RECOGNISING ACHIEVEMENT

Oxford Cambridge and RSA Examinations

OCR GCSE IN MATHEMATICS B (*MEI*) J519

Key Features

- Modular approach allows candidates to take the first paper early.
- All candidates have access to Grade C.
- A clear progression route to AS/A Level Mathematics specifications.
- The course can be taken over **one** or **two** years.
- A set of textbooks written by the MEI team of authors.
- MEI support.

Support and In-service Training for Teachers

- A 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 OCR website at www.ocr.org.uk .
- Mark schemes and a report on the examination, compiled by senior examining personnel after each examination session.

In addition, MEI offers the following support:

- Practice papers and other relevant materials.
- Continuing Professional Development (CPD) days and half-days (which can be combined with CPD on any aspect of MEI specifications).
- A local branch structure with meetings locally for all MEI centres two or three times a year.
- A dedicated website and newsletters.
- Direct access to mathematicians for advice.
- Annual conference in July.

For first teaching from September 2007

CONTENTS

Throughout the specification the following icons are used to signpost teaching and learning opportunities in: Citizenship ICT Key Skills

OCR GCSE IN MATHEMATICS B (*MEI*) (J519)

SECTION A: SPECIFICATION SUMMARY

TIERS

Grades	Foundation Tier G to C	Higher Tier D to A*
A*		Candidates take B293 and B294
A		
B		
C	Candidates take B291 and B292	
D		
E		
F		
G		

UNITS

Unit Number	Title	Duration	Weighting
B291	Foundation – Modular paper	1.5 hours	40%
B292	Foundation – Terminal paper	2 hours	60%
B293	Higher – Modular paper	1.5 hours	40%
B294	Higher – Terminal paper	2 hours	60%

QUESTION PAPERS

- The specification has been divided into **two** tiers, Foundation and Higher. Units B291 and B292 cover the content for the Foundation Tier and units B293 and B294 cover the content for the Higher Tier. Candidates at each tier will be entered for **two** papers (the Modular paper and the Terminal paper); the results will be aggregated to give a final grade.
- Each question paper will be in **two** sections, A and B. The two sections will have the same time allowance and each will contribute 50% of the marks for that paper.
- In each question paper, Section A will be completed without the use of a calculator. In Section B of each question paper, candidates will be expected to use a scientific or graphical calculator.

- Criteria which expressly require the use of written or mental methods will only be assessed in Section A and criteria which expressly require the use of a calculator, including questions designed to test the effective use of a calculator, will only be assessed in Section B.
- *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.
- In each question paper there will be a proportion of questions demanding the unprompted solution of multi-step problems.
- Manipulative algebra will be given the required weighting at both Foundation and Higher Tiers.
- At each tier of entry 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.
- At each tier of entry, candidates may take the Modular paper (B291 for Foundation candidates and B293 for Higher candidates) at an earlier session or at the same time as sitting the Terminal paper (B292 for Foundation candidates and B294 for Higher candidates).
- Candidates may re-sit the Modular paper (B291 or B293) once only *prior* to certification. The better score will be used in the aggregation. *After* certification candidates who wish to re-sit must sit *at least* the Terminal paper (B292 or B294) again, but may carry forward their Modular paper mark.

ENTRY OPTIONS

This qualification will first be certificated in June 2009.

- The Modular papers (B291 and B293) will be available from June 2008 and at every subsequent session (January and June).
- The Terminal papers (B292 and B294) will be available from June 2009 and at every subsequent session (January and June).

Entry Code/ Option Code	Tier	Valid Combinations
J519/F	Foundation	B291 **plus** B292
J519/H	Higher	B293 **plus** B294

SECTION B: GENERAL INFORMATION

1 Introduction

1.1 RATIONALE

This specification is designed to ensure that candidates are equipped to meet the demands of both education and industry at this level, in accordance with the philosophy of MEI. The aims are:

- to provide a carefully staged route of progression through mathematics at this level;
- to foster an understanding of the relationship between the mathematics content and its actual use in the real world;
- to enable candidates to be more functional in their mathematics.

This is a two-stage assessment procedure which allows (but does **not** require) one of the two examinations to be taken at an earlier stage, for example at the end of the first year of a two-year course. This gives candidates the motivation to work throughout the course and to master the more basic, earlier work, rather than leaving everything to the last minute and then finding that the demand is too high.

This specification is thus distinctive in a number of ways:

- The standard GCSE content is divided into **two** units at each tier, with the second dependent on the more basic first. These units are tied to the grade descriptors for the National Curriculum.
- The question papers are designed to assess candidates at the level at which they are working.
- The first unit in each tier will form the assessment for the Modular paper. The Terminal paper will **not** have as the main focus of a question the material to be assessed in the Modular paper.
- The specification encourages an approach to teaching and learning that is based on real-world problems and the sort of activities which they generate. Where possible the style of questions also reinforces this approach.
- The mode of assessment involves **two** question papers. At each tier the Modular paper is designed to be taken before the end of the course and tests the basic work upon which much of the rest of the course is built.
- Above all, however, this specification is designed to provide candidates with skills and approaches to learning that will remain with them for the rest of their lives.

OCR has taken great care in the preparation of this specification and specimen 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 B.

1.3 LEVEL OF QUALIFICATION

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

Candidates who gain Grades G to D will have achieved an award at Level 1.
Candidates who gain Grades C to A* will have achieved an award at Level 2.

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 Level 1 within the National Qualifications Framework or could proceed to Level 2. 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 Entry Level Certificates in Mathematics Specifications A (3910) and B (3913).

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 other OCR GCSE Mathematics specifications.

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 Number* 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 Number* 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** also enter for any Entry Level Certificate, Free-Standing Mathematics Unit (including *Additional Mathematics*) or NVQ qualification.

Every specification is assigned 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 comply in every respect with the revised Code of Practice requirements for courses starting after September 2001.

1.10 STATUS IN WALES AND NORTHERN IRELAND

This specification has been approved by DELLS 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, specimen assessment materials and supporting documentation only in English.

Further information concerning the provision of specimen assessment materials in Welsh and Irish may be obtained from the OCR Customer Contact Centre (telephone 01223 553998)[1].

2 Specification Aims

The stated aim of MEI is to promote the links between education and industry in mathematics and to produce relevant examination and teaching specifications and support material.

The overall aims of this specification are to encourage candidates to:

- develop a positive attitude to mathematics;
- consolidate basic skills and meet appropriately challenging work;
- think and communicate mathematically – precisely, logically and creatively;
- develop functional problem-solving skills so that they can apply their mathematical knowledge in everyday life, in other curriculum areas and in employment;
- make efficient use of appropriate technology;
- work both independently and as members of a team;
- appreciate the place and use of mathematics in society;
- develop an appreciation of the interdependence of different branches of mathematics;
- build a firm foundation for further study.

The Modular paper (B291 or B283) specifically aims to:

- provide an accessible paper which can be taken during the course to give candidates a sense of achievement and progress;
- provide information on candidates' mathematical progress;

[1] The OCR Customer Contact Centre is open to take your calls between 8.00am and 5.30pm. Please note that as part of our quality assurance programme your call may be recorded or monitored for training purposes.

- help candidates who are also working towards Key Skill *Application of Number* by providing the techniques they need in the early part of the course.

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 in the question 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 **two** tiers: Foundation Tier and Higher Tier. Foundation Tier assesses Grades G to C and Higher Tier assesses Grades D to A*. Candidates will be entered for either the Foundation Tier or the Higher Tier.

In no circumstances will a candidate entered for the Foundation Tier Terminal paper be awarded a grade higher than Grade C. Candidates achieving marginally less than the minimum mark for Grade D on the Higher Tier will be awarded Grade E. Candidates failing to achieve this standard will be ungraded.

<table>
<tr><th>Grades</th><th>Foundation Tier
G to C</th><th>Higher Tier
D to A*</th></tr>
<tr><td>A*</td><td></td><td rowspan="5">Candidates take
B293 and B294</td></tr>
<tr><td>A</td><td></td></tr>
<tr><td>B</td><td></td></tr>
<tr><td>C</td><td rowspan="5">Candidates take
B291 and B292</td></tr>
<tr><td>D</td></tr>
<tr><td>E</td><td></td></tr>
<tr><td>F</td><td></td></tr>
<tr><td>G</td><td></td></tr>
</table>

4.2 UNITS

Unit Number	Title	Duration	Weighting
B291	Foundation – Modular paper	1.5 hours	40%
B292	Foundation – Terminal paper	2 hours	60%
B293	Higher – Modular paper	1.5 hours	40%
B294	Higher – Terminal paper	2 hours	60%

4.3 RE-SIT RULES

Candidates may re-sit the Modular paper (B291 or B293) once only *prior* to certification. The better score will be used in the aggregation.

After certification candidates who wish to re-sit must sit *at least* the Terminal paper (B292 or B294) again, but may carry forward their Modular paper mark.

Individual unit results will have a shelf-life limited only by that of the specification.

4.4 CERTIFICATION

Candidates must be entered for certification to claim their overall grade. Candidates should be entered under the relevant option code (see below).

Entry Options

Entry Code/ Option Code	Tier	Valid Combinations
J519/F	Foundation	B291 **plus** B292
J519/H	Higher	B293 **plus** B294

Terminal Rules

Units B292 and B294 can only be taken in the terminal session.

Entry Patterns

Candidates may take the full assessment at the end of their course or they may choose to take their first (Modular) paper earlier. The following patterns illustrate the possibilities:

- A **two**-year course with full assessment at the end.
- A **two**-year course with B291 or B293 taken in June of the first year or January of the second year.
- A **one**-year course with full assessment at the end.
- A **one**-year course with B291 or B293 taken in January.

- A **one-and-a-half**-year course with B291 or B293 taken in June and B292 or B294 taken the following January.

4.5 QUESTION PAPERS

- The specification has been divided into **two** tiers, Foundation and Higher. B291 and B292 cover the content for the Foundation Tier and B293 and B294 cover the content for the Higher Tier. Candidates at each tier will be entered for **two** papers (the Modular paper and the Terminal paper) – the results will be aggregated to give a final grade.
- Each paper will be in **two** sections, A and B. The two sections will have the same time allowance and each will contribute 50% of the marks for that paper.
- In each paper, Section A will be completed without the use of a calculator. In Section B of each paper, candidates will be expected to use a scientific or graphical calculator.
- Criteria which expressly require the use of written or mental methods will only be assessed in Section A and criteria which expressly require the use of a calculator, including questions designed to test the effective use of a calculator, will only be assessed in Section B.
- *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.
- In each paper there will be a proportion of questions demanding the unprompted solution of multi-step problems.
- Manipulative algebra will be given the required weighting at both Foundation and Higher Tiers.
- At each level of entry 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.
- At each level of entry, candidates may take the Modular paper (B291 for Foundation candidates and B293 for Higher candidates) at an earlier session or at the same time as sitting the Terminal paper (B292 for Foundation candidates and B294 for Higher candidates).
- Candidates may re-sit the Modular paper (B291 or B293) once only *prior* to certification. The better score will be used in the aggregation. *After* certification candidates who wish to re-sit must sit *at least* the Terminal paper (B292 or B294) again, but may carry forward their Modular paper mark.
- The allocation of marks and grades on the papers is shown in the following grid.

Unit	Grades Available	Marks Allocated to Grades	Total Marks	Duration
B291 (Foundation)	G – F, E – C	44, 28	72	1.5 hours
B292 (Foundation)	G – F, E – C	42, 58	100	2 hours
B293 (Higher)	D – C, B – A*	44, 28	72	1.5 hours
B294 (Higher)	D – C, B – A*	42, 58	100	2 hours

- The allocation of marks between Assessment Objectives is shown in the following grid.

Unit	AO2: Number	AO2: Algebra	AO3: Shape, Space and Measures	AO4: Handling Data
B291 (Foundation)	21-23	14-15	18-22	14-17
B292 (Foundation)	30-33	21-23	25-30	17-21
B293 (Higher)	14-15	21-23	18-22	14-17
B294 (Higher)	21-23	30-33	25-30	17-21

4.6 UNIFORM MARKS

The written papers have a total weighting of 100%.

The specification is graded on a Uniform Mark Scale. The uniform mark thresholds for each of the assessments are shown below:

Grade	Foundation B291	Foundation B292	Higher B293	Higher B294	Total (Max. 400)
A*			144	216	360
A			128	192	320
B			112	168	280
C	96	144	96	144	240
D	80	120	80	120	200
E	64	96	*	*	160
F	48	72			120
G	32	48			80

*At higher tier Grade E is an allowed grade, and in common with other specifications the boundary is set at half band width.

4.7 AVAILABILITY

This qualification will first be certificated in June 2009.

There are **two** assessment sessions in each year, in January and June as follows:

- The Modular papers (B291 and B293) will be available from June 2008 and at every subsequent session (January and June).
- The Terminal papers (B292 and B294) will be available from June 2009 and at every subsequent session (January and June).

4.8 WEIGHTING OF ASSESSMENT OBJECTIVES

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

AO2: Number and Algebra	**AO3: Shape, Space and Measures**	**AO4: Handling Data**	**Total**
50-55%	25-30%	18-22%	100%

A minimum of 20% of the assessment on each paper will be attributable to AO1 in contexts provided by the other assessment objectives.

4.9 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 and efficiently; know how to enter complex calculations and use function keys for reciprocals, squares and powers (Foundation Tier: F2.3o);
- 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 (Higher Tier: H2.3o).

Questions will be set in B292 and B294 (the Terminal papers) 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.

4.10 GUIDED LEARNING HOURS

This GCSE specification requires a nominal **90** guided learning hours (glhs) of delivery time.

4.11 DIFFERENTIATION

In the question papers, B291, B292, B293 and B294, 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.

4.12 AWARDING OF GRADES

The written papers will have a total weighting of 100%.

A candidate's mark for each paper will be combined in the appropriate weighting to give a total mark for the specification. The candidate's grade will be determined by the total mark.

If the Modular paper is taken more than once prior to certification then the better mark will be used. Following certification the mark from the better of the last two attempts will be used.

In Foundation Tier, candidates achieving less than the minimum mark for Grade G will be ungraded. In Higher Tier, candidates achieving marginally less than the minimum mark for Grade D may be awarded Grade E; those with lower marks will be ungraded.

4.13 GRADE DESCRIPTIONS

Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The descriptions must be interpreted in relation to the content in the specification; 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. Candidates 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. Candidates use coordinates in all **four** quadrants to locate and specify points.

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 use appropriate techniques 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 use 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 linear. Candidates calculate one quantity as a percentage of another. They multiply **two** expressions of the form $(x + \mathrm{n})$; 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 draw and use graphs of quadratic functions.

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 solve problems involving 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 use mathematical instruments to carry out accurate constructions of loci.

Candidates construct and interpret frequency diagrams with grouped data. 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. 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 manipulate simple surds. 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. 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. They understand and use the effect of enlargement on areas and volumes of shapes and solids.

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 entire Foundation PoS forms the basis for the content of the Foundation Tier specification. In a few instances, content has been drawn from the Higher PoS, with the Grade A*, A and B material excluded. This material is highlighted in grey in the Foundation Tier table.
- The entire Higher PoS forms the basis for the content of the Higher Tier specification. The Higher PoS is assumed to subsume the content of the Foundation PoS. In a few instances, however, content has been drawn explicitly from the Foundation PoS, with the Grade E, F and G material excluded. This material is highlighted in grey in the Higher Tier table.

National Curriculum references (NC ref) have been included.

Those prefaced **F** refer to the Foundation PoS.
E.g. **F3.2b** refers to AO**3** (*Shape, space and measures*), Section **2** (*Geometrical reasoning*) Statement **b** (*distinguish between acute, obtuse ...*)

Those prefaced **H** refer to the Higher PoS.

The material is cumulative. Only the material listed for the Modular paper (B291 and B293) will be assessed in the Modular paper. The material listed for the Modular paper will **not** be the focus of a question in the Terminal paper (B292 and B294), but knowledge of it is assumed and may form part of the assessment.

Throughout the specification the following icons are used to signpost teaching and learning opportunities in: Citizenship ICT Key Skills

The icons indicate areas where useful exemplars might be found but the absence of an icon in any area should not be taken to indicate that exemplars that contribute to Key Skills and Citizenship cannot be found within that area.

5.1 FOUNDATION TIER SPECIFICATION CONTENT

AO2: Number and Algebra	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
		1 Using and Applying Number and Algebra			
Problem solving	F2.1a	select and use suitable problem-solving strategies and efficient techniques to solve numerical and algebraic problems			PS1.1, PS2.1 Includes choosing relevant information when some is redundant
	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			PS1.2, PS2.2
	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			
Communicating	F2.1e	interpret and discuss numerical and algebraic information presented in a variety of forms			
	F2.1f	use notation and symbols correctly and consistently within a given problem			N1.3, PS1.1
	F2.1g	use a range of strategies to create numerical, 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			C1.3, N1.3, PS1.3
	F2.1h	present and interpret solutions in the context of the original problem			
	F2.1i	review and justify their choice of mathematical presentation			PS1.1, PS2.3, C1.3
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), identify exceptional cases when solving problems			(1) e.g. using simple codes that substitute numbers for letters
	F2.1k	show step-by-step deduction in solving a problem			
	F2.1l	understand the difference between a practical demonstration and a proof			
	F2.1m	recognise the importance of 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			

AO2: Number and Algebra	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
		2 Numbers and the Number System			
Integers	F2.2a 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 positive numbers and negative integers, 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 the concepts and vocabulary of highest common factor, least common multiple, prime number and prime factor decomposition	
Powers and roots	F2.2b	use the terms 'square', 'positive square root' and 'cube'; use index notation(1) for squares, cubes and powers of 10	F2.2b H2.2b	use the terms 'negative square root' and 'cube root'; use index laws for multiplication and division of integer powers; express standard index form both in conventional notation and on a calculator display	(1) e.g. 8^2 Includes simple integer powers, e.g. 2^4 Includes interpretation of calculator displays
Fractions	F2.2c	understand equivalent fractions, simplifying a fraction by cancelling all common factors	F2.2c	order fractions by rewriting them with a common denominator	Includes mixed numbers
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	(1) e.g. 0.137 = 137/1000
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)			(1) e.g. 10% means 10 parts per 100 and 15% of Y means 15/100 ×Y (2) e.g. commerce and business, including rate of inflation, VAT and interest rates Financial capability
Ratio	F2.2f	use ratio notation, including reduction to its simplest form and its various links to fraction notation			

AO2: Number and Algebra	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
3 Calculations					
Number operations and the relationships between them	F2.3a H2.3a	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; 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	H2.3a	use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of integer powers; use inverse operations	Includes negative integers N1.2, N2.2
	F2.3b	use brackets	F2.3b	use the hierarchy of operations	
	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; perform short division to convert a simple fraction to a decimal	F2.3c	add and subtract fractions by writing them with a common denominator	(1) e.g. for scale drawings and construction of models, down payments, discounts
			F2.3d H2.3d	understand and use unit fractions as multiplicative inverses(1); multiply and divide a fraction by an integer, by a unit fraction and by a general fraction	(1) e.g. by thinking of multiplication by $^1/_5$ as division by 5
	F2.3e	convert simple fractions of a whole to percentages of the whole and vice versa(1)	F2.3e	convert simple fractions of a whole to percentages of the whole and vice versa(1), then understand the multiplicative nature of percentages as operators(2)	(1) e.g. analysing diets, budgets or the costs of running, maintaining and owning a car (2) A 15% decrease in value Y is calculated as 0.85 × Y
			F2.3f	divide a quantity in a given ratio	

AO2: Number and Algebra	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
		3 Calculations (continued)			
Mental methods	F2.3g H2.3g	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 integer squares from 11×11 to 15×15 and the corresponding square roots; recall the cubes of 2, 3, 4, 5 and 10, and the fraction-to-decimal conversion of familiar simple fractions[2]			(1) e.g. 37 + 63 = 100; (2) e.g. 1/2, 1/4, 1/5, 1/10, 1/100, 1/3, 2/3, 1/8
	F2.3h	round to the nearest integer and to **one** significant figure; estimate answers to problems involving decimals			Includes rounding to a given number of decimal places N1.2, N2.2
	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			(1) e.g. estimate $\sqrt{85}$ (2) e.g. 13.76 – 5.21, 20.08 + 12.4 (3) e.g. 1.8×2, $3.6 \div 4$
Written methods	F2.3j	use standard column procedures for addition and subtraction of integers and decimals			Financial capability
	F2.3k	use standard column procedures for multiplication of integers and decimals, understanding where to position the decimal point by considering what happens if they multiply equivalent fractions	F2.3k	solve a problem involving division by a decimal (up to **two** decimal places) by transforming it to a problem involving division by an integer	N1.2, N2.2
			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	N1.2, N2.2
			F2.3m	solve simple percentage problems, including increase and decrease[1]	(1) VAT, annual rate of inflation, income tax, discounts
			F2.3n	solve word problems about ratio and proportion, including using informal strategies and the unitary method of solution[1]	(1) e.g. given that *m* identical items cost £*y*, then one item costs £*y*/*m* and *n* items cost £(*n* x *y*/*m*) the number of items that can be bought for £*z* is *z* x *m*/*y*
			H2.3n	use π in exact calculations, without a calculator	

AO2: Number and Algebra	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
3 Calculations (continued)					
Calculator methods	F2.3o	use calculators effectively and efficiently; know how to enter complex calculations and use function keys for reciprocals, squares and powers			
			F2.3p	enter a range of calculations, including those involving standard index form and measures[1]	(1) e.g. time calculations in which fractions of an hour must be entered as fractions or as decimals
			F2.3q H2.3p	understand the calculator display[1], 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	(1) e.g. in money calculations, or when the display has been rounded by the calculator
4 Solving Numerical Problems					
	F2.4a	draw on their knowledge of operations and the relationships between them, and of simple integer powers and their corresponding roots, to solve problems and word problems, including those involving ratio and proportion, a range of measures and compound measures, metric units, and conversion between metric and common imperial units, set in a variety of contexts	F2.4a H2.4a	draw on their knowledge of operations and inverse operations, 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, fractions, percentages and measures and conversion between measures, and compound measures defined within a particular situation	N1.2, N2.2
			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	N1.2, N2.2
	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	H2.4b	estimate answers to problems	
			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	N1.2, N2.2

AO2: Number and Algebra	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
5 Equations, Formulae and Identities					
Use of symbols	F2.5a 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(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)	F2.5a 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 general, unspecified and independent numbers in identities(3), and in functions they define new expressions or quantities by referring to known quantities(4)	(1) e.g. $5x + 1 = 16$ (2) e.g. $V = IR$ (3) e.g. $3x + 2x = 5x$ for all values of x (4) e.g. $y = 2x$
	F2.5b	understand that the transformation of algebraic expressions obeys and generalises the rules of generalised arithmetic(1); manipulate algebraic expressions by collecting like terms(3)	F2.5b H2.5b	expand the product of **two** linear expressions(2); manipulate algebraic expressions by multiplying a single term over a bracket, and by taking out common factors(4); distinguish in meaning between the words ‘equation’, ‘formula’, ‘identity’ and ‘expression’	(1) e.g. $a(b + c) = ab + ac$ (2) e.g. $(2x + 5)(3x – 2) = 6x^2 + 11x – 10$ (3) e.g. $x + 5 – 2x – 1 = 4 – x$ (4) e.g. $9x – 3 = 3(3x – 1)$ or $x^2 – 3x = x(x – 3)$
Index notation	F2.5c	use index notation for simple positive integer powers, and simple instances of index laws(1); substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$	F2.5c	use index notation for simple negative integer powers, and simple instances of index laws(1); substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$	(1) e.g. $x^2 \times x^3 = x^5$; $x^6 \div x^7 = x^{-1}$
Inequalities			F2.5d	solve simple linear inequalities in **one** variable, and represent the solution set on a number line	
Equations	H2.5e	solve simple equations(2) by using inverse operations or by transforming both sides in the same way	H2.5e	set up simple equations(1); solve simple equations(2) by using inverse operations or by transforming both sides in the same way	(1) e.g. find the angle a in a triangle with angles a, $a + 10$, $a + 20$ (2) e.g. $11 – 4x = 2$; $3(2x + 1) = 8$; $2(1 – x) = 6(2 + x)$; $3x^2 = 48$; $3 = 12/x$
Linear equations	F2.5e	solve linear equations, with integer coefficients, in which the unknown appears on either side: 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	F2.5e	solve linear equations, with integer coefficients, in which the unknown appears on either side or on both sides of the equation	

AO2: Number and Algebra	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
5 Equations, Formulae and Identities (continued)					
Formulae	F2.5f	use formulae from mathematics and other subjects[1] expressed initially in words and then using letters and symbols[2]; substitute numbers into a formula; change its subject[3]	F2.5f	derive a formula and change its subject[3]	(1) e.g. for area of a triangle or a parallelogram, area enclosed by a circle, volume of a prism (2) e.g. formulae for the area of a triangle, the area enclosed by a circle, wage earned = hours worked × rate per hour (3) e.g. find r given that $C=\pi r$, find x given $y = mx + c$ N2.2, IT1.2, IT2.2 Candidates could use a spreadsheet to construct formulae to model situations Candidates could use a spreadsheet or graphic calculator to construct and use formulae
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]	(1) e.g. $x^3 = x - 900$; ${}^1/x = x^2 - 5$
6 Sequences, Functions and Graphs					
Sequences			F2.6a H2.6a	generate terms of a sequence using term-to-term and position-to-term definitions of the sequence; 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 nth term of an arithmetic sequence, justifying its form by referring to the activity or context from which it was generated	Includes simple sequence of odd or even numbers; Squared integers and sequences derived from diagrams

AO2: Number and Algebra	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
		6 Sequences, Functions and Graphs (continued)			
Graphs of linear functions	F2.6b	use the 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)			(1) e.g. $y = 2x + 3$ (2) e.g. $x + y = 7$ Candidates could use a spreadsheet to calculate points and to draw graphs to explore the effects of varying m and c in the graph of $y = mx + c$ Candidates could generate functions from plots of experimental data using simple curve-fitting techniques on graphic calculators or with graphics software IT1.2, IT2.2
	New F2.6c	discuss and interpret graphs modelling real situations(1); understand that the point of intersection of **two** different lines in the same **two** variables that simultaneously describe a real situation is the solution to the simultaneous equations represented by the lines; draw line of best fit through a set of linearly-related points and find its equation	F2.6c	construct linear functions from real-life problems and plot their corresponding graphs; understand that the point of intersection of **two** different lines in the same **two** variables that simultaneously describe a real situation is the solution to the simultaneous equations represented by the lines; draw line of best fit through a set of linearly-related points and find its equation	(1) e.g. know that the lines represented by the equations $y = -5x$ and $y = 3 - 5x$ are parallel, each having gradient (–5) (2) the line with equation $y = x/5$ is perpendicular to these lines and has gradient $^1/_5$
Gradients	F2.6d	find the gradient of lines given by equations of the form $y = mx + c$ (when values are given for m and c); investigate the gradients of parallel lines			
Interpreting graphical information	F2.6e	interpret information presented in a range of linear and non-linear graphs(1)			(1) e.g. 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 C1.2, N2.1
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	(1) e.g. $y = x^2$; $y = 3x^2 + 4$ (2) e.g. $y = x^2 - 2x + 1$

AO3: Shape, space and measures	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
1 Using and Applying Shape, Space and Measures					
Problem solving	F3.1a H3.1a	select problem-solving strategies and resources, including ICT tools, to use in geometrical work, and monitor their effectiveness; consider and explain the extent to which the selections they made were appropriate			IT1.2, PS1.1, PS2.1
	F3.1b	select and combine known facts and problem-solving strategies to solve complex problems			PS1.2, PS2.2
	F3.1c H3.1c	identify what further information is needed to solve a geometrical problem; break complex problems down into a series of tasks; develop and follow alternative lines of enquiry			PS1.2, PS1.3, PS2.2, PS2.3
Communicating	F3.1d	interpret, discuss and synthesise geometrical information presented in a variety of forms			C1.2
	F3.1e 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			C1.3
	F3.1f	use geometrical language appropriately			
	F3.1g	review and justify their choices of mathematics presentation			C1.3, PS1.3, PS2.3
Reasoning	F3.1h	distinguish between practical demonstrations and proofs			
	F3.1i	apply mathematical reasoning, explaining and justifying inferences and deductions			PS1.3, PS2.3
	F3.1j	show step-by-step deduction in solving a geometrical problem			
	F3.1k	state constraints and give starting points when making deductions			
	F3.1l	recognise the limitations of any assumptions that are made; understand the effects that varying the assumptions may have on the solution			
	F3.1m	identify exceptional cases when solving geometrical problems			

AO3: Shape, space and measures	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
				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 rectilinear shapes			F3.2c 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°; understand a proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices	
			F3.2d	use angle properties of equilateral, isosceles and right-angled triangles; understand congruence; explain why the angle sum of a quadrilateral is 360°	
	F3.2f	recall the essential properties of special types of quadrilateral, including square, rectangle, parallelogram, trapezium and rhombus	F3.2f H3.2c	recall the definitions of special types of quadrilateral, including square, rectangle, parallelogram, trapezium and rhombus; classify quadrilaterals by their geometric properties	Includes a kite
	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			
	F3.2h	understand, recall and use Pythagoras' theorem			
			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	
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, sector and segment	F3.2i	understand that inscribed regular polygons can be constructed by equal division of a circle	

AO3: Shape, space and measures	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
2 Geometrical Reasoning (continued)					
3-D shapes	F3.2j	explore the geometry of cuboids (including cubes), and shapes made from cuboids			Includes isometric drawing 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	solve problems involving surface areas and volumes of prisms	
3 Transformations and Coordinates					
Specifying transformations			F3.3a H3.3a	understand that rotations are specified by a centre and an (anticlockwise) angle; rotate a shape about the origin, or any other point; measure the angle of rotation using right angles, simple fractions of a turn or degrees; understand that reflections are specified by a mirror line, at first using a line parallel to an axis, then a mirror line such as $y = x$ or $y = -x$; understand that translations are specified by a distance and direction(or a vector), and enlargements by a centre and positive scale factor	Includes reflection in the x-axis or y-axis or in a given mirror line; Includes the order of rotational symmetry of a shape and includes tessellations
Properties of transformations			F3.3b 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, recognising that these transformations 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	
			F3.3c	recognise, visualise and construct enlargements of objects using positive scale factors greater than **one**, then positive scale factors less than **one**; understand from this that any **two** circles and any **two** squares are mathematically similar, while, in general, **two** rectangles are not	Includes enlarging a shape on a grid; Includes enlarging a shape by shape factor 3, gives the centre of enlargement

AO3: Shape, space and measures	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
		3 Transformations and Coordinates (continued)			
Properties of transformations (continued)	F3.3d	use and interpret maps and scale drawings	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; understand the implications of enlargement for area and for volume; distinguish between formulae for perimeter, area and volume by considering dimensions; understand and use simple examples of the relationship between enlargement and areas and volumes of shapes and solids	
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(1); find the coordinates of points identified by geometrical information(2); find the coordinates of the midpoint of the line segment AB, given points A and B, then calculate the length AB	(1) e.g. find the coordinates of the fourth vertex of a parallelogram with vertices at (2, 1), (–7, 3) and (5, 6) (2) e.g. identify the coordinates of the vector of a cupboard drawn on a 3D grid
Vectors			H3.3f	understand and use vector notation for translations	
		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	F3.4a	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	
			F3.4b	understand angle measure using the associated language(1)	(1) e.g. use bearings to specify direction
	F3.4c	understand and use compound measures, including speed(2)	F3.4c H3.4a	understand and use compound measures, including speed(2) and density	(2) e.g. how far do you go travelling at 40 mph for 3 hours?

AO3: Shape, space and measures	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
4 Measures and Construction (continued)					
Construction	F3.4d	measure and draw lines to the nearest millimetre, and angles to the nearest degree	F3.4d	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	
			F3.4e	use straight edge and compasses to do standard constructions, including an equilateral triangle with a given side, 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			Includes perimeter of simple shapes Includes areas of parallelograms and trapezium; Includes half-circles and quarter circles N2.2
	F3.4g	find volumes of cuboids, recalling the formula and understanding the connection to counting cubes and how it extends this approach	F3.4g	calculate volumes of right prisms and 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			F3.4j	find loci, both by reasoning and by using ICT to produce shapes and paths(1)	(1) e.g. a region bounded by a circle and an intersecting line IT1.2

AO4: Handling data	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
		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			N2.1, PS1.1, PS1.2, PS2.1, PS2.2, IT1.1, IT1.2, IT2.1
	F4.1b H4.1b	identify what further information is needed to pursue a particular line of enquiry; 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)			PS1.2, PS1.3, PS2.2
	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			PS1.3, PS2.3
Communicating	F4.1e	interpret, discuss and synthesise information presented in a variety of forms			Candidates could use databases or spreadsheets to present their findings and display their data. C1.3, N1.3, IT1.2, IT2.3
	F4.1f	communicate mathematically, including using ICT, making use of diagrams and related explanatory text			IT1.2, IT2.3
	F4.1g	examine critically, and justify, their choices of mathematical presentation of problems involving data			
Reasoning	F4.1h	apply mathematical reasoning, explaining and justifying inferences and deductions			IT1.1
	H4.1e	identify exceptional or unexpected cases when solving statistical problems			Promoting the skill of enquiry
	F4.1i H4.1f	explore connections in mathematics and look for relationships between variables when analysing data			
	F4.1j	recognise the limitations of any assumptions and the effects that varying the assumptions could have on the conclusions drawn from data analysis			Promoting the skill of enquiry

AO4: Handling data	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
		2 Specifying the Problem and Planning			
	F4.2a	see that random processes are unpredictable			
	F4.2b H4.2b	Identify key questions that can be addressed by statistical methods			
	F4.2c	discuss how data relate to a problem, identify possible sources of bias and plan to minimise it			C1.1, C1.2
	F4.2d	identify which primary data they need to collect and in what format, including grouped data, considering appropriate equal class intervals			
	F4.2e H4.2e	design an experiment or survey; decide what primary and secondary data to use			IT1.1, IT1.2, N1.1
		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			
			F4.3b	gather data from secondary sources, including printed tables and lists from ICT-based sources	IT1.1, IT2.1, N1.1
	F4.3c	design and use two-way tables for discrete and grouped 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 frequency diagrams and stem-and-leaf diagrams	F4.4a	draw and produce, using paper and ICT, diagrams for continuous data, including line graphs for time series and scatter graphs	Includes pictograms and bar charts Includes frequency polygons, histograms with equal class intervals and frequency diagrams for grouped discrete data N1.3, N2.3, IT1.2, IT2.3
	F4.4b	calculate mean, range and median of small data sets with discrete then continuous data	F4.4b	identify the modal class for grouped data	N1.2, N2.2 Includes the mode
			F4.4g	find the median for large data sets and calculate an estimate of the mean for large data sets with grouped data	N1.2, N2.2

AO4: Handling data	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
4 Processing and Representing Data (continued)					
	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), or from relative frequency	Include the addition of simple probabilities
	F4.4e	list **all** outcomes for single events, and for **two** successive events, in a systematic way			
	F4.4f	identify different mutually-exclusive outcomes and know that the sum of the probabilities of all these outcomes is 1			
			F4.4h	draw lines of best fit by eye, understanding what these represent	
	H4.4j	use relevant statistical functions on a calculator or spreadsheet			
5 Interpreting and Discussing Results					
	F4.5a	relate summarised data to the initial questions			
	F4.5b	interpret a wide range of graphs and diagrams and draw conclusions			Includes interpreting a stem and leaf diagram N1.3, N2.3
	F4.5c	look at data to find patterns and exceptions			Candidates could use databases to present their findings
	F4.5d	compare distributions and make inferences, using the shapes of distributions and measures of average and range	F4.5d	compare distributions and make inferences, using the shapes of distributions and measures of average and range	N1.3, N2.3
	F4.5e	consider and check results and modify their approach if necessary			PS1.3
			F4.5f 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'	

AO4: Handling data	NC ref	Modular Paper 1 G – C Candidates should be taught to:	NC ref	Terminal Paper 2 G – C Candidates should be taught to:	Key Skills and notes
5 Interpreting and Discussing Results (continued)					
			F4.5g	use the vocabulary of probability to interpret results involving uncertainty and prediction[1]	(1) e.g. "there is some evidence from this sample that …"
			F4.5h	compare experimental data and theoretical probabilities	
			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	
	F4.5j	discuss implications of findings in the context of the problem			IT1.1
			F4.5k	interpret social statistics including index numbers[1]; time series[2]; and survey data[3]	(1) e.g. the General Index of Retail Prices (2) e.g. population growth; (3) e.g. the National Census

5.2 HIGHER TIER SPECIFICATION CONTENT

AO2: Number and Algebra	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
		1 Using and Applying Number and Algebra			
	H2.1a	select and use appropriate and efficient techniques and strategies to solve problems of increasing complexity, involving numerical and algebraic manipulation			PS1.1, PS2.1 Includes choosing relevant information when some is redundant
Problem solving	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			PS1.2, PS2.2
	H2.1c	break down a complex calculation into simpler steps before attempting to solve it and justify their choice of methods			
	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			
	H2.1e	discuss their work and explain their reasoning using an increasing range of mathematical language and notation			
	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			N1.3, PS1.1
Communicating	H2.1g	present and interpret solutions in the context of the original problem			C1.3, N1.3, PS1.3
	H2.1h	use notation and symbols correctly and consistently within a given problem			
	H2.1i	examine critically, improve, then justify their choice of mathematical presentation; present a concise, reasoned argument			PS1.1, PS2.3, C1.3
	H2.1j	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, identify exceptional cases when solving problems			
Reasoning	H2.1k	understand the difference between a practical demonstration and a proof			
	H2.1l	show step-by-step deduction in solving a problem; derive proofs using short chains of deductive reasoning			
	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			

AO2: Number and Algebra	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
2 Numbers and the Number System					
Integers	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	H2.2b	use the terms 'square', 'positive square root', '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			(1) e.g. 8^2 Includes interpretation of calculator displays
Fractions	H2.2c	understand equivalent fractions, simplifying a fraction by cancelling all common factors; order fractions by rewriting them with a common denominator			
Decimals			H2.2d	recognise that each terminating decimal is a fraction; recognise that recurring decimals are exact fractions, and that some exact fractions are recurring decimals(1); order decimals	(1) e.g. 1/7 = 0.142857142857...
Percentages	F2.2e H2.2e	understand that 'percentage' means 'number of parts per 100' and use this to compare proportions; interpret percentage as the operator 'so many hundredths of'; use percentage in real-life situations			
Ratio	H2.2f	use ratio notation, including reduction to its simplest form and its various links to fraction notation			

AO2: Number and Algebra	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
		3 Calculations			
Number operations and the relationships between them	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	H2.3a	use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of 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
	H2.3b	use brackets and the hierarchy of operations			
	H2.3c	calculate a given fraction of a given quantity, 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)(1); convert a recurring decimal to a fraction(2)	(1) e.g. 0.142857142857… = 1/7 (2) e.g. convert $^1/_7$ to a decimal
	H2.3d	understand and use unit fractions as multiplicative inverses(1); multiply and divide a given fraction by an integer, by a unit fraction and by a general fraction			(1) e.g. by thinking of multiplication by $^6/_7$ as multiplication by 6 followed by division by 7 (or vice versa) Includes multiplication and division of mixed numbers.
	H2.3e	convert simple fractions of a whole to percentages of the whole and vice versa; then understand the multiplicative nature of percentages as operators(1)	H2.3e	calculate an original amount when given the transformed amount after a percentage change; reverse percentage problems(2)	(1) e.g. a 15% increase in value Y, followed by a 15% decrease, is calculated as $1.15 \times 0.85 \times Y$ (2) e.g. 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	divide a quantity in a given ratio			

AO2: Number and Algebra	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
		3 Calculations (continued)			
Mental methods	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, the fact that $n^0 = 1$ and $n^{-1} = {}^1/n$ for positive integers n(1), the corresponding rule for negative numbers(2), $n^{½} = \sqrt{n}$ and $n^{⅓} = \sqrt[3]{n}$ for any positive number n(3)			(1) e.g. $10^0 = 1$; $9^{-1} = 1/9$ (2) e.g. $5^{-2} = 1/5^2 = 1/25$ (3) e.g. $25^{½} = 5$ and $64^{1/3} = 4$
	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)	H2.3h	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	(1) e.g. $0.1234 = 1.234 \times 10^{-1}$ N1.2, N2.2
	F2.3i	develop a range of strategies for mental calculation; add and subtract mentally numbers with up to **one** decimal place(1); multiply and divide numbers with no more than **one** decimal digit(2), using the commutative, associative, and distributive laws and factorisation where possible, or place value adjustments			(1) e.g. 13.76 – 5.21, 20.08 + 12.4 (2) e.g. 1.8×2, $3.6 \div 4$
Written methods	H2.3i	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			
	H2.3j	solve percentage problems, including percentage increase and decrease(1)	H2.3j	solve percentage problems, including reverse percentages(1)	(1) e.g. VAT, annual rate of inflation, income tax, discounts, simple interest Financial capability
	F2.3k H2.3k	division by decimal (up to **two** decimal places) by division using an integer; understand where to position the decimal point by considering what happens if they multiply equivalent fractions, e.g. "given that…work out…"; represent repeated proportional change using a multiplier raised to a power(1)			(1) e.g. 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	calculate with standard index form(1)	(1) e.g. $2.4 \times 10^7 \times 5 \times 10^3 = 12 \times 10^{10} = 1.2 \times 10^{11}$; $(2.4 \times 10^7) \div (5 \times 10^3) = 4.8 \times 10^3$

AO2: Number and Algebra	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
		3 Calculations (continued)			
Written methods (continued)	F2.3n	solve word problems about ratio and proportion, including using informal strategies and the unitary method of solution[1]			(1) e.g. 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 $z \times m/y$ N1.2, N2.2
	H2.3n	use surds and π in exact calculations, without a calculator	H2.3n	rationalise a denominator such as $1/\sqrt{3} = \sqrt{3}/3$	
Calculator methods	H2.3o	use calculators effectively and efficiently; use an extended range of function keys, including trigonometrical and statistical functions relevant across this programme of study	H2.3o	use calculators effectively and efficiently, knowing how to enter complex calculations	
	F2.3p H2.3p	enter a range of calculations, including those involving measures[1]; 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			(1) e.g. 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			
			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	
			H2.3t	use calculators to explore exponential growth and decay[1], using a multiplier and the power key	(1) e.g. in science or geography

AO2: Number and Algebra	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
4 Solving Numerical Problems					
	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, inverse proportion, surds, measures and conversion between measures, and compound measures defined within a particular situation	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 reverse percentages, defined within a particular situation	N1.2, N2.2
	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			N1.2, N2.2
5 Equations, Formulae and Identities					
Use of symbols	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[(1)], defined quantities or variables in formulae, general, unspecified and independent numbers in identities[(2)], and in functions they define new expressions or quantities by referring to known quantities[(3)]			(1) e.g. $x^2 + 1 = 82$ (2) e.g. $(x + 1)^2 = x^2 + 2x + 1$ for all values of x (3) e.g. $y = 2 - 7x$; $y = 1/x$ with $x \neq 0$ $f(x)$ notation may be used
	H2.5b	understand that the transformation of algebraic entities obeys and generalises the well-defined rules of generalised arithmetic; expand the product of **two** linear expressions[(2)]; manipulate algebraic expressions by collecting like terms[(5)], multiplying a single term over a bracket, taking out common factors, factorising quadratic expressions[(6)] including the difference of **two** squares[(7)] and cancelling common factors in rational expressions[(8)]			(1) e.g. $(2x + 5)(3x - 2) = 6x^2 + 11x - 10$ (2) e.g. $4x^2 + 6xy = 2x(2x + 3y$ (3) e.g. $2(x + 1)^2/(x + 1) = 2(x + 1)$ (4) e.g. $x^2 - 9 = (x + 3)(x - 3)$ (5) e.g. simplify ${}^1/_x + {}^3/_{(2-x)}$

AO2: Number and Algebra	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
5 Equations, Formulae and Identities (continued)					
	H2.5c	**know the meaning of and use the words ‘equation’, ‘formula’, ‘identity’ and ‘expression’**			
Index notation	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 $2x^3$			(1) e.g. $(x^2)^3 = x^6$
Inequalities	H2.5j	solve 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	
Equations	H2.5e	solve simple equations(2) by using inverse operations or by transforming both sides in the same way	H2.5e	set up simple equations(1)	(1) e.g. find the angle a in a triangle with angles a, $a + 10$, $a + 20$ (2) e.g. $11 – 4x = 2$; $3(2x + 1) = 8$; $2(1 – x) = 6(2 + x)$; $3x^2 = 48$; $3 = 12/x$
Linear equations	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(1); 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			(1) e.g. $(x + 2)/3 = {}^5/_2$; $(17 – x)/4 = 2 – x$
Formulae	H2.5g	use formulae from mathematics and other subjects(1); substitute numbers into a formula; change the subject of a formula including cases where a power of the subject appears	H2.5g	change the subject of a formula including cases where the subject occurs twice; generate a formula(2)	(1) e.g. volume of a cone (2) e.g. find the perimeter of a rectangle given its area A and the length l of **one** side N2.2, IT1.2, IT2.2 Candidates could use a spreadsheet or graphic calculator to construct and use formulae
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)			(1) e.g. $x^3 = x – 900$; ${}^1/x = x^2 – 5$

AO2: Number and Algebra	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
				5 Equations, Formulae and Identities (continued)	
Direct and inverse proportion			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)	(1) e.g. $y \propto x$, $y \propto x^2$, $y \propto {}^1/x$, $y \propto {}^1/x^2$
Simultaneous linear equations	**H2.5i**	**find the exact solutions 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**			
Quadratic equations	**H2.5 k**	**solve simple quadratic equations by factorisation, completing the square and using the quadratic formula**			
Simultaneous linear and quadratic equations	**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 $x^2 + y^2 = r^2$**	**(1) e.g. $y = 11x - 2$ and $y = 5x^2$**
				6 Sequences, Functions and Graphs	
Sequences	**H2.6 a**			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 nth term of an arithmetic sequence, justifying its form by reference to the activity or context from which it was generated	

AO2: Number and Algebra	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
6 Sequences, Functions and Graphs (continued)					
Graphs of linear functions	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, or implicitly; no table or axes given			Candidates 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	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) and lines perpendicular to each other(2)			(1) e.g. know that the lines represented by the equations $y = -5x$ and $y = 3 - 5x$ are parallel, each having gradient (–5) (2) the line with equation $y = x/5$ is perpendicular to these lines and has gradient $^1/_5$
Interpreting graphical information	H2.6d	discuss and interpret graphs modelling real situations(1)	H2.6d	construct linear functions and plot the corresponding graphs arising from real-life problems	(1) e.g. 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
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	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	(1) e.g. $y = x^2$; $y = 3x^2 + 4$ (2) e.g. $y = x^2 - 2x + 1$
Other functions	H2.6f	plot graphs of simple cubic functions, the reciprocal function $y = {}^1/_x$ with $x \neq 0$, the exponential function $y = k^x$ for integer values of x and simple positive values of k, 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			IT 1.1 , IT 1.2 , IT 2.2 Other functions

AO2: Number and Algebra	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
6 Sequences, Functions and Graphs (continued)					
Transformation of functions			H2.6g	apply to the graph of $y = \mathrm{f}(x)$ the transformations $y = \mathrm{f}(x) + \mathrm{a}$, $y = \mathrm{f}(\mathrm{a}x)$, $y = \mathrm{f}(x + \mathrm{a})$, $y = \mathrm{af}(x)$ for linear, quadratic, sine and cosine functions $\mathrm{f}(x)$	Candidates could use software to explore transformations of graphs IT2.2
Loci			H2.6h	construct the graphs of simple loci 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	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
1 Using and Applying Shape, Space and Measures					
Problem solving	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			IT1.2, PS1.1, PS2.1
	H3.1b	select and combine known facts and problem-solving strategies to solve more complex geometrical problems			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	communicate mathematically, with emphasis on a critical examination of the presentation and organisation of results, and on effective use of symbols and geometrical diagrams			C1.3
	H3.1e	use precise formal language and exact methods for analysing geometrical configurations			
	F3.1g	review and justify their choices of mathematics presentation			C1.3, PS1.3, PS2.3
Communicating	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			C1.3
	H3.1e	use precise formal language and exact methods for analysing geometrical configurations			
	F3.1g	review and justify their choices of mathematics presentation			C1.3, PS1.3, PS2.3
Reasoning	F3.1h	distinguish between practical demonstrations and proofs			
	H3.1f	apply mathematical reasoning, progressing from brief mathematical explanations towards full justifications in more complex contexts			PS1.3, PS2.3
	H3.1g	explore connections in geometry; pose conditional constraints of the type “If… then…”; and ask questions “What if…?” or “Why?”			
	H3.1h	show step-by-step deduction in solving a geometrical problem			
	H3.1i	state constraints and give starting points when making deductions			
	H3.1j	understand the necessary and sufficient conditions under which generalisations, inferences and solutions to geometrical problems remain valid			

AO3: Shape, space and measures	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
2 Geometrical Reasoning					
Properties of triangles and other rectilinear shapes	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°; understand a proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other **two** vertices			
	H3.2b	use angle properties of equilateral, isosceles and right-angled triangles; explain why the angle sum of a quadrilateral is 360°			
	H3.2c	recall the definitions of special types of quadrilateral, including square, rectangle, parallelogram, trapezium and rhombus; classify quadrilaterals by their geometric properties			Includes a kite
			H3.2d	calculate and use the sums of the interior and exterior angles of quadrilaterals, pentagons and hexagons; calculate and use the angles of regular polygons.	Includes octagons and decagons
	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			
			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	understand, recall and use Pythagoras' theorem in 2-D, then 3-D problems; investigate the geometry of cuboids including cubes, and shapes made from cuboids, including the use of Pythagoras' theorem to calculate lengths in **three** dimensions			

AO3: Shape, space and measures	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
		2 Geometrical Reasoning (continued)			
Properties of triangles and other rectilinear shapes (continued)	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, 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 $\frac{1}{2}ab\sin C$	H3.2g	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	
Properties of circles	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	H3.2h	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; 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°; prove and use the alternate segment theorem	
3-D shapes	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, pyramids, cylinders, cones and spheres; solve problems involving more complex shapes and solids, including segments of circles and frustums of cones			

AO3: Shape, space and measures	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
3 Transformations and Coordinates					
Specifying transformations			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 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; 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	Includes the single transformation equivalent to a combination of transformations; Candidates could use software to explore transformations and their effects on properties of shapes includes reflection in x = c or y= c or $y = -x$; Includes describing a single transformation
			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 and negative scale factors	Includes enlarging a shape by shape factor 3, gives the centre of enlargement
	H3.3d	use and interpret maps and scale drawings; 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	H3.3d	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	

AO3: Shape, space and measures	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
3 Transformations and Coordinates (continued)					
Coordinates	H3.3e	understand that **one** coordinate identifies a point on a number line, that **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(1); find the coordinates of points identified by geometrical information; find the coordinates of the midpoint of the line segment *AB*, given the points *A* and *B*, then calculate the length *AB*			(1) e.g. identify the coordinates of the vector of a cupboard drawn on a 3D grid
Vectors			H3.3f	understand and use vector notation; 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	
4 Measures and Construction					
Measures	H3.4a	use angle measure; 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			
Construction			F3.4d H3.4b	draw approximate constructions of triangles and other 2-D shapes, using a ruler and protractor, given information about 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 specified cubes, regular tetrahedra, square-based pyramids and other 3-D shapes	

AO3: Shape, space and measures	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
4 Measures and Construction (continued)					
Construction (continued)			H3.4c	use straight edge and compasses to do standard constructions including an equilateral triangle with a given side, 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 F3.4i H3.4d	calculate perimeters and areas of shapes made from triangles and rectangles; 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 area measures, including square centimetres and square metres, and volume measures, including cubic centimetres and cubic metres; find circumferences of circles and areas enclosed by circles, recalling relevant formulae; calculate the lengths of arcs and the areas of sectors of circles			Includes areas of parallelograms and trapezium; Includes half-circles and quarter circles N2.2
Loci			H3.4e	find loci, both by reasoning and by using ICT to produce shapes and paths(1)	(1) e.g. a region bounded by a circle and an intersecting line IT1.2

AO4: Handling data	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
1 Using and Applying Handling Data					
Problem solving	H4.1a	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			N2.1, PS1.1, PS1.2, PS2.1, PS2.2, IT1.1, IT1.2, IT2.1
	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)			PS1.2, PS1.3, PS2.2
Communicating	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			IT1.2, IT2.3
Reasoning	H4.1d	apply mathematical reasoning, explaining and justifying inferences and deductions, justifying arguments and solutions			IT1.1
	H4.1e	identify exceptional or unexpected cases when solving statistical problems			Promoting the skill of enquiry
	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			Promoting the skill of enquiry
2 Specifying the Problem and Planning					
	H4.2a	see that random processes are unpredictable			
	H4.2b	identify key questions that can be addressed by statistical methods			
	H4.2c	discuss how data relate to a problem, identify possible sources of bias and plan to minimise it			C1.1, C1.2
	H4.2d	identify which primary data they need to collect and in what format, including grouped data, considering appropriate equal class intervals; select and justify a sampling scheme and a method to investigate a population, including random and stratified sampling			
	H4.2e	design an experiment or survey; decide what primary and secondary data to use			IT1.1, IT1.2, N1.1

AO4: Handling data	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
3 Collecting Data					
	H4.3a	collect data using various methods, including observation, controlled experiment, data logging, questionnaires and surveys			
			H4.3b	gather data from secondary sources, including printed tables and lists from ICT-based sources	IT1.1, IT2.1, N1.1
	H4.3c	design and use two-way tables for discrete and grouped data			
	H4.3d	deal with practical problems such as non-response or missing data			
4 Processing and Representing Data					
	H4.4a	draw and produce, using paper and ICT, pie charts for categorical data, and diagrams for continuous data, including line graphs (time series), frequency diagrams, scatter graphs, 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 cumulative frequency tables and diagrams, box plots and histograms for grouped continuous data	Includes frequency polygons, histograms with equal class intervals and frequency diagrams for grouped discrete data N1.3, N2.3, IT1.2, IT2.3
	H4.4e	find the median, quartiles and interquartile range for large data sets and calculate the mean for large data sets with grouped data			N1.2, N2.2
	H4.4b	understand and use estimates or measures of probability from theoretical models, or from relative frequency			Include the addition of simple probabilities
	H4.4c	list **all** outcomes for single events, and for **two** successive events, in a systematic way			
	H4.4d	identify different mutually-exclusive outcomes and know that the sum of the probabilities of all these outcomes is 1			
	H4.4i	draw lines of best fit by eye, understanding what these represent			
			H4.4f	calculate an appropriate moving average	
			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 $P(A) \times P(B)$	Includes conditional probabilities

AO4: Handling data	NC ref	Modular Paper 3 D – A* Candidates should be taught to:	NC ref	Terminal Paper 4 D – A* Candidates should be taught to:	Key Skills and notes
4 Processing and Representing Data (continued)					
			H4.4h	use tree diagrams to represent outcomes of compound events, recognising when events are independent	
	H4.4j	use relevant statistical functions on a calculator or spreadsheet	H4.4j	use relevant statistical functions on a calculator or spreadsheet	
5 Interpreting and Discussing Results					
	H4.5a	relate summarised data to the initial questions			
	H4.5b	interpret a wide range of graphs and diagrams and draw conclusions; identify seasonality and trends in time series			Includes interpreting a stem and leaf diagram N1.3, N2.3
	H4.5c	look at data to find patterns and exceptions			Candidates could use databases to present their findings
	H4.5d	understand frequency density	H4.5d	compare distributions and make inferences, using shapes of distributions and measures of average and spread, including median and quartiles	N1.3, N2.3
	H4.5e	consider and check results, and modify their approach if necessary			PS1.3
			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'	
			H4.5g	use the vocabulary of probability to interpret results involving uncertainty and prediction(1)	(1) e.g. "there is some evidence from this sample that …"
			H4.5h	compare experimental data and theoretical probabilities	
			H4.5i	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 parameters	
			F4.5k	interpret social statistics including index numbers(1); time series(2); and survey data(3)	(1) e.g. the General Index of Retail Prices (2) e.g. population growth; (3) e.g. the National Census

Breadth of Study (Foundation Programme of Study)

During the key stage, candidates 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 (e.g. spreadsheets, databases, geometry or graphic packages), using calculators correctly and efficiently, and knowing when not to use a calculator.

Breadth of Study (Higher Programme of Study)

During the key stage, candidates 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: FURTHER INFORMATION

6 Opportunities for Teaching

6.1 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 and efficiently; know how to enter complex calculations and use function keys for squares, square roots and powers (Foundation Tier: F2.3o);
- 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 (Higher Tier: H2.3o).

Questions will be set in B292 and B294 (the Terminal papers) 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	F4.3b, H4.3b Revision

6.2 CITIZENSHIP

From September 2002, the National Curriculum for England at Key Stage 4 has included 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

6.3 SPIRITUAL, MORAL, ETHICAL, SOCIAL, LEGISLATIVE, ECONOMIC 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.

6.4 SUSTAINABLE DEVELOPMENT, HEALTH AND SAFETY CONSIDERATIONS AND EUROPEAN DEVELOPMENTS

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 assessment material.

Sustainable development issues may be addressed in:

- questions set in context (e.g. pie charts).

OCR has taken account of the 1988 Resolution of the Council of the European Community in preparing this specification and associated specimen assessment material. 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.

7 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 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 exists.

	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 (www.ocr.org.uk). A summary document for Key Skills Coordinators showing ways in which opportunities for Key Skills arise within GCSE courses has been published.

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

8 Reading List

Any appropriate up-to-date text for GCSE Mathematics will be suitable for use with this specification so centres will not be disadvantaged if they change from other specifications.

9 Arrangements for Candidates with Particular 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 (telephone 01223 552505) as early as possible during the course.

10 Support and In-service Training for Teachers

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

- a 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 OCR website at www.ocr.org.uk;
- past question papers and mark schemes, available from the Publications Department (telephone 0870 870 66 22; fax 0870 870 6621; e-mail: publications@ocr.org.uk);
- a report on the examination, compiled by senior examining personnel after each examination session.