set up and use equations to solve word and other problems involving direct proportion or inverse proportion and relate algebraic solutions to graphical representation of the equations (1)		Higher : (1) [for example, $y \propto x$, $y \propto x^2$, $y \propto 1/x$, $y \propto 1/x^2$]
H2.5i	.....		
H2.5j	.....		
H2.5k	solve quadratic equations by factorisation, completing the square and using the quadratic formula		
H2.5l	solve exactly, by elimination of an unknown, two simultaneous equations in two unknowns, one of which is linear in each unknown, and the other is linear in one unknown and quadratic in the other (1), or where the second is of the form $x^2 + y^2 = r^2$		Higher : (1) [for example, $y = 11x - 2$ and $y = 5x^2$]
H2.5m	.....		Intermediate/Higher : (1) [for example, $x^3 = x - 900$]

AO2 Number and Algebra	NC ref	Foundation Tier	NC ref	Intermediate Tier
		pupils should be taught to:		pupils should be taught to:
6. Sequences, functions and graphs				
Sequences	F2.6a	generate terms of a sequence using term-to term and position-to-term definitions of the sequence	H2.6a	generate common integer sequences (including sequences of odd or even integers, squared integers, powers of 2, powers of 10, triangular numbers); generate terms of a sequence using term-to-term and position-to-term definitions of the sequence; use linear expressions to describe the *n*th term of an arithmetic sequence, justifying its form by reference to the activity or context from which it was generated
Graphs of linear functions	F2.6b	use the conventions for coordinates in the plane; plot points in all four quadrants; plot graphs of functions in which y is given explicitly in terms of x (1) or implicitly (2)	H2.6b	use conventions for coordinates in the plane; plot points in all four quadrants; recognise (when values are given for m and c) that equations of the form $y = mx + c$ correspond to straight-line graphs in the coordinate plane; plot graphs of functions in which y is given explicitly in terms of x (1), or implicitly (2)
	F2.6c	construct linear functions from real-life problems and plot their corresponding graphs; discuss and interpret graphs arising from real situations	H2.6c	find the gradient of lines given by equations of the form $y = mx + c$ (when values are given for m and c); understand that the form $y = mx + c$ represents a straight line and that m is the gradient of the line, and c is the value of the y-intercept; explore the gradients of parallel lines (1)
Interpreting graphical information	F2.6e	interpret information presented in a range of linear and non-linear graphs (1)	H2.6d	construct linear functions and plot the corresponding graphs arising from real-life problems; discuss and interpret graphs modelling real situations (2)
Quadratic functions			H2.6e	generate points and plot graphs of simple quadratic functions(1), then more general quadratic functions (2); find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function
Other functions			H2.6f	plot graphs of: simple cubic functions (1), the reciprocal function $y = 1/x$ with $x \neq 0$, using a spreadsheet or graph plotter as well as pencil and paper; recognise the characteristic shapes of all these functions
Transformation of functions				
Loci			H2.6h	construct the graphs of simple loci

NC ref	Higher Tier		Key Skills and notes
	pupils should be taught to:		
6. Sequences, functions and graphs			
H2.6a	generate common integer sequences (including sequences of odd or even integers, squared integers, powers of 2, powers of 10, triangular numbers); use linear expressions to describe the *n*th term of an arithmetic sequence, justifying its form by reference to the activity or context from which it was generated		
H2.6b	recognise (when values are given for *m* and *c*) that equations of the form $y = mx + c$ correspond to straight-line graphs in the coordinate plane	  	Foundation/Intermediate : (1)[for example, $y = 2x + 3$], (2) [for example, $x + y = 7$] Foundation : Pupils could use a spreadsheet to calculate points and to draw graphs to explore the effects of varying *m* and *c* in the graph of $y = mx + c$. Intermediate/Higher : Pupils could generate functions from plots of experimental data using simple curve fitting techniques on graphic calculators or with graphics software. IT1.2, IT2.2
H2.6c	..... and lines perpendicular to these lines (2)		Intermediate/Higher : (1)[for example, know that the lines represented by the equations $y = -5x$ and $y = 3 – 5x$ are parallel, each having gradient (-5) and that (2) the line with equation $y = x/5$ is perpendicular to these lines and has gradient 1/5]
H2.6d	.....		Foundation : (1) [for example, graphs describing trends, conversion graphs, distance-time graphs, graphs of height or weight against age, graphs of quantities that vary against time, such as employment] Intermediate/Higher : (2) [for example, distance-time graph for a particle moving with constant speed, the depth of water in a container as it empties, the velocity-time graph for a particle moving with constant acceleration] C1.2, N2.1
H2.6e	..... find the intersection points of the graphs of a linear and quadratic function, knowing that these are the approximate solutions of the corresponding simultaneous equations representing the linear and quadratic functions		Intermediate/Higher : (1) [for example, $y = x^2$; $y = 3x^2 + 4$], (2) [for example, $y = x^2 – 2x + 1$]
H2.6f	..... plot graphs of: the exponential function $y = k^x$ for integer values of *x* and simple positive values of *k* (2), the circular functions $y = \sin x$ and $y = \cos x$, using a spreadsheet or graph plotter as well as pencil and paper; recognise the characteristic shapes of all these functions		Intermediate/Higher : (1) [for example, $y = x^3$], Higher : (2) [for example, $y = 2^x$; $y = (½)^x$] IT1.1, IT1.2, IT2.2
H2.6g	apply to the graph of $y = f(x)$ the transformations $y = f(x) + a$, $y = f(ax)$, $y = f(x + a)$, $y = af(x)$ for linear, quadratic, sine and cosine functions $f(x)$	 	Higher : Pupils could use software to explore transformations of graphs. IT2.2
H2.6h	..... including the circle $x^2 + y^2 = r^2$ for a circle of radius *r* centred at the origin of coordinates; find graphically the intersection points of a given straight line with this circle and know that this corresponds to solving the two simultaneous equations representing the line and the circle		

AO3 Shape, space and measures	NC ref	Foundation Tier	NC ref	Intermediate Tier
		pupils should be taught to:		pupils should be taught to:
1. Using and Applying shape, space and measures				
Problem solving	F3.1a	select problem-solving strategies and resources, including ICT tools, to use in geometrical work, and monitor their effectiveness	H3.1a	select the problem-solving strategies to use in geometrical work, and consider and explain the extent to which the selections they made were appropriate
	F3.1b	select and combine known facts and problem-solving strategies to solve complex problems	H3.1b	select and combine known facts and problem-solving strategies to solve more complex geometrical problems
	F3.1c	identify what further information is needed to solve a geometrical problem; break complex problems down into a series of tasks	H3.1c	develop and follow alternative lines of enquiry
Communic-ating	F3.1d	interpret, discuss and synthesise geometrical information presented in a variety of forms	H3.1d	communicate mathematically, with emphasis on a critical examination of the presentation and organisation of results, and on effective use of symbols and geometrical diagrams
	F3.1e	communicate mathematically, by presenting and organising results and explaining geometrical diagrams		review and justify their choices of mathematics presentation ;
	F3.1f	use geometrical language appropriately		
Reasoning	F3.1i	apply mathematical reasoning, explaining and justifying inferences and deductions	H3.1f	apply mathematical reasoning, progressing from brief mathematical explanations towards full justifications in more complex contexts
			H3.1g	explore connections in geometry; pose conditional constraints of the type 'If … then … '; and ask questions 'What if … ?' or 'Why?'
	F3.1j	show step-by-step deduction in solving a geometrical problem	H3.1h	.....
			H3.1i	state constraints and give starting points when making deductions
2. Geometrical reasoning				
Angles	F3.2a	recall and use properties of angles at a point, angles on a straight line (including right angles), perpendicular lines, and opposite angles at a vertex		
	F3.2b	distinguish between acute, obtuse, reflex and right angles; estimate the size of an angle in degrees		
Properties of triangles and other recti-linear shapes	F3.2c	use parallel lines, alternate angles and corresponding angles; understand the properties of parallelograms and a proof that the angle sum of a triangle is 180 degrees; understand a proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices	H3.2a	distinguish between lines and line segments; use parallel lines, alternate angles and corresponding angles; understand the consequent properties of parallelograms and a proof that the angle sum of a triangle is 180 degrees; understand a proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices

NC ref	Higher Tier		Key Skills and notes
	pupils should be taught to:		
1. Using and Applying shape, space and measures			
H3.1a	.....	 	IT1.2, PS1.1, PS2.1
H3.1b	.....		PS1.2, PS2.2
H3.1c	develop and follow alternative lines of enquiry, justifying their decisions to follow or reject particular approaches		PS1.2, PS1.3, PS2.2, PS2.3
H3.1d	.....		C1.2,
H3.1e	use precise formal language and exact methods for analysing geometrical configurations		C1.3
H3.1f	.....		C1.3, PS1.3, PS2.3
H3.1g	.....		
			PS1.3, PS2.3
H3.1i	.....		
H3.1j	understand the necessary and sufficient conditions under which generalisations, inferences and solutions to geometrical problems remain valid		
2. Geometrical reasoning			
H3.2a	distinguish between lines and line segments		

AO3 Shape, space and measures	NC ref	Foundation Tier	NC ref	Intermediate Tier
		pupils should be taught to:		pupils should be taught to:
	F3.2d	use angle properties of equilateral, isosceles and right-angled triangles; understand congruence; explain why the angle sum of any quadrilateral is 360 degrees	H3.2b	use angle properties of equilateral, isosceles and right-angled triangles; explain why the angle sum of a quadrilateral is 360 degrees
	F3.2e	use their knowledge of rectangles, parallelograms and triangles to deduce formulae for the area of a parallelogram, and a triangle, from the formula for the area of a rectangle		
	F3.2f	recall the essential properties of special types of quadrilateral, including square, rectangle, parallelogram, trapezium and rhombus; classify quadrilaterals by their geometric properties	H3.2c	recall the definitions of special types of quadrilateral, including square, rectangle, parallelogram, trapezium and rhombus; classify quadrilaterals by their geometric properties
	F3.2g	calculate and use the sums of the interior and exterior angles of quadrilaterals, pentagons and hexagons; calculate and use the angles of regular polygons	H3.2d	.....
			H3.2f	understand, recall and use Pythagoras' theorem in 2-D problems; investigate the geometry of cuboids including cubes, and shapes made from cuboids
			H3.2g	understand similarity of triangles and of other plane figures, and use this to make geometric inferences; understand, recall and use trigonometrical relationships in right-angled triangles, and use these to solve problems, including those involving bearings
Properties of circles	F3.2i	recall the definition of a circle and the meaning of related terms, including centre, radius, chord, diameter, circumference, tangent, arc; understand that inscribed regular polygons can be constructed by equal division of a circle	H3.2h	recall the definition of a circle and the meaning of related terms, including centre, radius, chord, diameter, circumference, tangent, arc, sector and segment; understand that the tangent at any point on a circle is perpendicular to the radius at that point; understand and use the fact that tangents from an external point are equal in length; explain why the perpendicular from the centre to a chord bisects the chord; understand that inscribed regular polygons can be constructed by equal division of a circle; use the facts that the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference, the angle subtended at the circumference by a semicircle is a right angle, that angles in the same segment are equal, and that opposite angles of a cyclic quadrilateral sum to 180 degrees
3-D shapes	F3.2j	explore the geometry of cuboids (including cubes), and shapes made from cuboids		
	F3.2k	use 2-D representations of 3-D shapes and analyse 3-D shapes through 2-D projections and cross-sections, including plan and elevation	H3.2i	use 2-D representations of 3-D shapes and analyse 3-D shapes through 2-D projections and cross-sections, including plan and elevation; solve problems involving surface areas and volumes of prisms, cylinders

NC ref	Higher Tier		Key Skills and notes
	pupils should be taught to:		
H3.2e	understand and use SSS, SAS, ASA and RHS conditions to prove the congruence of triangles using formal arguments, and to verify standard ruler and compass constructions		
H3.2f	..... , including the use of Pythagoras' theorem in 3-D problems to calculate lengths in three dimensions		
H3.2g	..... then use these relationships in 3-D contexts, including finding the angles between a line and a plane (but not the angle between two planes or between two skew lines); calculate the area of a triangle using $\frac{1}{2}ab\sin C$; draw, sketch and describe the graphs of trigonometric functions for angles of any size, including transformations involving scalings in either or both the x and y directions; use the sine and cosine rules to solve 2-D and 3-D problems		
H3.2h	recall the meaning of the terms sector and segment; understand that the tangent at any point on a circle is perpendicular to the radius at that point; understand and use the fact that tangents from an external point are equal in length; explain why the perpendicular from the centre to a chord bisects the chord; prove and use the facts that the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference, the angle subtended at the circumference by a semicircle is a right angle, that angles in the same segment are equal, and that opposite angles of a cyclic quadrilateral sum to 180 degrees; prove and use the alternate segment theorem		
H3.2i	solve problems involving surface areas and volumes of prisms, pyramids, cylinders, cones and spheres; solve problems involving more complex shapes and solids, including segments of circles and frustrums of cones		

AO3 Shape, space and measures	NC ref	Foundation Tier	NC ref	Intermediate Tier
		pupils should be taught to:		pupils should be taught to:
3. Transformations and coordinates				
Specifying transforma-tions	F3.3a	understand that rotations are specified by a centre and an (anticlockwise) angle; rotate a shape about the origin; measure the angle of rotation using right angles, simple fractions of a turn; understand that reflections are specified by a mirror line, at first using line parallel to an axis, understand that translations are specified by a distance and direction, and enlargements by a centre and positive scale factor	H3.3a	understand that rotations are specified by a centre and an (anticlockwise) angle; use any point as the centre of rotation; measure the angle of rotation, using right angles, fractions of a turn or degrees; understand that reflections are specified by a (mirror) line; understand that translations are specified by giving a distance and direction (or a vector), and enlargements by a centre and a positive scale factor
Properties of transforma-tions	F3.3b	recognise and visualise rotations, reflections and translations, including reflection symmetry of 2-D and 3-D shapes, and rotation symmetry of 2-D shapes; transform triangles and other 2-D shapes by translation, rotation and reflection, recognising that these transformations preserve length and angle, so that any figure is congruent to its image under any of these transformations	H3.3b	recognise and visualise rotations, reflections and translations including reflection symmetry of 2-D and 3-D shapes, and rotation symmetry of 2-D shapes; transform triangles and other 2-D shapes by translation, rotation and reflection and combinations of these transformations; distinguish properties that are preserved under particular transformations
	F3.3c	recognise, visualise and construct enlargements of objects using positive scale factors greater than one; understand from this that any two circles and any two squares are mathematically similar, while, in general, two rectangles are not	H3.3c	recognise, visualise and construct enlargements of objects; understand from this that any two circles and any two squares are mathematically similar, while, in general, two rectangles are not, then use positive fractional scale factors
	F3.3d	recognise that enlargements preserve angle but not length; identify the scale factor of an enlargement as the ratio of the lengths of any two corresponding line segments and apply this to triangles; understand the implications of enlargement for perimeter; use and interpret maps and scale drawings	H3.3d	recognise that enlargements preserve angle but not length; identify the scale factor of an enlargement as the ratio of the lengths of any two corresponding line segments; understand the implications of enlargement for perimeter; use and interpret maps and scale drawings; understand the difference between formulae for perimeter, area and volume by considering dimensions
Coordinates	F3.3e	understand that one coordinate identifies a point on a number line, two coordinates identify a point in a plane and three coordinates identify a point in space, using the terms '1-D', '2-D' and '3-D'; use axes and coordinates to specify points in all four quadrants; locate points with given coordinates; find the coordinates of points identified by geometrical information (1); find the coordinates of the midpoint of the line segment AB, given points A and B	H3.3e	..... then calculate the length AB
Vectors			H3.3f	understand and use vector notation;

NC ref	Higher Tier		Key Skills and notes
	pupils should be taught to:		
3. Transformations and coordinates			
H3.3a	use any point as the centre of rotation; measure the angle of rotation, using fractions of a turn or degrees; understand that translations are specified by a vector		
H3.3b	transform triangles and other 2-D shapes by combinations of translation, rotation and reflection; use congruence to show that translations, rotations and reflections preserve length and angle, so that any figure is congruent to its image under any of these transformations; distinguish properties that are preserved under particular transformations		Intermediate/Higher : Pupils could use software to explore transformations and their effects on properties of shapes.
H3.3c	use positive fractional and negative scale factors (for enlargement)		
H3.3d	understand the difference between formulae for perimeter, area and volume by considering dimensions; understand and use the effect of enlargement on areas and volumes of shapes and solids		
H3.3e	calculate the length *AB*		Foundation : (1) [for example, find the coordinates of the fourth vertex of a parallelogram with vertices at (2, 1) (-7, 3) and (5, 6)
H3.3f	..... calculate, and represent graphically the sum of two vectors, the difference of two vectors and a scalar multiple of a vector; calculate the resultant of two vectors; understand and use the commutative and associative properties of vector addition; solve simple geometrical problems in 2-D using vector methods		

AO3 Shape, space and measures	NC ref	Foundation Tier	NC ref	Intermediate Tier
		pupils should be taught to:		pupils should be taught to:
4. Measures and construction				
Measures	F3.4a	interpret scales on a range of measuring instruments, including those for time and mass; convert measurements from one unit to another; know rough metric equivalents of pounds, feet, miles, pints and gallons; make sensible estimates of a range of measures in everyday settings	H3.4a	use angle measure (1); know that measurements using real numbers depend on the choice of unit; recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction; convert measurements from one unit to another; understand and use compound measures, including speed and density
	F3.4b	understand angle measure using the associated language (1)		
	F3.4c	understand and use speed		
Construction	F3.4d	measure and draw lines to the nearest millimetre, and angles to the nearest degree; draw triangles and other 2-D shapes using a ruler and protractor, given information about their side lengths and angles; understand, from their experience of constructing them, that triangles satisfying SSS, SAS, ASA and RHS are unique, but SSA triangles are not; construct cubes, regular tetrahedra, square-based pyramids and other 3-D shapes from given information	H3.4b	draw approximate constructions of triangles and other 2-D shapes, using a ruler and protractor, given information about side lengths and angles; construct specified cubes, regular tetrahedra, square-based pyramids and other 3-D shapes
	F3.4e	use straight edge and compasses to do standard constructions including an equilateral triangle with a given side	H3.4c	....., the midpoint and perpendicular bisector of a line segment, the perpendicular from a point to a line, the perpendicular from a point on a line, and the bisector of an angle
Mensuration	F3.4f	find areas of rectangles, recalling the formula, understanding the connection to counting squares and how it extends this approach; recall and use the formulae for the area of a parallelogram and a triangle; find the surface area of simple shapes using the area formulae for triangles and rectangles; calculate perimeters and areas of shapes made from triangles and rectangles	H3.4d	find the surface area of simple shapes by using the formulae for the areas of triangles and rectangles; find volumes of cuboids, recalling the formula and understanding the connection to counting cubes and how it extends this approach; calculate volumes of right prisms and of shapes made from cubes and cuboids; convert between volume measures including cm^3 and m^3; find circumferences of circles and areas enclosed by circles, recalling relevant formulae
	F3.4g	find volumes of cuboids, recalling the formula and understanding the connection to counting cubes and how it extends this approach; calculate volumes of shapes made from cubes and cuboids		
	F3.4h	find circumferences of circles and areas enclosed by circles recalling relevant formulae		
	F3.4i	convert between area measures, including square centimetres and square metres, and volume measures, including cubic centimetres and cubic metres		
Loci			H3.4e	find loci, both by reasoning and by using ICT to produce shapes and paths (1)

NC ref	Higher Tier		Key Skills and notes
	pupils should be taught to:		
	4. Measures and construction		
H3.4a	know that measurements using real numbers depend on the choice of unit; recognise that measures given to the nearest whole unit may be inaccurate by up to one half in either direction; understand and use compound measures, including speed and density		Intermediate/Higher : (1) [for example, use bearings to specify direction]
			Foundation : (1) [for example, use bearings to specify direction]
H3.4c	.....		
H3.4d	find the surface area of simple shapes by using the formulae for the areas of triangles and rectangles; find volumes of cuboids, recalling the formula and understanding the connection to counting cubes and how it extends this approach; calculate volumes of right prisms; convert between volume measures including cm^3 and m^3; calculate the lengths of arcs and the areas of sectors of circles		N2.2
H3.4e	.....	 	Intermediate/Higher : (1) [for example, a region bounded by a circle and an intersecting line] IT1.2

AO4 Handling data	NC ref	Foundation Tier	NC ref	Intermediate Tier
		pupils should be taught to:		pupils should be taught to:
1. Using and applying handling data				
Problem solving	F4.1a	carry out each of the four aspects of the handling data cycle to solve problems: (i) specify the problem and plan: formulate questions in terms of the data needed, and consider what inferences can be drawn from the data; decide what data to collect (including sample size and data format) and what statistical analysis is needed (ii) collect data from a variety of suitable sources, including experiments and surveys, and primary and secondary sources (iii) process and represent the data: turn the raw data into usable information that gives insight into the problem (iv) interpret and discuss the data: answer the initial question by drawing conclusions from the data	H4.1a	.....
	F4.1b	identify what further information is needed to pursue a particular line of enquiry	H4.1b	select the problem-solving strategies to use in statistical work, and monitor their effectiveness (these strategies should address the scale and manageability of the tasks, and should consider whether the mathematics and approach used are delivering the most appropriate solutions)
	F4.1c	select and organise the appropriate mathematics and resources to use for a task		
	F4.1d	review progress while working; check and evaluate solutions		
Communic-ating	F4.1e	interpret, discuss and synthesise information presented in a variety of forms	H4.1c	communicate mathematically, with emphasis on the use of an increasing range of diagrams and related explanatory text, on the selection of their mathematical presentation, explaining its purpose and approach, and on the use of symbols to convey statistical meaning
	F4.1f	communicate mathematically, including using ICT, making use of diagrams and related explanatory text		
Reasoning	F4.1h	apply mathematical reasoning, explaining inferences and deductions	H4.1d	apply mathematical reasoning, explaining and justifying inferences and deductions, justifying arguments and solutions
			H4.1e	identify exceptional or unexpected cases when solving statistical problems
	F4.1i	explore connections in mathematics and look for cause and effect when analysing data	H4.1f	explore connections in mathematics and look for relationships between variables when analysing data
			H4.1g	recognise the limitations of any assumptions and the effects that varying the assumptions could have on the conclusions drawn from data analysis

NC ref	Higher Tier		Key Skills and notes
	pupils should be taught to:		
1. Using and applying handling data			
H4.1a	.....		N2.1, PS1.1, PS1.2, PS2.1, PS2.2, IT1.1, IT1.2, IT2.1
H4.1b	.....		PS1.2, PS1.3, PS2.2
			PS1.3, PS2.3
H4.1c	.....	 	Intermediate/Higher : Pupils could use databases or spreadsheets to present their findings and display their data. C1.3, N1.3, IT1.2, IT2.3
			IT1.2, IT2.3
H4.1d	.....		IT1.1
H4.1e	.....		All tiers : Promoting the skill of enquiry
H4.1f	.....		
H4.1g	.....		Intermediate/Higher Tiers : Promoting the skill of enquiry

AO4 Handling data	NC ref	Foundation Tier	NC ref	Intermediate Tier
		pupils should be taught to:		pupils should be taught to:
2. Specifying the problem and planning				
	F4.2a	see that random processes are unpredictable	H4.2a	.....
	F4.2b	identify questions that can be addressed by statistical methods	H4.2b	identify key questions that can be addressed by statistical methods
	F4.2c	discuss how data relate to a problem	H4.2c	..... identify possible sources of bias and plan to minimise it
	F4.2d	identify which primary data they need to collect and in what format, including grouped data, considering appropriate equal class intervals	H4.2d	.....
	F4.2e	design an experiment or survey; decide what secondary data to use	H4.2e	.....
3. Collecting data				
	F4.3a	design and use data-collection sheets for grouped discrete and continuous data; collect data using various methods, including observation, controlled experiment, data logging, questionnaires and surveys	H4.3a	collect data using various methods, including observation, controlled experiment, data logging, questionnaires and surveys
	F4.3b	gather data from secondary sources, including printed tables and lists from ICT-based sources	H4.3b	.....
	F4.3c	design and use two-way tables for discrete and grouped data	H4.3c	.....
			H4.3d	deal with practical problems such as non-response or missing data
4. Processing and representing data				
	F4.4a	draw and produce, using paper and ICT, pie charts for categorical data, and diagrams for continuous data, including line graphs for time series, scatter graphs, frequency diagrams and stem-and-leaf diagrams	H4.4a	draw and produce, using paper and ICT, pie charts for categorical data, and diagrams for continuous data, including line graphs (time series), scatter graphs, frequency diagrams, stem-and-leaf diagrams, cumulative frequency tables and diagrams and box plots
	F4.4b	calculate mean, range and median of small data sets with discrete then continuous data; identify the modal class for grouped data	H4.4e	find the median, quartiles and interquartile range for large data sets and calculate the mean for large data sets with grouped data
			H4.4f	calculate an appropriate moving average
	F4.4h	draw lines of best fit by eye, understanding what these represent	H4.4i	.....
			H4.4j	use relevant statistical functions on a calculator or spreadsheet
	F4.4c	understand and use the probability scale		
	F4.4d	understand and use estimates or measures of probability from theoretical models (including equally likely outcomes)	H4.4b	understand and use estimates or measures of probability from theoretical models, or from relative frequency
	F4.4e	list all outcomes for single events, and for two successive events, in a systematic way	H4.4c	.....
	F4.4f	identify different mutually exclusive outcomes and know that the sum of the probabilities of all these outcomes is 1	H4.4d	.....
			H4.4h	use tree diagrams to represent outcomes of compound events, recognising when events are independent

NC ref	Higher Tier		Key Skills and notes
	pupils should be taught to:		
2. Specifying the problem and planning			
H4.2c	identify possible sources of bias and plan to minimise it		C1.1, C1.2
H4.2d	select and justify a sampling scheme and a method to investigate a population, including random and stratified sampling		
H4.2e	decide what primary and secondary data to use		IT1.1, IT1.2, N1.1
3. Collecting data			
		 	IT1.1, IT2.1, N1.1
H4.3d	.....		
4. Processing and representing data			
H4.4a	draw and produce, using paper and ICT, cumulative frequency tables and diagrams, box plots and histograms for grouped continuous data		N1.3, N2.3, IT1.2, IT2.3
H4.4e	.....		N1.2, N2.2
H4.4f	.....		
H4.4i	.....		
H4.4j	.....		
H4.4b	.....		
H4.4g	know when to add or multiply two probabilities: if A and B are mutually exclusive, then the probability of A or B occurring is $P(A) + P(B)$, whereas if A and B are independent events, the probability of A and B occurring is $P(A) \times P(B)$		
H4.4h	.....		

AO4 Handling data	NC ref	Foundation Tier	NC ref	Intermediate Tier
		pupils should be taught to:		pupils should be taught to:
5. Interpreting and discussing results				
	F4.5a	relate summarised data to the initial questions	H4.5a	.....
	F4.5b	interpret a wide range of graphs and diagrams and draw conclusions	H4.5b	interpret a wide range of graphs and diagrams and draw conclusions; identify seasonality and trends in time series
	F4.5c	look at data to find patterns and exceptions	H4.5c	.....
	F4.5d	compare distributions and make inferences, using the shapes of distributions and measures of average and range	H4.5d	compare distributions and make inferences, using shapes of distributions and measures of average and spread, including median and quartiles
	F4.5e	consider and check results and modify their approach if necessary	H4.5e	.....
	F4.5f	have a basic understanding of correlation as a measure of the strength of the association between two variables; identify correlation or no correlation using lines of best fit	H4.5f	appreciate that correlation is a measure of the strength of the association between two variables; distinguish between positive, negative and zero correlation using lines of best fit; appreciate that zero correlation does not necessarily imply 'no relationship' but merely 'no linear relationship'
	F4.5g	use the vocabulary of probability to interpret results involving uncertainty and prediction	H4.5g	..... (1)
	F4.5h	compare experimental data and theoretical probabilities	H4.5h	.....
	F4.5i	understand that if they repeat an experiment, they may – and usually will – get different outcomes, and that increasing sample size generally leads to better estimates of probability and population characteristics	H4.5i	.....
	F4.5j	discuss implications of findings in the context of the problem		
	F4.5k	interpret social statistics including index numbers (1); time series (2); and survey data (3)		

Breadth of Study (Foundation)

During the key stage, pupils should be taught the Knowledge, skills and understanding through:

a) extending mental and written calculation strategies and using efficient procedures confidently to calculate with integers, fractions, decimals, percentages, ratio and proportion
b) solving a range of familiar and unfamiliar problems, including those drawn from real-life contexts and other areas of the curriculum
c) activities that provide frequent opportunities to discuss their work, to develop reasoning and understanding and to explain their reasoning and strategies
d) activities focused on developing short chains of deductive reasoning and correct use of the '=' sign
e) activities in which they do practical work with geometrical objects, visualise them and work with them mentally
f) practical work in which they draw inferences from data, consider how statistics are used in real life to make informed decisions, and recognise the difference between meaningful and misleading representations of data
g) activities focused on the major ideas of statistics, including using appropriate populations and representative samples, using different measurement scales, using probability as a measure of uncertainty, using randomness and variability, reducing bias in sampling and measuring, and using inference to make decisions

h) substantial use of tasks focused on using appropriate ICT [for example, spreadsheets, databases, geometry or graphic packages], using calculators correctly and efficiently, and knowing when not to use a calculator.

NC ref	Higher Tier		Key Skills and notes
	pupils should be taught to:		
5. Interpreting and discussing results			
H4.5b	identify seasonality and trends in time series	 	N1.3, N2.3
			Foundation/ Intermediate : Pupils could use databases to present their findings.
H4.5d	compare distributions and make inferences, using shapes of distributions and measures of average and spread, including median and quartiles; understand frequency density		N1.3, N2.3
			PS1.3
H4.5f	.....		
			Intermediate : (1) [for example, ''here is some evidence from this sample that …']
			IT1.1
			Foundation : (1) [for example, the General Index of Retail Prices]; (2) [for example, population growth]; (3) [for example, the National Census]

Breadth of Study (Intermediate and Higher)

During the key stage, pupils should be taught the Knowledge, skills and understanding through:

a) activities that ensure they become familiar with and confident using standard procedures for the range of calculations appropriate to this level of study
b) solving familiar and unfamiliar problems in a range of numerical, algebraic and graphical contexts and in open-ended and closed form
c) using standard notations for decimals, fractions, percentages, ratio and indices
d) activities that show how algebra, as an extension of number using symbols, gives precise form to mathematical relationships and calculations
e) activities in which they progress from using definitions and short chains of reasoning to understanding and formulating proofs in algebra and geometry
f) a sequence of practical activities that address increasingly demanding statistical problems in which they draw inferences from data and consider the uses of statistics in society
g) choosing appropriate ICT tools and using these to solve numerical and graphical problems, to represent and manipulate geometrical configurations and to present and analyse data.

SECTION D: COURSEWORK

6 Internal Assessment Tasks

Two options are available within the specification:

Option A Centre-marked tasks,

Option B OCR-set and OCR-marked tasks.

Details of each option are given below. Whichever option is chosen, candidates must submit two types of task appropriate to their level of ability. One type of task will assess Using and Applying Mathematics (AO1) and the other will assess Handling Data (AO4). The time of year when candidates undertake the tasks is left to the discretion of the Centre, bearing in mind that candidates' work must be submitted for external standardisation or marking (depending on the option chosen) in April of the year of the examination.

It is recommended that:

- a maximum of two weeks of mathematics lessons and homework time is used to complete each type of task;
- in general, the write-up of each type of task should not be appreciably longer than 16-sides of A4 paper (excluding diagrams, graphs and spreadsheets).

In preparing work on the tasks candidates may refer to books or discuss ideas with each other or the teacher. Rough notes should not be attached to the final write-up submitted for assessment. Evidence in the form of data collected or computer printouts may be attached as appendices if it is directly referred to in the final write-up.

The write-up of each task must be completed independently by each candidate.

If a teacher possesses information likely to affect the assessment it should be conveyed to OCR by writing comments on the reverse side of the coursework cover sheet and, if appropriate, on the candidate's work. For example, at a lower level, a mark could be awarded for an oral statement made by the candidate to the teacher.

At the end of the time allowed for completion of a task all the sheets of a candidate's write-up should be securely fastened together with a treasury tag, along with any relevant appendices. It is not appropriate for candidates to present their work in bulky folders.

Following completion of work on the second type of task, the Centre should fasten together the tasks completed by a candidate, along with a cover sheet giving candidate information and authenticating the work. All work from a Centre should be arranged in candidate number order and stored securely.

Specimen tasks are provided in the OCR teacher support material.

Option A: Centre-marked Tasks

For Centres following this option a bank of suitable coursework tasks is provided in the OCR teacher support material. OCR will provide suggestions for new tasks on a regular basis. Some tasks may be differentiated according to ability and targeted at Foundation / Intermediate Tier candidates or Intermediate / Higher Tier candidates.

Alternatively, Centres may set their own open-ended tasks. In this case care must be exercised to ensure that the tasks set meet the task type requirements and are capable of being assessed using the nationally agreed assessment criteria found in Section 7.3.

Candidates **must** submit tasks from each of the following categories:

- Using and Applying Mathematics (this may be more than a single task);
- Handling Data (this **must** be a single substantial task).

Tasks in the Using and Applying Mathematics category will draw on the skills and concepts outlined in AO2 and/or AO3. Centres may wish to offer candidates the opportunity to complete more than one task in this category but the total time allocated must not exceed the two week limit. This approach may well be more appropriate when providing tasks targetting the lower mark ranges. Tasks in the Handling Data category will draw on skills and concepts outlined in AO4 and may **not** involve more than one piece of work.

Where Centres have set their own tasks, care must be exercised to ensure that each task enables candidates to demonstrate attainment at the highest level of which they are capable. It should be noted that tasks based on probability alone are unlikely to score well on the Handling Data marking criteria and such tasks should therefore be avoided.

Handling Data tasks do not have to involve first-hand collection of (primary) data. It is perfectly acceptable for the data involved to be secondary subject to suitable data sets being made available to candidates. Where such data is provided it must consist of at least 20 suitable variables with a minimum of 100 data items per variable. Equally, simulation activities are acceptable providing they lead to statistical (rather than probability) tasks.

Once each type of task is completed the class teacher will judge the value of the task(s) using the assessment criteria found in Section 7.3.

For the purpose of external moderation a sample of work will be requested by the Moderator whose name and address will be supplied by OCR (see Section 7.4). Some of this work may be retained by OCR.

Option B: OCR-set and OCR-marked Tasks

Each year OCR will set and mark candidates' coursework. The tasks (together with information about preparatory work needed, if any) will be sent to Centres during May of the calendar year before the examination. The tasks may be photocopied.

On receipt of the tasks, Centres should check whether any preparation is needed before candidates start work on them. 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 each task.

Two sets of tasks will be provided. One set of tasks will be suitable for Foundation / Intermediate Tier candidates; the other set will be suitable for Intermediate / Higher Tier candidates. Each candidate will be required to submit **either** the set of tasks suitable for Foundation / Intermediate Tier candidates **or** the set 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, while the Intermediate / Higher Tier tasks may prove inaccessible to less able candidates. It is therefore important that the set of tasks chosen is appropriate to the ability of the candidate.

On a specified date all the work from the Centre should be sent to the examiner whose name and address will be supplied by OCR. Some of this work may be retained by OCR.

6.1 NATURE OF COURSEWORK

Coursework gives candidates opportunities to use and apply their mathematical skills in practical and real-life situations, or within mathematics itself. Tasks should challenge candidates and allow a range of possible approaches. In their responses candidates will have to make decisions about how to tackle the problem, what resources they need, where and how 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.

Using and Applying Mathematics (AO1) should be integral to the course of study, not incidental to it. It is hoped that classroom work on AO1 will permeate the whole course, supporting the development of the skills and processes outlined in AO2, AO3 and AO4. Indeed, candidates are not likely to score as highly in the coursework component as they could if their only experience of investigative or practical work are those occasions when their coursework tasks are being carried out. In particular, candidates preparing for assessment are advised to practise answering investigative and practical tasks.

OCR coursework is designed to allow assessment of candidates' ability to use and apply mathematics in practical, real-life tasks and within mathematics itself. The coursework component has been developed to translate the requirements of the National Curriculum into good classroom practice for candidates across the whole ability range and to provide opportunities for candidates to use information technology where appropriate.

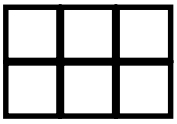
6.2 EXEMPLAR COURSEWORK TASKS

Centre set tasks (assessing Using and Applying Mathematics)

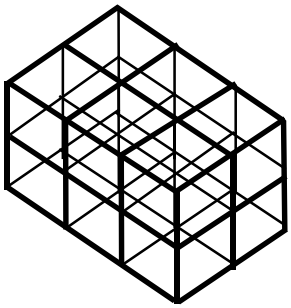
Rigid structures

Rigid structures are made from unit lengths of rod.

Two examples are shown below:



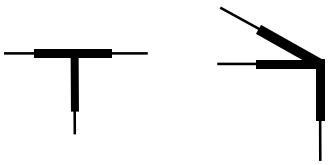
This structure is made from 17 rods



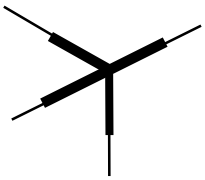
This structure is made from 75 rods

The individual rods in the structure are held together using different types of joint.

Some examples are shown below:



two examples of 3 joints



a 4 joint

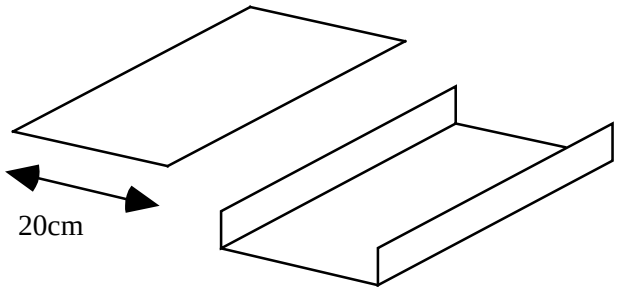
Investigate structures built from unit rods.

(The 2 D part of this task is accessible to Foundation / Intermediate candidates)

Guttering

A building firm produces guttering from long strips of sheet plastic each 20cm wide.

One of their products is produced by bending the plastic into a rectangular shape as shown:



Investigate what shape of guttering is most effective.

(This task is accessible to all candidates.)

Centre set tasks (assessing Handling Data)

Estimations

"Estimations made by adults are more accurate than estimations made by children". Investigate.

(This task is accessible to all candidates).

Heads

"The taller you are, the larger your head".

Investigate the truth of this statement.

(This task is accessible to all candidates, but may be more appropriate for Higher / Intermediate candidates)

OCR set task (assessing Using and Applying Mathematics)

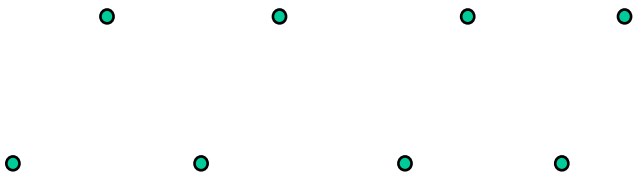
Suitable for Foundation / Intermediate Tiers

Dotty Roofs

You will need triangular spotty paper for this task.

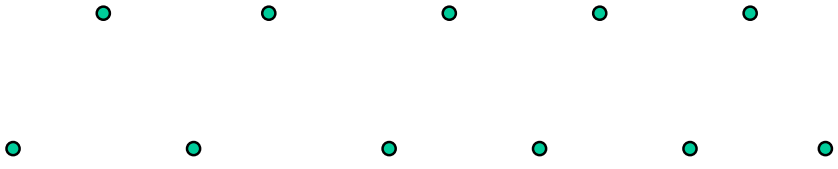
A roof is made out of spots in the shape of a trapezium.

1. This is described as a 5 spot roof.



How many spots are used to make this roof?

2. Here is another roof.



(a) How would this roof be described?
(b) How many spots are used to make it?

3. For roofs made from two rows of spots, investigate the number of spots used to make each one.

4. Extend your investigation to other sized roofs.

OCR set task (assessing Using and Applying Mathematics)

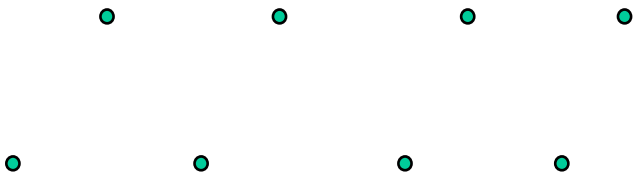
Suitable for Intermediate / Higher Tiers

Dotty Roofs

You will need triangular spotty paper for this task.

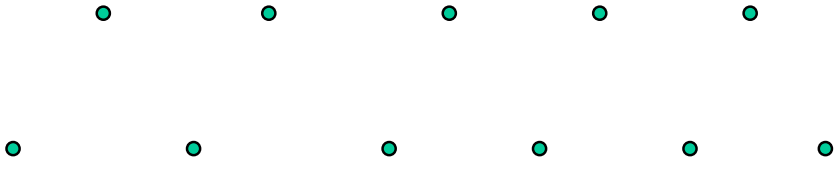
A roof is made out of spots in the shape of a trapezium.

1. This is described as a 5 spot roof.



How many spots are used to make this roof?

2. Here is another roof.



(a) How would this roof be described?
(b) How many spots are used to make it?

3. Extend your investigation to other sized roofs.

OCR set task (assessing Handling Data)

Suitable for Foundation / Intermediate Tiers

Gulliver's Problem

> "…. They measured my right thumb, and desired no more; for a mathematical computation that twice round my thumb is once round the wrist and so on to the neck and the waist …."
>
> [extract from Gulliver's Travels by Jonathan Swift]

1. Test Gulliver's theory that twice the distance around a thumb is the same as the distance around that person's wrist.

   You will need to collect data to test the theory.

   You should plan what data to collect.

   Explain why you chose this data.

2. Use your data to predict the distance around a person's waist and comment upon the answer you work out.

3. Suggest other relationships for yourself. Investigate using any valid statistical method.

OCR set task (assessing Handling Data)

Suitable for Intermediate / Higher Tiers

Gulliver's Problem

> "…. They measured my right thumb, and desired no more; for a mathematical computation that twice round my thumb is once round the wrist and so on to the neck and the waist …."
>
> [extract from Gulliver's Travels by Jonathan Swift]

Investigate using any valid statistical method.

7 Regulations for Internal Assessment

7.1 SUPERVISION AND AUTHENTICATION OF COURSEWORK

OCR expects teachers to supervise and guide candidates who are undertaking work which is internally assessed (i.e. coursework). The degree of teacher guidance in candidates' work will vary according to the kinds of work being undertaken. It should be remembered, however, that candidates are required to reach their own judgements and conclusions.

When supervising internally assessed tasks, teachers are expected to:

- offer candidates advice about how best to approach such tasks;
- exercise continuing supervision of work in order to monitor progress and to prevent plagiarism;
- ensure that the work is completed in accordance with the specification requirements and can be assessed in accordance with the specified marking criteria and procedures.

Internally assessed work should be completed in the course of normal curriculum time and supervised and marked by the teacher. Some of the work, by its very nature, may be undertaken outside the Centre e.g. research work, testing etc. As with all internally assessed work, the teacher must be satisfied that the work submitted for assessment is the candidate's own work.

7.2 PRODUCTION AND PRESENTATION OF INTERNALLY ASSESSED WORK

Candidates must observe certain procedures in the production of internally assessed work.

- Any copied material must be suitably acknowledged.
- Quotations must be clearly marked and a reference provided wherever possible.
- Work submitted for moderation must be marked with the:

  Centre number;
  Centre name;
  candidate number;
  candidate name;
  specification code and title;
  assignment title.

- All work submitted for moderation must be kept in a flat card file (not a ring binder).

7.3 MARKING CRITERIA FOR INTERNALLY ASSESSED WORK

The tasks must be marked using the generic marking guides referred to later in this document.

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.

Strands

The assessment criteria in the generic marking guides are based on the National Curriculum Key Stage 4 programmes of study. The criteria for assessing Using and Applying Mathematics (AO1) have been grouped under three strands of assessment, namely Strategy (S), Communication (C) and Reasoning (R). The criteria for assessing Handling Data (AO4) have been grouped under three strands, namely Specify and Plan (S), Collect, Process and Represent (C), and Interpret and Discuss (I).

The maximum number of marks available for each strand is 8. Descriptions are provided for each mark. 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. The criteria are to be used as **best-fit** indicative descriptions and the statements within them are not to be taken as hurdles. Each piece of a candidates' work should be assessed in relation to the appropriate criteria with the mark most appropriate to the work as a whole being awarded for each strand.

For the Handling Data criteria, the final step is to decide between the lower and the higher mark available for that description. This decision may well involve looking again at the criteria above and below the selected **best fit** criterion and deciding if the candidates' work is closer to the lower or higher criterion. It is not appropriate to take each statement in each description and regard it as a separate assessment criterion.

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 need 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 complex mathematical treatment.

Assessment

For each task, the mark awarded for each strand is the mark which **best fits** the candidate's performance. The assessor should write and ring, for example, 'S6' at the point on the script where there is evidence that the candidate has attained a mark of 6 in strand S.

Where there are references to 'at least the level detailed in the Handling Data paragraph of the grade description for grade X', work which uses no technique beyond the specified grade is indicative of the lower of the two marks. To obtain the higher of the two marks requires processing and analysis using techniques that best fit a more demanding standard.

For Option A, the assessor will record the highest mark in each strand on a copy of the coursework cover sheet for the candidate's work. The assessor will then add together the marks for each strand across both tasks completed by the candidate to give an overall mark out of 48.

For Option B, the mark boxes on the coursework cover sheet should be left blank.

Using and Applying Mathematics - Generic Marking Guide

In these criteria, there is an intended approximate link between 7 marks and grade A, 5 marks and grade C, and 3 marks and grade F.

Strategy

MARK	DESCRIPTION
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.
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.
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.
4	Candidates carry through substantial tasks and solve quite complex problems by breaking them down into smaller, more manageable tasks.
5	Starting from problems or contexts that have been presented to them, candidates introduce questions of their own, which generate fuller solutions.
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.
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.
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.

Communication

MARK	DESCRIPTION
1	Candidates discuss their mathematical work and are beginning to explain their thinking. They use and interpret mathematical symbols and diagrams.
2	Candidates present information and results in a clear and organised way explaining the reasons for their presentation.
3	Candidates show understanding of situations by describing them mathematically using symbols, words and diagrams.
4	Candidates interpret, discuss and synthesise information presented in a variety of mathematical forms. Their writing explains and informs their use of diagrams.
5	Candidates examine critically and justify their choice of mathematical presentation, considering alternative approaches and explaining improvements they have made.
6	Candidates convey mathematical meaning through consistent use of symbols.
7	Candidates use mathematical language and symbols accurately in presenting a convincing reasoned argument.
8	Candidates use mathematical language and symbols efficiently in presenting a concise reasoned argument.

Reasoning

MARK	DESCRIPTION
1	Candidates show that they understand a general statement by finding particular examples that match it.
2	Candidates search for a pattern by trying out ideas of their own.
3	Candidates make general statements of their own, based on evidence they have produced, and give an explanation of their reasoning.
4	Candidates are beginning to give mathematical justification for their generalisations; they test them by checking particular cases.
5	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 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' reports include mathematical justifications, explaining their solutions to problems involving a number of features or variables.
8	Candidates provide a mathematically rigorous justification or proof of their solution to a complex problem, considering the conditions under which it remains valid.

Handling Data - Generic Marking Guide

In these criteria, there is an intended approximate link between 7 marks and grade A, 5 marks and grade C, and 3 marks and grade F.

Where there are references to 'at least the level detailed in the handling data paragraph of the grade description for grade X', work which uses no technique beyond the specified grade is indicative of the lower of the two marks. To obtain the higher of the two marks requires processing and analysis using techniques that best fit a more demanding standard.

Specify and Plan

MARK	DESCRIPTION
1 - 2	Candidates choose a simple well-defined problem. Their aims have some clarity. The appropriate data to collect are reasonably obvious. An overall plan is discernible and some attention is given to whether the plan will meet the aims. The structure of the report as a whole is loosely related to the aims.
3 - 4	Candidates choose a problem involving routine use of simple statistical techniques and set out reasonably clear aims. Consideration is given to the collection of data. Candidates describe an overall plan largely designed to meet the aims and structure the project report so that results relating to some of the aims are brought out. Where appropriate, they use a sample of adequate size.
5 - 6	Candidates consider a more complex problem. They choose appropriate data to collect and state their aims in statistical terms with the selection of an appropriate plan. Their plan is designed to meet the aims and is well described. Candidates consider the practical problems of carrying out the survey or experiment. Where appropriate, they give reasons for choosing a particular sampling method. The project report is well structured so that the project can be seen as a whole.
7 - 8	Candidates work on a problem requiring creative thinking and careful specification. They state their aims clearly in statistical terms and select and develop an appropriate plan to meet these aims giving reasons for their choice. They foresee and plan for practical problems in carrying out the survey or experiment. Where appropriate, they consider the nature and size of sample to be used and take steps to avoid bias. Where appropriate, they use techniques such as control groups, or pre-tests of questionnaires or data sheets, and refine these to enhance the project. The project report is well structured and the conclusions are related to the initial aims.

Collect, Process and Represent

MARK	DESCRIPTION
1 - 2	Candidates collect data with limited relevance to the problem and plan. The data are collected or recorded with little thought given to processing. Candidates use calculations of the simplest kind. The results are frequently correct. Candidates present information and results in a clear and organised way. The data presentation is sometimes related to their overall plan.
3 - 4	Candidates collect data with some relevance to the problem and plan. The data are collected or recorded with some consideration given to efficient processing. Candidates use straightforward and largely relevant calculations involving techniques of at least the level detailed in the handling data paragraph of the grade description for grade F. The results are generally correct. Candidates show understanding of situations by describing them using statistical concepts, words and diagrams. They synthesise information presented in a variety of forms. Their writing explains and informs their use of diagrams, which are usually related to their overall plan. They present their diagrams correctly, with suitable scales and titles.
5 - 6	Candidates collect largely relevant and mainly reliable data. The data are collected in a form designed to ensure that they can be used. Candidates use a range of more demanding, largely relevant calculations that include techniques of at least the level detailed in the handling data paragraph of the grade description for grade C. The results are generally correct and no obviously relevant calculation is omitted. There is little redundancy in calculation or presentation. Candidates convey statistical meaning through precise and consistent use of statistical concepts that is sustained throughout the work. They use appropriate diagrams for representing data and give a reason for their choice of presentation, explaining features they have selected.
7 - 8	Candidates collect reliable data relevant to the problem under consideration. They deal with practical problems such as non-response, missing data or ensuring secondary data are appropriate. Candidates use a range of relevant calculations that include techniques of at least the level detailed in the handling data paragraph of the grade description for grade A. These calculations are correct and no obviously relevant calculation is omitted. Numerical results are rounded appropriately. There is no redundancy in calculation or presentation. Candidates use language and statistical concepts effectively in presenting a convincing reasoned argument. They use an appropriate range of diagrams to summarise the data and show how variables are related.

Interpret and Discuss

MARK	DESCRIPTION
1 - 2	Candidates comment on patterns in the data. They summarise the results they have obtained but make little attempt to relate the results to the initial problem.
3 - 4	Candidates comment on patterns in the data and any exceptions. They summarise and give a reasonably correct interpretation of their graphs and calculations. They attempt to relate the summarised data to the initial problem, though some conclusions may be incorrect or irrelevant. They make some attempt to evaluate their strategy.
5 - 6	Candidates comment on patterns in the data and suggest reasons for exceptions. They summarise and correctly interpret their graphs and calculations, relate the summarised data to the initial problem and draw appropriate inferences. Candidates use summary statistics to make relevant comparisons and show an informal appreciation that results may not be statistically significant. Where relevant, they allow for the nature of the sampling method in making inferences about the population. They evaluate the effectiveness of the overall strategy and make a simple assessment of limitations.
7 - 8	Candidates comment on patterns and give plausible reasons for exceptions. They correctly summarise and interpret graphs and calculations. They make correct and detailed inferences from the data concerning the original problem using the vocabulary of probability. Candidates appreciate the significance of results they obtain. Where relevant, they allow for the nature and size of the sample and any possible bias in making inferences about the population. They evaluate the effectiveness of the overall strategy and recognise limitations of the work done, making suggestions for improvement. They comment constructively on the practical consequences of the work.

7.4 MODERATION

All internally assessed work (for Option A) is marked by the teacher and internally standardised by the Centre. Marks are then submitted to OCR by a specified date, after which moderation takes place in accordance with OCR procedures. The purpose of moderation is to ensure that the standard of the award of marks for internally assessed work is the same for each Centre and that each teacher has applied the standards appropriately across the range of candidates within the Centre.

The sample of work which is presented to the Moderator for moderation must show how the marks have been awarded in relation to the marking criteria defined in Section 7.3.

Each candidate's work should have a coursework cover sheet attached to it with a summary of the marks awarded for each task.

7.5 MINIMUM REQUIREMENTS FOR INTERNALLY ASSESSED WORK

There should be clear evidence that work has been attempted and some work produced.

If a candidate submits no work for an internally assessed component, then the candidate should be indicated as being absent from that component on the mark sheets submitted to OCR. If a candidate completes any work at all for an internally assessed component then the work should be assessed according to the criteria and marking instructions and the appropriate mark awarded, which may be zero.

SECTION E: FURTHER INFORMATION

8 Opportunities for Teaching

8.1 ICT

In order to play a full part in modern society, candidates need to be confident and effective users of ICT. Where appropriate, candidates should be given opportunities to use ICT in order to further their study of Mathematics.

The assessment of this course requires candidates to:

- use calculators effectively, know how to enter complex calculations and use function keys for reciprocals, squares and powers (Foundation Tier: F2.3o);
- use calculators effectively and efficiently, know how to enter complex calculations; use an extended range of function keys, including trigonometrical and statistical functions relevant to the Programme of Study (Intermediate and Higher Tiers: H2.3o).

Questions will be set on Papers 2, 4 and 6 that will specifically test the use of calculators.

This section offers guidance on opportunities for using ICT during the course. These opportunities are also indicated within the content of Section C by the  symbol. Such opportunities may or may not contribute to the provision of evidence for IT Key Skills. Where such opportunities do contribute, they are identified by the use of the  symbol.

ICT Application/Development	Opportunities for Using ICT During the Course (NC ref)
Spreadsheets	F2.5f, F2.6d, H2.5g, H4.1c
Databases	F4.5c, H4.1c, H4.5c
Graphics calculators	H2.5g, H2.6b-6f
Graphics software	H2.6b-6g, H3.3b-3f, F3.1a, H3.4e
Internet	Research for Handling Data, e.g. F4.3b, H4.3b Revision

Candidates may choose to use ICT when undertaking the tasks for internal assessment.

8.2 CITIZENSHIP

From September 2002, the National Curriculum for England at Key Stage 4 includes a mandatory programme of study for Citizenship. Parts of this programme of study may be delivered through an appropriate treatment of other subjects.

This section offers guidance on opportunities for developing knowledge, skills and understanding of citizenship issues during the course. These opportunities are also indicated within the content of Section 5 by a  symbol.

Citizenship Programme of Study	Opportunities for Teaching Citizenship Issues during the Course
Financial capability through applying mathematics to problems set in financial contexts	F2.2e, F2.3m, H2.3j
Promoting the skill of enquiry and communication of topical political and other issues	F4.1i, H4.1e
Awareness of the use and abuse of statistics	H4.1e, H4.1g, F4.5k, H4.5b

8.3 SPIRITUAL, MORAL, ETHICAL, SOCIAL AND CULTURAL ISSUES

- Spiritual development: through helping candidates obtain an insight into the infinite, and through explaining the underlying mathematical principles behind natural forms and patterns.
- Moral development: helping candidates recognise how logical reasoning can be used to consider the consequences of particular decisions and choices and helping them learn the value of mathematical truth.
- Social development: through helping candidates work together productively on complex mathematical tasks and helping them see that the result is often better than any of them could achieve separately.
- Cultural development: through helping candidates appreciate that mathematical thought contributes to the development of our culture and is becoming increasingly central to our highly technological future, and through recognising that mathematicians from many cultures have contributed to the development of modern day mathematics.

8.4 HEALTH, SAFETY AND ENVIRONMENTAL ISSUES

OCR has taken account of the 1988 Resolution of the Council of the European Community and the Report *Environmental Responsibility: An Agenda for Further and Higher Education*, 1993 in preparing this specification and associated specimen assessments.

Environmental issues may be addressed in:

- questions set in context (e.g. pie charts);
- Handling Data (AO4) investigations.

8.5 THE EUROPEAN DIMENSION

OCR has taken account of the 1988 Resolution of the Council of the European Community in preparing this specification and associated specimen assessments. European examples should be used where appropriate in the delivery of the subject content. Relevant European legislation is identified within the specification where applicable.

- Questions may be set on currency and foreign exchange.

9 Key Skills

Key Skills are central to successful employment and underpin further success in learning independently. Whilst they are certified separately, the Key Skills guidance for this qualification has been designed to support the teaching and learning of the content. Opportunities for developing the generic Key Skills of Communication, Application of Number and Information Technology are indicated through the use of a key symbol in Section C. The wider Key Skills of Working with Others, Problem Solving and Improving own Learning and Performance may also be developed through the teaching programmes associated with the specification.

Key Skills are signposted in this specification in Section 5 (Specification Content). The following matrix indicates those Key Skills for which opportunities for at least some coverage of the relevant Key Skills unit exist.

	Communication	Application of Number	IT	Working with Others	Improving Own Learning and Performance	Problem Solving
Level 1	✓	✓	✓			✓
Level 2	✓	✓	✓			✓

Detailed opportunities for generating Key Skills evidence through this specification are posted on the OCR website. A summary document for key Skills coordinators showing ways in which opportunities for Key Skills arise within GCSE courses will be published during 2001.

A grade in the range of G to D in GCSE Mathematics provides exemption for the external test for the Application of Numbers Key Skill at Level 1.

A grade in the range of C to A* in GCSE Mathematics provides exemption for the external test for the Application of Numbers Key Skill at Level 2.

10 Reading List

At the time of the publication of this specification Hodder and Stoughton are preparing the following GCSE Mathematics textbooks to accompany this course. They will be endorsed by OCR for use with this specification subject to OCR's quality assurance procedure before final publication.

GCSE Mathematics Intermediate Course (published by Hodder and Stoughton in 2000) is presently subject to minor revisions, is specifically aimed at this specification and has been written by OCR examiners.

GCSE Mathematics Higher Course and **GCSE Mathematics Foundation Course** (to be published by Hodder and Stoughton in April, 2001) are specifically aimed at this specification and are being written by OCR examiners.

Series Editor *Brian Seager*

Howard Baxter, Mike Handbury, John Jeskins, Jean Mathers, Mark Patmore.

For further details, please contact the Mathematics team at OCR Cambridge Office.

Any appropriate up-to-date text for GCSE Mathematics will be suitable for use with this specification so Centres will not be disadvantaged by using other than the above texts.

Internal Assessment Guidance Materials will be published by OCR.

11 Arrangements for Candidates with Special Needs

For candidates who are unable to complete the full assessment or whose performance may be adversely affected through no fault of their own, teachers should consult the *Inter-Board Regulations and Guidance Booklet for Special Arrangements and Special Consideration*.

In such cases, advice should be sought from the OCR Special Requirements team (tel 01223 552505) as early as possible during the course.

12 Support and In-service Training for Teachers

To support teachers using this specification, OCR will make the following materials and services available:

- a full programme of In-Service training meetings arranged by the Training and Customer Support Division (telephone 01223 552950);
- specimen question papers and mark schemes, available from the Publications department (telephone 0870 870 66 22);
- past question papers and mark schemes, available from the Publications department (telephone 0870 870 66 22);
- coursework guidance materials;
- written advice on coursework proposals;
- a report on the examination, compiled by senior examining personnel after each examination session;
- individual feedback to each Centre on the moderation of internally assessed work (Option A);
- direct access to a Mathematics Subject Officer.