OCR GCSE in Mathematics A J562

specification

Version 2 July 2010

Maths
TOOLKIT 2010
Making the changes work for you
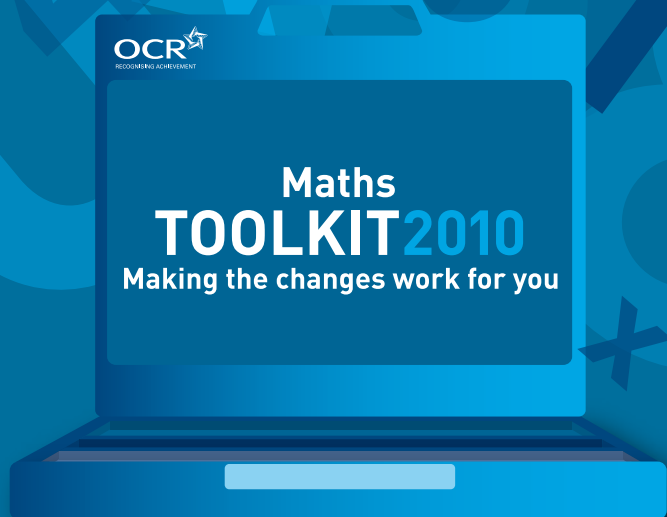
Why choose OCR GCSE Mathematics A?

The Mathematics A specification has been carefully built with teachers and learners in mind. With its exciting teaching and learning materials, it is designed to be engaging and accessible.

More flexibility
Thanks to its straightforward and genuinely flexible structure, you can teach the qualification in a linear or a modular format – or even both within the same cohort – allowing you to meet the needs of a wide range of learners and abilities. Learners are able to take a mixture of foundation and higher tier units. All learners have access to grade C.

More choice
Your learners will have a greater choice of options when it comes to entries and re-sits, as a November session is available in addition to January and June. Certification is available in January, June and November.

Support all the way
When it comes to support, we provide all you will need. For example, you can use our free online results analysis service - 'Active Results' with which you can analyse your learners' results in greater detail.

Unique teaching resources
Our GCSE pilot has allowed us to develop expertise in assessing problem solving and mathematics in context, and we provide unique, dedicated teaching resources to assist you – giving you and your learners the confidence to succeed in these new areas.

Support

We're developing a wide range of resources to ensure there is support for you at every stage of your preparation for the new GCSE Maths 2010 specification. In developing the support, we are talking to teachers and other key stakeholders to make sure we are offering you the most practical help we can. Below, you will find a brief guide to the support that is available for you.

- **Specimen assessment materials**
- **Guide to curriculum planning for Maths**
- **Sample schemes of work and lesson plans**
- **Mock papers – only via Interchange**
- **Learner/Parent's Guide**
- **Active Results**

- **Dedicated problem solving guide**
- **Endorsed publisher materials**

- **Past papers**
- **Interchange**
- **INSET (free until December 2010)**
- **Continual Professional Development**

Contents

1. Introduction to GCSE Mathematics A

1.1   Overview of OCR GCSE Mathematics A

Unit A501/01:
Mathematics Unit A (Foundation)

Written paper
1 hour
60 marks
25% of the qualification

Calculator permitted

or

Unit A501/02:
Mathematics Unit A (Higher)

Written paper
1 hour
60 marks
25% of the qualification

Calculator permitted

AND

Unit A502/01:
Mathematics Unit B (Foundation)

Written paper
1 hour
60 marks
25% of the qualification

Calculator **not** permitted

or

Unit A502/02:
Mathematics Unit B (Higher)

Written paper
1 hour
60 marks
25% of the qualification

Calculator **not** permitted

AND

Unit A503/01:
Mathematics Unit C (Foundation)

Written paper
1·5 hours
100 marks
50% of the qualification

Calculator permitted

or

Unit A503/02:
Mathematics Unit C (Higher)

Written paper
2 hours
100 marks
50% of the qualification

Calculator permitted

1.2   Key aspects of OCR GCSE Mathematics A

The following aspects are stipulated by QCDA:
- Assessment objectives
- Proportion of calculator use
- Functional elements of mathematics
- QWC (quality of written communication)

What is being assessed?

All GCSE Mathematics specifications for first teaching from September 2010 have the same set of assessment objectives.

Candidates are expected to demonstrate the following in the context of the content described:

	Assessment objectives	Weighting (%)
AO1	• recall and use their knowledge of the prescribed content	45-55
AO2	• select and apply mathematical methods in a range of contexts	25-35
AO3	• interpret and analyse problems and generate strategies to solve them	15-25

For the first time, quality of written communication is assessed in all GCSE Mathematics specifications.

Functional elements of mathematics

Functional elements of mathematics are assessed in this specification, as in all GCSE Mathematics specifications for first teaching from September 2010.

Learners do not have to pass Functional Skills Mathematics at Level 2 to gain a Grade C or higher in GCSE Mathematics. However, if they have been prepared for GCSE Mathematics A, they may also be in a position to achieve a Functional Skills Mathematics qualification.

The scheme of assessment

Certification is available in January, June *and* November. Learners sit three units - Units A and B are each worth 25% and Unit C is worth 50%. Each of these three units has **specified** content. Learners are able to take a mixture of Foundation tier and Higher tier units.

Learners are not allowed to use a calculator for 25% of the assessment (Unit B), although a calculator is permitted for the remaining 75% (Units A and C).

At both Foundation and Higher tier, Units A and B are each of 1 hour's duration. Unit C is of 1·5 hours' duration at Foundation tier, and of 2 hours' duration at Higher tier.

Using this specification as a linear course

If your centre is used to teaching a linear course, you will see that this specification, although unitised, can still be taken in this way. When learners wish to certificate at the end of their course, they sit Units A and B (which are timetabled together) in one examination slot and Unit C in a second examination slot in the series. If learners wish to re-sit to improve their grades they can then take individual units in subsequent series, providing that the terminal rule is met.

1.3   Guided learning hours

GCSE Mathematics A requires 120-140 guided learning hours in total.

2. Content of GCSE Mathematics A

2.1   Summary of GCSE Mathematics A content

Unit A501/01:
Mathematics Unit A (Foundation)

- General problem solving skills
- Number
- Hierachy of operations
- Ratio
- Factors, multiples and primes
- General algebra and coordinates
- Sequences and formulae
- Linear equations
- General measures
- Constructions
- Maps
- Pythagoras' theorem in 2D
- Data handling

Unit A501/02:
Mathematics Unit A (Higher)

- General problem solving skills
- Number
- Hierachy of operations
- Ratio
- Factors, multiples and primes
- General algebra and coordinates
- Sequences and formulae
- Linear equations
- General measures
- Constructions
- Maps
- **Core trigonometry**
- Pythagoras' theorem in 2D **and 3D**
- Data handling

Unit A502/01:
Mathematics Unit B (Foundation)

- General problem solving skills
- Number
- Fractions, decimals and percentages
- Indices and surds
- General algebra and coordinates
- Functions and graphs
- Inequalities
- General measures
- Angles and properties of shapes
- Transformations
- Bivariate data

Unit A502/02:
Mathematics Unit B (Higher)

- General problem solving skills
- Number
- Fractions, decimals and percentages
- Indices and surds
- General algebra and coordinates
- Functions and graphs
- Inequalities
- General measures
- Angles and properties of shapes
- Transformations
- **Vectors**
- Bivariate data

Unit A503/01:
Mathematics Unit C (Foundation)

- General problem solving skills
- Number
- Upper and lower bounds
- Social arithmetic
- General algebra and coordinates
- Algebraic manipulation
- Real life and non-linear functions
- General measures
- Area and volume
- The study of chance

Unit A503/02:
Mathematics Unit C (Higher)

- General problem solving skills
- Number
- **Standard index form**
- Upper and lower bounds
- Social arithmetic
- General algebra and coordinates
- Algebraic manipulation
- Real life and non-linear functions
- General measures
- Area and volume
- **Extension trigonometry and Pythagoras' theorem**
- The study of chance

*The above headings with "General" in the title contain statements that appear in more than one unit. More detailed information is provided in Section 2, in the Examples column.

2.2   Unit A501/01: *Mathematics Unit A (Foundation)*

This unit assumes the use of a calculator.

FA1 General problem solving skills		Examples
These skills should underpin and influence the learning experiences of all candidates in mathematics. They will be assessed within this paper.		
1.1 - Solve problems using mathematical skills	Candidates should be able to:	Statements a to k are repeated across all Units
	a. select and use suitable problem solving strategies and efficient techniques to solve numerical problems;	
	b. 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;	
	c. break down a complex calculation into simpler steps before attempting to solve it and justify their choice of methods;	
	d. use notation and symbols correctly and consistently within a problem;	
	e. use a range of strategies to create numerical representations of a problem and its solution; move from one form of representation to another in order to get different perspectives on the problem;	
	f. interpret and discuss numerical information presented in a variety of forms;	
	g. present and interpret solutions in the context of the original problem;	
	h. review and justify their choice of mathematical presentation;	
	i. understand the importance of counter-example and identify exceptional cases when solving problems;	
	j. show step-by-step deduction in solving a problem;	
	k. recognise the importance of assumptions when deducing results; recognise the limitations of any assumptions that are made and the effect that varying those assumptions may have on the solution to a problem.	

FA2 Number		Examples
2.1 - Add, subtract, multiply and divide any number	Candidates should be able to:	Statement a is repeated in Unit A503
	a. understand and use positive numbers and negative integers both as positions and translations on a number line;	
	b. add, subtract, multiply and divide integers and then any number;	
	c. multiply or divide any number by powers of 10;	
	d. multiply or divide any positive number by a number between 0 and 1;	
	e. multiply and divide by a negative number.	
2.2 - Approximate to a specified or appropriate degree of accuracy	Candidates should be able to:	Statement c is repeated in Unit A502
	a. use their previous understanding of integers and place value to deal with arbitrarily large positive numbers;	• Write 13 066 using words
	b. round numbers to a given power of 10;	• Write 13 066 correct to the nearest 100
	c. round to the nearest integer, to a given number of decimal places and to one significant figure.	• Write 13·066 correct to 1 decimal place
2.3 - Use calculators effectively and efficiently	Candidates should be able to:	Statements a to c are repeated in Unit A503 (but, there, include standard form calculations)
	a. use calculators effectively and efficiently;	• Calculate $1·6^3$, $\sqrt{7·29}$,
	b. know how to enter complex calculations and use function keys for reciprocals, squares and powers;	$\dfrac{2·6 - 0·8}{0·2}$, $\sqrt[3]{6·1^2 - 0·81}$
	c. enter a range of calculations, including those involving measures.	• When using money interpret a calculator display of 2·6 as £2·60

FA3 Hierachy of operations	Examples
3.1 - Understand and use number operations and the relationships between them, including inverse operations and hierarchy of operations	Candidates should be able to:
	a. use brackets and the hierarchy of operations.

For FA3 examples column:

- Calculate $\dfrac{(6 + 8)^2}{2 \cdot 5^2 - 1 \cdot 5^2}$

FA4 Ratio	Examples
4.1 - Use ratio notation, including reduction to its simplest form and its various links to fraction notation	Candidates should be able to:
	a. use ratio notation, including reduction to its simplest form;
	b. know its various links to fraction notation.
4.2 - Divide a quantity in a given ratio	Candidates should be able to:
	a. divide a quantity in a given ratio[1];
	b. determine the original quantity by knowing the size of one part of the divided quantity;
	c. solve word problems about ratio, including using informal strategies and the unitary method of solution[2].

FA4 examples column:

- Write the ratio 24:60 in its simplest form

(1) Divide £120 in the ratio 3:7

(2) 8 calculators cost £59·52. How much do 3 calculators cost?

FA5 Factors, multiples and primes		Examples
5.1 - Factors, multiples and primes	Candidates should be able to:	(1) Write down a number between 25 and 30 which is: i) a multiple of 7 ii) a prime number iii) a factor of 104
	a. use the concepts and vocabulary of factor (divisor), multiple, common factor, highest common factor, least common multiple, prime number and prime factor decomposition[1];	
	b. find the prime factor decomposition of positive integers[2].	(2) Write 96 as a product of prime factors using indices

FA6 General algebra and coordinates		Examples
6.1 - Symbols and notation	Candidates should be able to:	These statements are repeated across all Units
	a. distinguish the different roles played by letter symbols in algebra, using the correct notational conventions for multiplying or dividing by a given number;	(1) $5x + 1 = 16$ (2) $V = IR$ (3) $y = 2x$
	b. know that letter symbols represent definite unknown numbers in equations[1] defined quantities or variables in formulae[2];	
	c. know that in functions, letter symbols define new expressions or quantities by referring to known quantities[3].	
6.2 - Algebraic terminology	Candidates should be able to:	This statement is repeated across all Foundation Units
	a. distinguish in meaning between the words 'equation', 'formula' and 'expression'.	

FA6 General algebra and coordinates		Examples
6.3 - Use the conventions for coordinates in the plane	Candidates should be able to:	Statements a, b, c and d occur across all three Units, where an understanding of coordinates is needed to complete other sections of the work. However, 3D is not included in Unit A501.

(1) Plot (3, 6) and (2, -4) on the grid provided |
	a. use the conventions for coordinates in the plane; plot points in all four quadrants;	
	b. understand that one coordinate identifies a point on a number line and two coordinates identify a point in a plane using the terms '1D' and '2D';	
	c. use axes and coordinates to specify points in all four quadrants;	
	d. locate points with given coordinates[1];	
	e. find the coordinates of the midpoint of the line segment AB, given points A and B, then calculate the length AB.	

FA7 Sequences and formulae		Examples
7.1 - Derive a formula, substitute numbers into a formula and change the subject of a formula	Candidates should be able to:	(1) Formulae for the area of a triangle, the area enclosed by a circle, wage earned = hours worked × rate per hour
(2) Find r given that $C = \pi r$, find x given $y = mx + c$
	a. use formulae from mathematics and other subjects expressed initially in words and then using letters and symbols[1];	
	b. substitute numbers into a formula; derive a formula and change its subject[2].	
7.2 - Generate terms of a sequence using term-to-term and position-to-term definitions of the sequence	Candidates should be able to:	(1) Write down the first two terms of the sequence whose nth term is $3n - 5$
	a. generate terms of a sequence using term-to-term and position-to-term[1] definitions of the sequence;	
	b. generate common integer sequences (including sequences of odd or even integers, squared integers, powers of 2, powers of 10, triangular numbers).	
7.3 - Use linear expressions to describe the nth term of an arithmetic sequence	Candidates should be able to:	Foundation also includes simple sequence of odd or even numbers, squared integers and sequences derived from diagrams
	a. 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.	

FA8 Linear equations		Examples
8.1 - Manipulate algebraic expressions	Candidates should be able to:	(1) $a(b + c) = ab + ac$ (2) $x + 5 - 2x - 1 = 4 - x$ (3) $9x - 3 = 3(3x - 1)$ or $x^2 - 3x = x(x - 3)$
	a. understand that the transformation of algebraic expressions obeys and generalises the rules of generalised arithmetic[1];	
	b. manipulate algebraic expressions by collecting like terms[2], by multiplying a single term over a bracket, and by taking out common factors[3].	
8.2 - Set up and solve simple equations	Candidates should be able to:	(1) Richard is x years, Julie is twice as old and their combined age is 24 years. Write an equation to show this information. (2) $11 - 4x = 2$; $3(2x + 1) = 8$; $2(1 - x) = 6(2 + x)$; $3x^2 = 48$; $3 = \dfrac{12}{x}$
	a. set up simple equations[1];	
	b. solve simple equations[2] by using inverse operations or by transforming both sides in the same way;	
	c. solve linear equations, with integer coefficients, in which the unknown appears on either side or on both sides of the equation;	
	d. 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.	

FA9 General measures		Examples
9.1 - Interpret scales and use measurements	Candidates should be able to:	Statements a and e are repeated in Units A502 and A503
	a. interpret scales on a range of measuring instruments, including those for time and mass;	Statements b, c and f are repeated in Unit A503
	b. know that measurements using real numbers depend on the choice of unit;	
	c. understand angle measure using the associated language[1];	(1) Use bearings to specify direction
	d. make sensible estimates of a range of measures in everyday settings[2];	(2) Given a picture of a building and an adult man, estimate the height of the building in metres
	e. convert measurements from one unit to another;	(3) A water barrel holds 10 gallons. Roughly how many litres is this?
	f. know rough metric equivalents of pounds, feet, miles, pints and gallons[3].	

FA10 Constructions		Examples
10.1 - Draw triangles and other 2D shapes using a ruler and protractor	Candidates should be able to:	(1) Use a ruler and protractor to construct triangle ABC with AB = 5cm, BC = 6cm and angle ABC = 30°
	a. measure and draw lines to the nearest millimetre, and angles to the nearest degree;	
	b. draw triangles and other 2D shapes using a ruler and protractor, given information about their side lengths and angles[1].	
10.2 - Use straight edge and a pair of compasses to do constructions	Candidates should be able to:	(1) Use a ruler and a pair of compasses to construct a triangle with sides 4cm, 8cm and 9cm
	a. use straight edge and a pair of compasses to do standard constructions[1], including;	
	i. an equilateral triangle with a given side,	(2) Construct the locus of points equidistant from P and Q
	ii. the midpoint and perpendicular bisector of a line segment[2],	(3) AB and BC
	iii. the perpendicular from a point to a line, the perpendicular from a point on a line, and	
	iv. the bisector of an angle[3].	
10.3 - Construct loci	Candidates should be able to:	A region bounded by a circle and an intersecting line
	a. find loci, by reasoning, to produce shapes and paths.	

FA11 Maps	Examples
11.1 - Maps, bearings and drawings	Candidates should be able to:
	a. use and interpret maps and scale drawings;
	b. use bearings to specify direction and to solve problems.

FA12 Pythagoras' theorem in 2D	Examples
12.1 - Use Pythagoras' theorem	Candidates should be able to:
	a. understand, recall and use Pythagoras' theorem to solve simple cases in 2D.

FA13 Data handling	Examples
13.1 - Understand and use statistical problem solving process/handling data cycle	Candidates should be able to: a. 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.

FA13 Data handling		Examples
13.2 - Experimenting	Candidates should be able to:	
	a. discuss how data relate to a problem, identify possible sources of bias and plan to minimise it;	
	b. identify key questions that can be addressed by statistical methods;	
	c. design an experiment or survey and decide what primary and secondary data to use;	
	d. design and use data-collection sheets for grouped discrete and continuous data;	
	e. gather data from secondary sources, including printed tables and lists from ICT-based sources;	
	f. design and use two-way tables for discrete and grouped data.	
13.3 - Processing	Candidates should be able to:	
	a. draw and produce pie charts for categorical data, and diagrams for continuous data, frequency diagrams (bar charts, frequency polygons and fixed interval histograms) and stem and leaf diagrams;	
	b. calculate mean, range and median of small data sets with discrete then continuous data;	
	c. identify the modal class for grouped data;	
	d. find the median for large data sets and calculate an estimate of the mean for large data sets with grouped data.	

FA13 Data handling		Examples
13.4 - Interpreting	Candidates should be able to:	
	a. look at data to find patterns and exceptions;	
	b. interpret a wide range of graphs and diagrams and draw conclusions;	
	c. interpret social statistics including index numbers, and survey data;	
	d. compare distributions and make inferences, using the shapes of distributions and measures of average and range;	
	e. understand that if they repeat an experiment, they may – and usually will – get different outcomes, and that increasing sample size generally leads to better population characteristics.	

2.3   Unit A501/02: *Mathematics Unit A (Higher)*

The content of A501/02 subsumes all the content of A501/01.

This unit assumes the use of a calculator.

HA1 General problem solving skills		Examples
These skills should underpin and influence the learning experiences of all candidates in mathematics. They will be assessed within this paper.		
1.1 - Solve problems using mathematical skills	Candidates should be able to:	Statements a to k are repeated across all Units
	a. select and use suitable problem solving strategies and efficient techniques to solve numerical problems;	
	b. 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;	
	c. break down a complex calculation into simpler steps before attempting to solve it and justify their choice of methods;	
	d. use notation and symbols correctly and consistently within a problem;	
	e. use a range of strategies to create numerical representations of a problem and its solution; move from one form of representation to another in order to get different perspectives on the problem;	
	f. interpret and discuss numerical information presented in a variety of forms;	
	g. present and interpret solutions in the context of the original problem;	
	h. review and justify their choice of mathematical presentation;	
	i. understand the importance of counter-example and identify exceptional cases when solving problems;	
	j. show step-by-step deduction in solving a problem;	
	k. recognise the importance of assumptions when deducing results; recognise the limitations of any assumptions that are made and the effect that varying those assumptions may have on the solution to a problem.	

HA2 Number		Examples
2.1 - Add, subtract, multiply and divide any number	Candidates should be able to:	Statement a is repeated in Unit A503
	a. understand and use positive numbers and negative integers, both as positions and translations on a number line;	
	b. add, subtract, multiply and divide integers and then any number;	
	c. multiply or divide any number by powers of 10;	
	d. multiply or divide any positive number by a number between 0 and 1;	
	e. multiply and divide by a negative number.	
2.2 - Approximate to a specified or appropriate degree of accuracy	Candidates should be able to:	Statement c is repeated in Unit A502
	a. use their previous understanding of integers and place value to deal with arbitrarily large positive numbers;	• Write 13 066 using words
	b. round numbers to a given power of 10;	• Write 13 066 correct to the nearest 100
	c. round to the nearest integer, to a given number of decimal places and to one significant figure.	• Write 13·066 correct to 1 decimal place
2.3 - Use calculators effectively and efficiently, including statistical and trigonometrical functions	Candidates should be able to:	Statements a to c are repeated in Unit A503 (but, there, include standard form calculations)
	a. use calculators effectively and efficiently;	• Calculate $1·6^3$, $\sqrt{7·29}$,
	b. know how to enter complex calculations and use function keys for reciprocals, squares and powers;	$\dfrac{2·6 - 0·8}{0·2}$, $\sqrt[3]{6·1^2 - 0·81}$
	c. enter a range of calculations, including those involving measures.	• When using money interpret a calculator display of 2·6 as £2·60

HA3 Hierachy of operations		Examples
3.1 - Understand and use number operations and the relationships between them, including inverse operations and hierarchy of operations	Candidates should be able to:	
	a. use brackets and the hierarchy of operations.	• Calculate $\dfrac{(6+8)^2}{2\cdot5^2 - 1\cdot5^2}$

HA4 Ratio		Examples
4.1 - Use ratio notation, including reduction to its simplest form and its various links to fraction notation	Candidates should be able to:	
	a. use ratio notation, including reduction to its simplest form;	• Write the ratio 24:60 in its simplest form
	b. know its various links to fraction notation.	
4.2 - Divide a quantity in a given ratio	Candidates should be able to:	
	a. divide a quantity in a given ratio[1];	(1) Divide £120 in the ratio 3:7
	b. determine the original quantity by knowing the size of one part of the divided quantity;	(2) 8 calculators cost £59·52. How much do 3 calculators cost?
	c. solve word problems about ratio, including using informal strategies and the unitary method of solution[2].	

HA5 Factors, multiples and primes		Examples
5.1 - Factors, multiples and primes	Candidates should be able to:	(1) Write down a number between 25 and 30 which is: i) a multiple of 7 ii) a prime number iii) a factor of 104
	a. use the concepts and vocabulary of factor (divisor), multiple, common factor, highest common factor, least common multiple, prime number and prime factor decomposition[1];	
	b. find the prime factor decomposition of positive integers[2].	(2) Write 96 as a product of prime factors using indices

HA6 General algebra and coordinates		Examples
6.1 - Symbols and notation	Candidates should be able to:	These statements are repeated across all Units
	a. distinguish the different roles played by letter symbols in algebra, using the correct notational conventions for multiplying or dividing by a given number;	These examples relate specifically to Higher tier:
	b. know that letter symbols represent definite unknown numbers in equations[1], defined quantities or variables in formulae and general, unspecified independent numbers in identities[2];	**(1)** $x^2 + 1 = 82$ **(2)** $(x + 1)^2 \quad x^2 + 2x + 1$ for all values of x
	c. know that in functions, letter symbols define new expressions or quantities by referring to known quantities[3].	**(3)** $y = 2 - 7x$; $y = \dfrac{1}{x}$ with $x \quad 0$ **f(x) notation may be used**
6.2 - Algebraic terminology	Candidates should be able to:	This statement is repeated across all Higher Units
	a. distinguish in meaning between the words 'equation', 'formula', **'identity'** and 'expression'.	
6.3 - Use the conventions for coordinates in the plane	Candidates should be able to:	Statements a, b, c and d occur across all three Units, where an understanding of coordinates is needed to complete other sections of the work. However, 3D is not included in Unit A501.
	a. use the conventions for coordinates in the plane; plot points in all four quadrants;	
	b. understand that one coordinate identifies a point on a number line and two coordinates identify a point in a plane, using the terms '1D' and '2D';	
	c. use axes and coordinates to specify points in all four quadrants;	(1) Plot (3, 6) and (2, -4) on the grid provided
	d. locate points with given coordinates[1];	
	e. find the coordinates of the midpoint of the line segment AB, given points A and B, then calculate the length AB.	

HA7 Sequences and formulae		Examples
7.1 - Derive a formula, substitute numbers into a formula and change the subject of a formula	Candidates should be able to:	(1) Formulae for the area of a triangle, the area enclosed by a circle, wage earned = hours worked × rate per hour
	a. use formulae from mathematics and other subjects expressed initially in words and then using letters and symbols[1];	
	b. substitute numbers into a formula; derive a formula and change its subject[2].	(2) Find r given that $C = \pi r$, find x given $y = mx + c$
7.2 - Generate terms of a sequence using term-to-term and position-to-term definitions of the sequence	Candidates should be able to:	
	a. generate terms of a sequence using term-to-term and position-to-term[1] definitions of the sequence;	(1) Write down the first two terms of the sequence whose nth term is $3n - 5$
	b. generate common integer sequences (including sequences of odd or even integers, squared integers, powers of 2, powers of 10, triangular numbers).	
7.3 - Use linear expressions to describe the nth term of an arithmetic sequence	Candidates should be able to:	Foundation also includes simple sequence of odd or even numbers, squared integers and sequences derived from diagrams
	a. 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.	

HA8 Linear equations		Examples
8.1 - Manipulate algebraic expressions	Candidates should be able to:	(1) $a(b + c) = ab + ac$ (2) $x + 5 - 2x - 1 = 4 - x$ (3) $9x - 3 = 3(3x - 1)$ or $x^2 - 3x = x(x - 3)$
	a. understand that the transformation of algebraic expressions obeys and generalises the rules of generalised arithmetic[1];	
	b. manipulate algebraic expressions by collecting like terms[2], by multiplying a single term over a bracket, and by taking out common factors[3].	
8.2 - Set up and solve simple equations	Candidates should be able to:	(1) Richard is x years, Julie is twice as old and their combined age is 24 years. Write an equation to show this information. (2) $11 - 4x = 2$; $3(2x + 1) = 8$; $2(1 - x) = 6(2 + x)$; $3x^2 = 48$; $3 = \dfrac{12}{x}$
	a. set up simple equations[1];	
	b. solve simple equations[2] by using inverse operations or by transforming both sides in the same way;	
	c. solve linear equations, with integer coefficients, in which the unknown appears on either side or on both sides of the equation;	
	d. 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.	

HA9 General measures		Examples
9.1 - Interpret scales and use measurements	Candidates should be able to:	Statements a and e are repeated in Units A502 and A503 Statements b, c and f are repeated in Unit A503
	a. interpret scales on a range of measuring instruments, including those for time and mass;	
	b. know that measurements using real numbers depend on the choice of unit;	
	c. understand angle measure using the associated language[1];	(1) Use bearings to specify direction
	d. make sensible estimates of a range of measures in everyday settings[2];	(2) Given a picture of a building and an adult man, estimate the height of the building in metres
	e. convert measurements from one unit to another;	(3) A water barrel holds 10 gallons. Roughly how many litres is this?
	f. know rough metric equivalents of pounds, feet, miles, pints and gallons[3].	

HA10 Constructions		Examples
10.1 - Draw triangles and other 2D shapes using a ruler and protractor	Candidates should be able to:	(1) Use a ruler and a protractor to construct triangle ABC with AB = 5cm, BC = 6cm and angle ABC = 30°
	a. measure and draw lines to the nearest millimetre, and angles to the nearest degree;	
	b. draw triangles and other 2D shapes using a ruler and protractor, given information about their side lengths and angles[1].	
10.2 - Use straight edge and a pair of compasses to do constructions	Candidates should be able to:	(1) Use a ruler and a pair of compasses to construct a triangle with sides 4cm, 8cm and 9cm

	a. use straight edge and a pair of compasses to do constructions[1], including:
	  i. an equilateral triangle with a given side,
	  ii. the midpoint and perpendicular bisector of a line segment[2],
	  iii. the perpendicular from a point to a line, the perpendicular from a point on a line, and
	  iv. the bisector of an angle[3].
		(2) Construct the locus of points equidistant from P and Q
		(3) AB and BC

10.3 - Construct loci	Candidates should be able to:	A region bounded by a circle and an intersecting line
	a. find loci, by reasoning, to produce shapes and paths.	

HA11 Maps		Examples
11.1 - Maps, bearings and drawings	Candidates should be able to:	
	a. use and interpret maps and scale drawings;	
	b. use bearings to specify direction and to solve problems.	

HA12 Core trigonometry		Examples
12.1 - Solve 2D problems	Candidates should be able to:	• **Use sin, cos and tan to find lengths and angles in right-angled and isosceles triangles**
	a. **understand, recall and use trigonometrical relationships in right-angled triangles, and use these to solve problems, including those involving bearings.**	

HA13 Pythagoras' theorem in 2D and 3D		Examples
13.1 - Use Pythagoras' theorem	Candidates should be able to:	**(1) Find the length of the 'body' diagonal in a cuboid**
	a. understand, recall and use Pythagoras' theorem in 2D, **then 3D problems**[1].	

HA14 Data handling		Examples
14.1 - Understand and use statistical problem solving process/handling data cycle	Candidates should be able to:	
	a. 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, sampling methods[1] and data format) and what statistical analysis is needed;	(1) Including random and stratified sampling
	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.	

HA14 Data handling		Examples
14.2 - Experimenting	Candidates should be able to:	
	a. discuss how data relate to a problem, identify possible sources of bias and plan to minimise it;	
	b. identify key questions that can be addressed by statistical methods;	
	c. design an experiment or survey and decide what primary and secondary data to use;	
	d. design and use data-collection sheets for grouped discrete and continuous data;	
	e. gather data from secondary sources, including printed tables and lists from ICT-based sources;	
	f. design and use two-way tables for discrete and grouped data.	
14.3 - Processing	Candidates should be able to:	
	a. draw and produce pie charts for categorical data, and diagrams for continuous data, frequency diagrams (bar charts, frequency polygons and fixed interval histograms) and stem and leaf diagrams;	
	b. calculate mean, range and median of small data sets with discrete then continuous data;	
	c. identify the modal class for grouped data;	
	d. find the median for large data sets and calculate an estimate of the mean for large data sets with grouped data;	
	e. draw and produce cumulative frequency tables and diagrams, box plots and histograms for grouped continuous data;	
	f. find the quartiles and interquartile range for large data sets.	

HA14 Data handling		Examples
14.4 - Interpreting	Candidates should be able to:	
	a. look at data to find patterns and exceptions;	
	b. interpret a wide range of graphs and diagrams and draw conclusions;	
	c. interpret social statistics including index numbers, and survey data;	
	d. compare distributions and make inferences, using the shapes of distributions and measures of average and range;	
	e. understand that if they repeat an experiment, they may – and usually will – get different outcomes, and that increasing sample size generally leads to better population characteristics;	
	f. **compare distributions and make inferences, using shapes of distributions and measures of average and spread, including median and quartiles;**	
	g. **understand and use frequency density.**	

2.4   Unit A502/01: *Mathematics Unit B (Foundation)*

This unit will be assessed without the use of a calculator.

FB1 General problem solving skills		Examples
These skills should underpin and influence the learning experiences of all candidates in mathematics. They will be assessed within this paper.		
1.1 - Solve problems using mathematical skills	Candidates should be able to:	Statements a to k are repeated across all Units
	a. select and use suitable problem solving strategies and efficient techniques to solve numerical problems;	
	b. 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;	
	c. break down a complex calculation into simpler steps before attempting to solve it and justify their choice of methods;	
	d. use notation and symbols correctly and consistently within a problem;	
	e. use a range of strategies to create numerical representations of a problem and its solution; move from one form of representation to another in order to get different perspectives on the problem;	
	f. interpret and discuss numerical information presented in a variety of forms;	
	g. present and interpret solutions in the context of the original problem;	
	h. review and justify their choice of mathematical presentation;	
	i. understand the importance of counter-example and identify exceptional cases when solving problems;	
	j. show step-by-step deduction in solving a problem;	
	k. recognise the importance of assumptions when deducing results; recognise the limitations of any assumptions that are made and the effect that varying those assumptions may have on the solution to a problem.	

FB2 Number		Examples
2.1 - Add, subtract, multiply and divide any number	Candidates should be able to:	Statements a and b are repeated in Unit A503
	a. derive integer complements to 100;	
	b. recall all multiplication facts to 10 × 10, and use them to derive quickly the corresponding division facts;	
	c. develop a range of strategies for mental calculation; derive unknown facts from those they know;	
	d. add and subtract mentally numbers with up to two decimal places;	
	e. multiply and divide numbers with no more than one decimal place, using place value adjustments, factorisation and the commutative, associative, and distributive laws, where possible;	
	f. use a variety of methods for addition and subtraction of integers and decimals, understanding where to position the decimal point;	
	g. perform a calculation involving division by a decimal (up to two decimal places) by transforming it to a calculation involving division by an integer.	
2.2 - Approximate to a specified or appropriate degree of accuracy	Candidates should be able to:	Statement a is repeated from Unit A501 (statement c)
	a. round to the nearest integer, to any number of decimal places and to one significant figure;	
	b. estimate answers to problems involving decimals;	
	c. estimate and check answers to problems;	
	d. use a variety of checking procedures, including working the problem backwards, and considering whether a result is of the right order of magnitude.	

FB3 Fractions, decimals and percentages		Examples
3.1 - Calculate with fractions	Candidates should be able to:	
	a. calculate a given fraction of a given quantity, expressing the answer as a fraction;	
	b. express a given number as a fraction of another;	
	c. add and subtract fractions by writing them with a common denominator;	
	d. perform short division to convert a simple fraction to a decimal;	
	e. multiply and divide a fraction by an integer and by a unit fraction;	(1) Multiplication by $\frac{1}{5}$ is equivalent to division by 5
	f. understand and use unit fractions as multiplicative inverses[1];	
	g. use efficient methods to calculate with fractions, including mixed numbers;	
	h. recognise that, in some cases, only a fraction can express the exact answer;	
	i. understand 'reciprocal' as multiplicative inverse and know that any non-zero number multiplied by its reciprocal is 1 (and that zero has no reciprocal, since division by zero is not defined).	
3.2 - Order rational numbers	Candidates should be able to:	
	a. order integers;	
	b. order fractions by rewriting them with a common denominator;	
	c. order decimals.	
3.3 - Understand equivalent fractions	Candidates should be able to:	
	a. understand equivalent fractions and simplify a fraction by cancelling all common factors.	

FB3 Fractions, decimals and percentages		Examples
3.4 - Use decimal notation	Candidates should be able to:	(1) $0{\cdot}137 = \dfrac{137}{1000}$
	a. use decimal notation and recognise that each terminating decimal is a fraction[1];	
	b. recognise that recurring decimals are exact fractions;	
	c. know that some exact fractions are recurring decimals.	
3.5 - Understand percentage	Candidates should be able to:	
	a. understand that 'percentage' means 'number of parts per 100' and use this to compare proportions;	
	b. know the fraction-to-percentage (or decimal) conversion of familiar simple fractions.	
3.6 - Interpret fractions, decimals and percentages as operators	Candidates should be able to:	(1) A 15% decrease in Y is calculated as $0{\cdot}85 \times Y$
	a. interpret percentage as the operator 'so many hundredths of';	
	b. convert simple fractions of a whole to percentages of the whole, and vice versa;	
	c. understand the multiplicative nature of percentages as operators[1].	

FB4 Indices and surds		Examples
4.1 - Common index numbers	Candidates should be able to:	
	a. use the terms 'square', 'positive square root', 'negative square root', 'cube' and 'cube root';	
	b. recall integer squares from 11 × 11 to 15 × 15 and the corresponding square roots;	
	c. recall the cubes of 2, 3, 4, 5 and 10.	
4.2 - Use index notation	Candidates should be able to:	
	a. use index notation for squares, cubes and powers of 10;	
	b. use index notation for simple integer powers;	
	c. use index laws for multiplication and division of integer powers;	
	d. use index laws to simplify, and calculate the value of, numerical expressions involving multiplication and division of integer powers.	

FB5 General algebra and coordinates		Examples
5.1 - Symbols and notation	Candidates should be able to:	These statements are repeated across all Units
	a. distinguish the different roles played by letter symbols in algebra, using the correct notational conventions for multiplying or dividing by a given number;	(1) $5x + 1 = 16$
	b. know that letter symbols represent definite unknown numbers in equations[1] and defined quantities or variables in formulae[2];	(2) $V = IR$ (3) $y = 2x$
	c. know that in functions, letter symbols define new expressions or quantities by referring to known quantities[3].	
5.2 - Algebraic terminology	Candidates should be able to:	This statement is repeated across all Foundation Units
	a. distinguish in meaning between the words 'equation', 'formula' and 'expression'.	
5.3 - Use the conventions for coordinates in the plane	Candidates should be able to:	These points occur across all three Units, where an understanding of coordinates is needed to complete other sections of the work. However, 3D is not included in Unit A502.
	a. use the conventions for coordinates in the plane; plot points in all four quadrants;	
	b. understand that one coordinate identifies a point on a number line and two coordinates identify a point in a plane, using the terms '1D' and '2D';	(1) Plot (3, 6) and (2, -4) on the grid provided
	c. use axes and coordinates to specify points in all four quadrants;	
	d. locate points with given coordinates[1].	

FB6 Functions and graphs		Examples
6.1 - Functions from real life	Candidates should be able to:	Linear functions only required. These may intersect. Other real life functions are dealt with in Unit A503
	a. construct linear functions from real life problems and plot their corresponding graphs;	
	b. discuss and interpret linear graphs modelling real situations;	
	c. draw a line of best fit through a set of linearly-related points.	
6.2 - Set up and solve simple equations including simultaneous equations in two unknowns	Candidates should be able to:	
	a. 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.	
6.3 - Recognise and plot equations that correspond to straight line graphs in the coordinate plane, including finding gradients	Candidates should be able to:	(1) Know that the lines represented by $y = 5x$ and $y = 3 + 5x$ are parallel, each having gradient 5
	a. 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;	
	b. 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[1];	
	c. plot graphs of functions in which y is given explicitly in terms of x, or implicitly, where no table or axes are given.	

FB7 Inequalities		Examples
7.1 - Solve linear inequalities in one variable	Candidates should be able to:	
	a. solve simple linear inequalities in one variable, and represent the solution set on a number line.	

FB8 General measures		Examples
8.1 - Interpret scales and use measurements	Candidates should be able to:	These two statements are repeated from Unit A501
	a. interpret scales on a range of measuring instruments, including those for time and mass;	
	b. convert measurements from one unit to another.	

FB9 Angles and properties of shapes		Examples
9.1 - Lines and angles	Candidates should be able to:	
	a. recall and use properties of angles at a point, angles at a point on a straight line (including right angles), perpendicular lines, and opposite angles at a vertex;	
	b. distinguish between acute, obtuse, reflex and right angles; estimate the size of an angle in degrees;	
	c. distinguish between lines and line segments;	
	d. use parallel lines, alternate angles and corresponding angles;	
	e. understand the consequent properties of parallelograms and a proof that the angle sum of a triangle is 180°;	
	f. understand a proof that an exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices.	

FB9 Angles and properties of shapes		Examples
9.2 - Properties of shapes	Candidates should be able to:	
	a. use angle properties of triangles;	
	b. explain why the angle sum of a quadrilateral is 360°;	
	c. recall the essential properties and definitions of special types of quadrilateral, including square, rectangle, parallelogram, trapezium and rhombus;	
	d. classify quadrilaterals by their geometric properties;	
	e. recall the definition of a circle and the meaning of related terms, including centre, radius, chord, diameter, circumference, tangent, arc, sector and segment;	
	f. understand that inscribed regular polygons can be constructed by equal division of a circle.	
9.3 - Angles and polygons	Candidates should be able to:	
	a. calculate and use the sums of the interior and exterior angles of quadrilaterals, pentagons and hexagons;	
	b. calculate and use the angles of regular polygons.	

FB10 Transformations		Examples
10.1 - Congruence and similarity	Candidates should be able to:	
	a. understand congruence;	
	b. understand similarity of plane figures.	
10.2 - Transform 2D shapes	Candidates should be able to:	
	a. recognise and visualise rotations[1], reflections and translations, including reflection symmetry of 2D and 3D shapes, and rotation symmetry of 2D shapes;	
	b. understand that rotations are specified by a centre and an (anticlockwise) angle;	
	c. 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 $y = -x$[2];	(1) Includes the order of rotation symmetry of a shape
	d. understand that translations are specified by a column vector;	(2) Includes reflection in x-axis or y-axis or in a given mirror line
	e. transform triangles and other 2D shapes by translation, rotation and reflection and by combinations of these transformations[3];	(3) Includes the single transformation equivalent to a combination of transformations
	f. recognise that these transformations preserve length and angle, and hence that any figure is congruent to its image under any of these transformations;	(4) Includes enlarging a shape on a grid and enlarging a shape by a scale factor given the centre of enlargement
	g. understand that enlargements are specified by a centre and positive scale factor;	
	h. recognise, visualise and construct enlargements of shapes using positive scale factors[4];	
	i. understand from this that any two circles and any two squares are mathematically similar, while, in general, two rectangles are not;	
	j. distinguish properties that are preserved under particular transformations.	

FB11 Bivariate data		Examples
11.1 - Use charts and correlation	Candidates should be able to:	
	a. draw and interpret scatter graphs;	
	b. appreciate that correlation is a measure of the strength of the association between two variables;	
	c. distinguish between positive, negative and zero correlation using lines of best fit;	
	d. appreciate that zero correlation does not necessarily imply 'no relationship' but merely 'no linear relationship';	
	e. draw lines of best fit by eye and understand what these represent;	
	f. draw line graphs for time series;	
	g. interpret time series.	

2.5   Unit A502/02: *Mathematics Unit B (Higher)*

The content of A502/02 subsumes all the content of A502/01.

This unit will be assessed without the use of a calculator.

HB1 General problem solving skills		Examples
These skills should underpin and influence the learning experiences of all candidates in mathematics. They will be assessed within this paper.		
1.1 - Solve problems using mathematical skills	Candidates should be able to:	Statements a to k are repeated across all Units
	a. select and use suitable problem solving strategies and efficient techniques to solve numerical problems;	
	b. 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;	
	c. break down a complex calculation into simpler steps before attempting to solve it and justify their choice of methods;	
	d. use notation and symbols correctly and consistently within a problem;	
	e. use a range of strategies to create numerical representations of a problem and its solution; move from one form of representation to another in order to get different perspectives on the problem;	
	f. interpret and discuss numerical information presented in a variety of forms;	
	g. present and interpret solutions in the context of the original problem;	
	h. review and justify their choice of mathematical presentation;	
	i. understand the importance of counter-example and identify exceptional cases when solving problems;	
	j. show step-by-step deduction in solving a problem;	
	k. recognise the importance of assumptions when deducing results; recognise the limitations of any assumptions that are made and the effect that varying those assumptions may have on the solution to a problem.	

HB2 Number		Examples
2.1 - Add, subtract, multiply and divide any number	Candidates should be able to:	Statements a and b are repeated in Unit A503
	a. derive integer complements to 100;	
	b. recall all multiplication facts to 10 × 10, and use them to derive quickly the corresponding division facts;	
	c. develop a range of strategies for mental calculation; derive unknown facts from those they know;	
	d. add and subtract mentally numbers with up to two decimal places;	
	e. multiply and divide numbers with no more than one decimal place, using place value adjustments, factorisation and the commutative, associative, and distributive laws, where possible;	
	f. use a variety of methods for addition and subtraction of integers and decimals, understanding where to position the decimal point;	
	g. perform a calculation involving division by a decimal (up to two decimal places) by transforming it to a calculation involving division by an integer.	

HB2 Number		Examples
2.2 - Approximate to a specified or appropriate degree of accuracy	Candidates should be able to:	Statement a is repeated from Unit A501 (statement c)
	a. round to the nearest integer, to a given number of decimal places and to one significant figure;	
	b. estimate answers to problems involving decimals;	
	c. estimate and check answers to problems;	
	d. use a variety of checking procedures, including working the problem backwards, and considering whether a result is of the right order of magnitude;	
	e. **round to a given number of significant figures;**	
	f. **select, and use, an appropriate degree of accuracy in solving a problem;**	
	g. **develop a range of strategies for mental calculation;**	
	h. **derive unknown facts from those they already know.**	

HB3 Fractions, decimals and percentages		Examples
3.1 - Calculate with fractions	Candidates should be able to:	
	a. calculate a given fraction of a given quantity, expressing the answer as a fraction;	
	b. express a given number as a fraction of another;	
	c. add and subtract fractions by writing them with a common denominator;	
	d. perform short division to convert a simple fraction to a decimal;	
	e. multiply and divide a fraction by an integer and by a unit fraction;	(1) Multiplication by $\frac{1}{5}$ is equivalent to division by 5
	f. understand and use unit fractions as multiplicative inverses[1];	
	g. use efficient methods to calculate with fractions, including mixed numbers;	
	h. recognise that, in some cases, only a fraction can express the exact answer;	
	i. understand 'reciprocal' as multiplicative inverse and know that any non-zero number multiplied by its reciprocal is 1 (and that zero has no reciprocal, since division by zero is not defined);	
	j. **multiply and divide a fraction by a general fraction.**	
3.2 - Order rational numbers	Candidates should be able to:	
	a. order integers;	
	b. order fractions by rewriting them with a common denominator;	
	c. order decimals.	
3.3 - Understand equivalent fractions	Candidates should be able to:	
	a. understand equivalent fractions and simplify a fraction by cancelling all common factors.	

HB3 Fractions, decimals and percentages		Examples
3.4 - Use decimal notation	Candidates should be able to:	
	a. use decimal notation and recognise that each terminating decimal is a fraction[1];	(1) $0 \cdot 137 = \dfrac{137}{1000}$
	b. recognise that recurring decimals are exact fractions;	
	c. know that some exact fractions are recurring decimals;	**(2) Convert $0 \cdot \dot{3}$ to a fraction**
	d. **distinguish between fractions with denominators that have only prime factors of 2 and 5 (which are represented by terminating decimals), and other fractions;**	
	e. **convert a recurring decimal to a fraction[2].**	
3.5 - Understand percentage	Candidates should be able to:	
	a. understand that 'percentage' means 'number of parts per 100' and use this to compare proportions;	
	b. know the fraction-to-percentage (or decimal) conversion of familiar simple fractions.	
3.6 - Interpret fractions, decimals and percentages as operators	Candidates should be able to:	
	a. interpret percentage as the operator 'so many hundredths of';	(1) A 15% decrease in Y is calculated as $0 \cdot 85 \times Y$
	b. convert simple fractions of a whole to percentages of the whole, and vice versa;	
	c. understand the multiplicative nature of percentages as operators[1].	

HB4 Indices and surds		Examples
4.1 - Common index numbers	Candidates should be able to:	
	a. use the terms 'square', 'positive square root', 'negative square root', 'cube' and 'cube root';	
	b. recall integer squares from 11 × 11 to 15 × 15 and the corresponding square roots;	
	c. recall the cubes of 2, 3, 4, 5 and 10.	
4.2 - Use index notation	Candidates should be able to:	
	a. use index notation for squares, cubes and powers of 10;	
	b. use index notation for simple integer powers;	
	c. use index laws for multiplication and division of integer powers;	
	d. use index laws to simplify, and calculate the value of, numerical expressions involving multiplication and division of integer powers;	
	e. **know that $n^0 = 1$; understand that the inverse operation of raising a positive number to power n is raising the result of this operation to power $\frac{1}{n}$;**	
	f. **know that $n^{-1} = \frac{1}{n}$ (undefined for $n = 0$), and that $n^{1/2} = \sqrt{n}$ and $n = \sqrt[3]{n}$ for any positive number n;**	
	g. **use index laws to simplify, and calculate the value of, numerical expressions involving multiplication and division of integer, fractional and negative powers.**	
4.3 - Use surds in exact calculations	Candidates should be able to:	
	a. **use surds in exact calculations without a calculator;**	(1) $\frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$
	b. **rationalise a denominator[(1)].**	

HB5 General algebra and coordinates		Examples
5.1 - Symbols and notation	Candidates should be able to:	These statements are repeated across all Units These examples relate specifically to Higher tier: **(1)** $x^2 + 1 = 82$ **(2)** $(x + 1)^2 \equiv x^2 + 2x + 1$ for all values of x **(3)** $y = 2 - 7x$; $y = \dfrac{1}{x}$ with $x \neq 0$ **f(x) notation may be used**
	a. distinguish the different roles played by letter symbols in algebra, using the correct notational conventions for multiplying or dividing by a given number;	
	b. know that letter symbols represent definite unknown numbers in equations[1], defined quantities or variables in formulae and general, unspecified and independent numbers in identities[2];	
	c. know that in functions, letter symbols define new expressions or quantities by referring to known quantities[3].	
5.2 - Algebraic terminology	Candidates should be able to:	This statement is repeated across all Higher Units
	a. distinguish in meaning between the words 'equation', 'formula', **'identity'** and 'expression'.	
5.3 - Use the conventions for coordinates in the plane	Candidates should be able to:	These points occur across all three Units, where an understanding of coordinates is needed to complete other sections of the work. However, 3D is not included in Unit A502. (1) Plot (3, 6) and (2, -4) on the grid provided
	a. use the conventions for coordinates in the plane; plot points in all four quadrants;	
	b. understand that one coordinate identifies a point on a number line and two coordinates identify a point in a plane, using the terms '1D' and '2D';	
	c. use axes and coordinates to specify points in all four quadrants;	
	d. locate points with given coordinates[1].	

HB6 Functions and graphs		Examples
6.1 - Functions from real life	Candidates should be able to:	Linear functions only required. These may intersect. Other real life functions are dealt with in Unit A503
	a. construct linear functions from real life problems and plot their corresponding graphs;	
	b. discuss and interpret linear graphs modelling real situations;	
	c. draw a line of best fit through a set of linearly-related points.	
6.2 - Set up and solve simple equations including simultaneous equations in two unknowns	Candidates should be able to:	
	a. 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;	
	b. **solve exactly, by elimination of an unknown, two simultaneous equations in two unknowns, both of which are linear in each unknown.**	
6.3 - Recognise and plot equations that correspond to straight line graphs in the coordinate plane, including finding gradients	Candidates should be able to:	(1) Know that the lines represented by $y = 5x$ and $y = 3 + 5x$ are parallel, each having gradient 5
	a. 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;	
	b. 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[1];	
	c. plot graphs of functions in which y is given explicitly in terms of x, or implicitly, where no table or axes are given.	
6.4 - Straight line graphs and the equation $y = mx + c$	Candidates should be able to:	**(1) Know that the lines represented by the equations $y = -5x$ and $y = 3 - 5x$ are parallel, each having gradient (−5)**
	a. **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;**	**(2) Know that the line with equation $y = \dfrac{x}{5}$ is perpendicular to these lines and has gradient $\dfrac{1}{5}$**
	b. **explore the gradients of parallel lines[1] and lines perpendicular to each other[2].**	

HB7 Inequalities		Examples
7.1 - Solve linear inequalities in one **or two** variables	Candidates should be able to:	
	a. solve simple linear inequalities in one variable, and represent the solution set on a number line;	
	b. **solve several linear inequalities in two variables, represent the inequalities on a suitable diagram, and find the solution set.**	

HB8 General measures		Examples
8.1 - Interpret scales and use measurements	Candidates should be able to:	These two statements are repeated from Unit A501
	a. interpret scales on a range of measuring instruments, including those for time and mass;	
	b. convert measurements from one unit to another.	

HB9 Angles and properties of shapes		Examples
9.1 - Lines and angles	Candidates should be able to:	
	a. recall and use properties of angles at a point, angles at a point on a straight line (including right angles), perpendicular lines, and opposite angles at a vertex;	
	b. distinguish between acute, obtuse, reflex and right angles; estimate the size of an angle in degrees;	
	c. distinguish between lines and line segments;	
	d. use parallel lines, alternate angles and corresponding angles;	
	e. understand the consequent properties of parallelograms and a proof that the angle sum of a triangle is 180°;	
	f. understand a proof that an exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices.	
9.2 - Properties of shapes	Candidates should be able to:	
	a. use angle properties of triangles;	
	b. explain why the angle sum of a quadrilateral is 360°;	
	c. recall the essential properties and definitions of special types of quadrilateral, including square, rectangle, parallelogram, trapezium and rhombus;	
	d. classify quadrilaterals by their geometric properties;	
	e. recall the definition of a circle and the meaning of related terms, including centre, radius, chord, diameter, circumference, tangent, arc, sector and segment;	
	f. understand that inscribed regular polygons can be constructed by equal division of a circle.	

HB9 Angles and properties of shapes		Examples
9.3 - Angles and polygons	Candidates should be able to:	
	a. calculate and use the sums of the interior and exterior angles of quadrilaterals, pentagons and hexagons;	
	b. calculate and use the angles of regular polygons.	
9.4 - Proofs and circle theorems	Candidates should be able to:	
	a. **understand and use the fact that the tangent at any point on a circle is perpendicular to the radius at that point;**	
	b. **understand and use the fact that tangents meeting at an external point are equal in length;**	
	c. **explain why the perpendicular from the centre to a chord bisects that chord;**	
	d. **prove and use these facts:**	
	i. **the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference;**	
	ii. **the angle subtended at the circumference in a semicircle is a right angle;**	
	iii. **angles in the same segment are equal;**	
	iv. **the alternate segment theorem;**	
	v. **opposite angles of a cyclic quadrilateral sum to 180°.**	

HB10 Transformations		Examples
10.1 - Congruence and similarity	Candidates should be able to:	
	a. understand congruence;	
	b. understand similarity of plane figures.	
10.2 - Transform 2D shapes	Candidates should be able to:	
	a. recognise and visualise rotations[1], reflections and translations, including reflection symmetry of 2D and 3D shapes, and rotation symmetry of 2D shapes;	
	b. understand that rotations are specified by a centre and an (anticlockwise) angle;	
	c. 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 $y = -x$[2];	
	d. understand that translations are specified by a column vector;	(1) Includes the order of rotation symmetry of a shape
	e. transform triangles and other 2D shapes by translation, rotation and reflection and by combinations of these transformations[3];	(2) Includes reflection in *x*-axis or *y*-axis or in a given mirror line
	f. recognise that these transformations preserve length and angle, and hence that any figure is congruent to its image under any of these transformations;	(3) Includes the single transformation equivalent to a combination of transformations
	g. understand that enlargements are specified by a centre and positive scale factor;	
	h. recognise, visualise and construct enlargements of shapes using positive scale factors, **then use positive fractional and negative scale factors;**	
	i. understand from this that any two circles and any two squares are mathematically similar, while, in general, two rectangles are not;	
	j. distinguish properties that are preserved under particular transformations.	

HB11 Vectors	Examples
11.1 - Use vectors	Candidates should be able to:	
	a. **understand and use vector notation;**	
	b. **calculate and represent graphically the sum of two vectors, the difference of two vectors and a scalar multiple of a vector;**	
	c. **calculate the resultant of two vectors;**	
	d. **understand and use the commutative and associative properties of vector addition;**	
	e. **solve simple geometrical problems in 2D using vector methods.**	

HB12 Bivariate data	Examples
12.1 - Use charts and correlation	Candidates should be able to:	
	a. draw and interpret scatter graphs;	
	b. appreciate that correlation is a measure of the strength of the association between two variables;	
	c. distinguish between positive, negative and zero correlation using lines of best fit;	
	d. appreciate that zero correlation does not necessarily imply 'no relationship' but merely 'no linear relationship';	
	e. draw lines of best fit by eye and understand what these represent;	
	f. draw line graphs for time series;	
	g. interpret time series.	

2.6   Unit A503/01: *Mathematics Unit C (Foundation)*

This unit assumes the use of a calculator

FC1 General problem solving skills		Examples
These skills should underpin and influence the learning experiences of all candidates in mathematics. They will be assessed within this paper.		
1.1 - Solve problems using mathematical skills	Candidates should be able to: a. select and use suitable problem solving strategies and efficient techniques to solve numerical problems; b. 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; c. break down a complex calculation into simpler steps before attempting to solve it and justify their choice of methods; d. use notation and symbols correctly and consistently within a problem; e. use a range of strategies to create numerical representations of a problem and its solution; move from one form of representation to another in order to get different perspectives on the problem; f. interpret and discuss numerical information presented in a variety of forms; g. present and interpret solutions in the context of the original problem; h. review and justify their choice of mathematical presentation; i. understand the importance of counter-example and identify exceptional cases when solving problems; j. show step-by-step deduction in solving a problem; k. recognise the importance of assumptions when deducing results; recognise the limitations of any assumptions that are made and the effect that varying those assumptions may have on the solution to a problem;	Statements a to k are repeated across all Units

FC1 General problem solving skills	Examples
Candidates should be able to:	
I. 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; fractions, percentages, measures and conversion between measures, and compound measures defined within a particular situation.	

FC2 Number		Examples
2.1 - Add, subtract, multiply and divide any number	Candidates should be able to:	Statement c is repeated from Unit A501 Statements a, b, d, e, f , g and h are repeated from Unit A502
	a. derive integer complements to 100;	
	b. recall all multiplication facts to 10 × 10, and use them to derive quickly the corresponding division facts;	
	c. understand and use positive and negative numbers both as positions and translations on a number line;	
	d. calculate a given fraction of a given quantity, expressing the answer as a fraction;	
	e. express a given number as a fraction of another;	
	f. add and subtract fractions by writing them with a common denominator;	
	g. multiply and divide a fraction by an integer and by a unit fraction;	
	h. understand and use unit fractions as multiplicative inverses.	
2.2 - Approximate to a specified or appropriate degree of accuracy	Candidates should be able to:	These statements build on the work in Unit A501
	a. round to the nearest integer, to any number of decimal places, specified or appropriate, and to any number of significant figures[1];	(1) Round 345·46 to the nearest integer, 1 decimal place, 2 significant figures
	b. understand the calculator display, knowing when to interpret the display[2], when the display has been rounded by the calculator, and not to round during the intermediate steps of a calculation;	(2) Know that 3·5 on a calculator means 3·50 in money context
	c. give solutions in the context of the problem to an appropriate degree of accuracy, interpreting the solution shown on a calculator display[3], and recognising limitations on the accuracy of data and measurements.	(3) Know that 3·66666667 on a calculator is a recurring decimal

FC2 Number		Examples
2.3 - Use calculators effectively and efficiently	Candidates should be able to:	Statements a and b are repeated in Unit A501
	a. use calculators effectively and efficiently[1];	
	b. know how to enter complex calculations and use function keys for reciprocals, squares and powers;	• Calculate $1 \cdot 6^3$, $\sqrt{7 \cdot 29}$,
	c. enter a range of calculations, including those involving measures.	$\dfrac{2 \cdot 6 - 0 \cdot 8}{0 \cdot 2}$, $\sqrt[3]{6 \cdot 1^2 - 0 \cdot 81}$
		• When using money interpret a calculator display of $2 \cdot 6$ as £2·60
2.4 - Substitute numbers into expressions involving indices	Candidates should be able to:	
	a. substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$ and evaluate the outcome.	

FC3 Use upper and lower bounds		Examples
3.1 - Inaccuracy in measurement	Candidates should be able to:	This statement is repeated in the General measures section
	a. recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction.	

FC4 Social arithmetic		Examples
4.1 - Apply problem solving skills	Candidates should be able to:	
	a. analyse real life problems using mathematical skills;	
	b. apply mathematical skills when solving real life problems;	
	c. communicate findings from solutions to real life problems;	
	d. interpret solutions to real life problems.	
4.2 - Use percentage and repeated percentage change	Candidates should be able to:	(1) Contexts may include finding % profit/loss, interest, tax, discount
	a. solve simple percentage problems in real life situations, including increase and decrease[1].	
4.3 - Understand and use direct and indirect proportion	Candidates should be able to:	(1) 5 books cost £23·50, find the cost of 3 books; foreign currency conversion; recipes; best value for money problems
	a. solve word problems about proportion, including using informal strategies and the unitary method of solution[1].	
4.4 - Solve real life problems involving measures	Candidates should be able to:	(1) Contexts may include interpreting timetables, costs of days out, paving patios, cost of decorating a room, contrasting costs of services
	a. explore and solve problems in real life contexts that use common measures (including time, money, mass, length, area and volume)[1];	
	b. explore and solve problems in real life contexts that use common compound measures such as speed and density;	
	c. use checking procedures, including inverse operations; work to stated levels of accuracy.	

FC5 General algebra and coordinates		Examples
5.1 - Symbols and notation	Candidates should be able to:	These statements are repeated across all Units
	a. distinguish the different roles played by letter symbols in algebra, using the correct notational conventions for multiplying or dividing by a given number;	
	b. know that letter symbols represent definite unknown numbers in equations[1] and defined quantities or variables in formulae[2];	(1) $5x + 1 = 16$ (2) $V = IR$ (3) $y = 2x$
	c. know that in functions, letter symbols define new expressions or quantities by referring to known quantities[3].	
5.2 - Algebraic terminology	Candidates should be able to:	This statement is repeated across all Foundation Units
	a. distinguish in meaning between the words 'equation', 'formula' and 'expression'.	
5.3 - Use the conventions for coordinates in the plane	Candidates should be able to:	Statements a, b, c and d occur across all three Units, where an understanding of coordinates is needed to complete other sections of the work
	a. use the conventions for coordinates in the plane; plot points in all four quadrants;	
	b. 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 '1D', '2D' and '3D';	Statement b occurs across all three Units but without the inclusion of 3D coordinates, which only appear in this Unit
	c. use axes and coordinates to specify points in all four quadrants;	
	d. locate points with given coordinates.	

FC6 Algebraic manipulation		Examples
6.1 - Manipulate algebraic expressions	Candidates should be able to:	(1) $a(b + c) = ab + ac$ (2) $x + 5 - 2x - 1 = 4 - x$ (3) $9x - 3 = 3(3x - 1)$ or $x^2 - 3x = x(x - 3)$
	a. understand that the transformation of algebraic expressions obeys and generalises the rules of general arithmetic[1];	
	b. manipulate algebraic expressions by collecting like terms[2], by multiplying a single term over a bracket, and by taking out common factors[3].	
6.2 - Use trial and improvement to solve equations	Candidates should be able to:	(1) $x^3 = x - 900$; $\dfrac{1}{x} = x^2 - 5$
	a. use systematic trial and improvement to find approximate solutions of equations where there is no simple analytical method of solving them[1].	

FC7 Real life and non-linear functions		Examples
7.1 - Functions from real life	Candidates should be able to:	May include distance time graphs, mobile phone charges, electricity bills Graphs may not be linear. Purely linear cases are dealt with in Unit A502
	a. discuss and interpret graphs modelling real situations.	
7.2 - Plot graphs of simple quadratic functions	Candidates should be able to:	(1) $y = x^2$; $y = 3x^2 + 4$ (2) Solve $3x^2 + 4 = 8$ from graph of $y = 3x^2 + 4$
	a. generate points and plot graphs of simple quadratic functions[1];	
	b. find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function[2].	

FC8 General measures		Examples
8.1 - Interpret scales and use measurements	Candidates should be able to:	Statements a to e are repeated from Unit A501
	a. interpret scales on a range of measuring instruments, including those for time and mass;	(1) Use bearings to specify direction
	b. know that measurements using real numbers depend on the choice of unit;	(2) Convert 23cm^2 to mm^2
	c. understand angle measure using the associated language[1];	(3) A water barrel holds 10 gallons. Roughly how many litres is this?
	d. convert measurements from one unit to another;	(4) How far do you go in 3 hours travelling at 40 mph?
	e. know approximate metric equivalents of pounds, feet, miles, pints and gallons[2];	
	f. recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction;	
	g. convert between area measures (including square centimetres and square metres), and volume measures (including cubic centimetres and cubic metres)[3];	
	h. understand and use compound measures (including speed[4] and density).	

FC9 Area and volume		Examples
9.1 - Perimeter, area (including circles), and volume	Candidates should be able to:	See also FC4.4 - Solve real life problems involving measures
	a. find areas of rectangles, recalling the formula, understanding the connection to counting squares;	(1) Could involve semicircles, and inverse problems e.g. find the diameter if the circumference is 60cm
	b. recall and use the formulae for the area of a parallelogram and a triangle;	
	c. work out the surface area of simple shapes using the area formulae for triangles and rectangles;	(2) Could involve inverse calculations - find the length of an edge given the volume and two other edges
	d. calculate perimeters and areas of shapes made from triangles and rectangles;	
	e. find circumferences of circles and areas enclosed by circles, recalling relevant formulae[1];	
	f. find volumes of cuboids, recalling the formula and understanding the connection to counting cubes[2];	
	g. calculate volumes of right prisms and of shapes made from cubes and cuboids;	
	h. use π in exact calculations.	
9.2 - Use 2D representations of 3D shapes	Candidates should be able to:	
	a. explore the geometry of cuboids (including cubes) and objects made from cuboids;	
	b. use 2D representations of 3D objects; analyse 3D objects through 2D projections (including plan and elevation) and cross-sections[1];	(1) Use of isometric paper is included
	c. draw nets of 3D objects[2];	(2) Cube, cuboid and simple pyramids
	d. solve problems involving the surface area and volume of prisms[3];	(3) Could include cylinders
	e. construct nets of cubes, regular tetrahedra, square-based pyramids and other 3D shapes from given information.	

FC9 Area and volume		Examples
9.3 - Enlargement	Candidates should be able to:	Statements a and b are repeated from Unit A502
	a. identify the scale factor of an enlargement as the ratio of the lengths of any two corresponding line segments and apply this to triangles;	(1) Know that sf 2 also doubles perimeter
	b. understand that enlargement preserves angle but not length;	(2) Know that sf 2 does not double area or volume
	c. understand the implications of enlargement for perimeter[1];	Formal treatment not required
	d. understand the implications of enlargement for area and volume[2].	

FC10 The study of chance		Examples
10.1 - Probability	Candidates should be able to:	
	a. use the vocabulary of probability to interpret results involving uncertainty and prediction[1];	(1) Use impossible, certain, evens, likely, unlikely
	b. understand and use the probability scale[2];	(2) Associate 0, 0·5, 1 with impossible, evens and certain and position events on a probability scale
	c. understand and use estimates or measures of probability from theoretical models (including equally-likely outcomes), or from relative frequency;	
	d. list all outcomes for single events, and for two successive events, in a systematic way[3];	(3) Use a sample space or list combinations systematically e.g. for 2 dice
	e. identify different mutually exclusive outcomes;	(4) Given the P(A) find P(not A), and given P(A) and P(B) find P(not A or B)
	f. know that the sum of the probabilities of all the possible mutually exclusive outcomes is 1[4];	
	g. 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;	(5) Compare the dice experiment results to theoretical and comment on possible bias
	h. compare experimental data to theoretical probabilities[5].	

2.7   Unit A503/02: *Mathematics Unit C (Higher)*

The content of A503/02 subsumes all the content of A503/01.

This unit assumes the use of a calculator

HC1 General problem solving skills		Examples
These skills should underpin and influence the learning experiences of all candidates in mathematics. They will be assessed within this paper.		
1.1 - Solve problems using mathematical skills	Candidates should be able to:	Statements a to k are repeated across all Units
	a. select and use suitable problem solving strategies and efficient techniques to solve numerical problems;	
	b. 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;	
	c. break down a complex calculation into simpler steps before attempting to solve it and justify their choice of methods;	
	d. use notation and symbols correctly and consistently within a problem;	
	e. use a range of strategies to create numerical representations of a problem and its solution; move from one form of representation to another in order to get different perspectives on the problem;	
	f. interpret and discuss numerical information presented in a variety of forms;	
	g. present and interpret solutions in the context of the original problem;	
	h. review and justify their choice of mathematical presentation;	
	i. understand the importance of counter-example and identify exceptional cases when solving problems;	
	j. show step-by-step deduction in solving a problem;	

HC1 General problem solving skills	Examples
Candidates should be able to:	
k. recognise the importance of assumptions when deducing results; recognise the limitations of any assumptions that are made and the effect that varying those assumptions may have on the solution to a problem;	
l. draw on their knowledge of operations and inverse operations (including powers and roots), and of methods of simplification (including factorisation and the use of the commutative, associative and distributive laws of addition, multiplication and factorisation) in order to select and use suitable strategies and techniques to solve problems and word problems, including those involving ratio and proportion, **repeated proportional change,** fractions, percentages **and reverse percentages, inverse proportion, surds,** measures and conversion between measures, and compound measures defined within a particular situation.	

HC2 Number		Examples
2.1 - Add, subtract, multiply and divide any number	Candidates should be able to:	Statement c is repeated from Unit A501 Statements a, b, d, e, f, g, h and i are repeated from Unit A502
	a. derive integer complements to 100;	
	b. recall all multiplication facts to 10 × 10, and use them to derive quickly the corresponding division facts;	
	c. understand and use positive and negative numbers both as positions and translations on a number line;	**(1)** $3\frac{2}{3} \times 2\frac{1}{4}$
	d. calculate a given fraction of a given quantity, expressing the answer as a fraction;	
	e. express a given number as a fraction of another;	
	f. add and subtract fractions by writing them with a common denominator;	
	g. multiply and divide a fraction by an integer and by a unit fraction;	
	h. understand and use unit fractions as multiplicative inverses;	
	i. **multiply and divide a fraction by a general fraction[1].**	
2.2 - Approximate to a specified or appropriate degree of accuracy	Candidates should be able to:	These statements build on the work in Unit A501
	a. round to the nearest integer, to any number of decimal places, specified or appropriate, and to any number of significant figures[1];	(1) Round 345·46 to the nearest integer, 1 decimal place, 2 significant figures
	b. understand the calculator display, knowing when to interpret the display[2], when the display has been rounded by the calculator, and not to round during the intermediate steps of a calculation;	(2) Know that 3·5 on a calculator means 3·50 in money context
	c. give solutions in the context of the problem to an appropriate degree of accuracy, interpreting the solution shown on a calculator display[3], and recognising limitations on the accuracy of data and measurements.	(3) Know that 3·66666667 on a calculator is a recurring decimal

HC2 Number		Examples
2.3 - Use calculators effectively and efficiently, including statistical and trigonometrical functions	Candidates should be able to:	Statements a, b and d are repeated from Unit A502
	a. use calculators effectively and efficiently[1];	(1) Calculate $1 \cdot 6^3$, $\sqrt{7 \cdot 29}$,
	b. know how to enter complex calculations and use function keys for reciprocals, squares and powers;	$\dfrac{2 \cdot 6 - 0 \cdot 8}{0 \cdot 2}$, $\sqrt[3]{6 \cdot 1^2 - 0 \cdot 81}$
	c. enter a range of calculations, including measures;	**(2) 5^{-7}**
	d. **use an extended range of function keys[2], including trigonometrical[3] and statistical functions;**	**(3) $\dfrac{5 \times \sin 35}{\sin 62}$**
	e. **use calculators for reverse percentage calculations.**	
2.4 - Substitute numbers into expressions involving indices	Candidates should be able to:	
	a. substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$ and evaluate the outcome.	

HC3 Standard index form		Examples
3.1 - Standard index form	Candidates should be able to:	
	a. **use and express standard index form expressed in conventional notation and on a calculator display;**	**(1) $(2 \cdot 4 \times 10^7) \times (5 \times 10^3)$**
	b. **order with numbers written in standard form;**	**$= 1 \cdot 2 \times 10^{11}$ OR**
	c. **calculate standard index form[1];**	**$(2 \cdot 4 \times 10^7) \div (5 \times 10^3)$**
	d. **convert between ordinary and standard index form representations[2], converting to standard index form to make sensible estimates for calculations involving multiplication and/or division.**	**$= 4 \cdot 8 \times 10^3$**
		(2) Write 165 000 in standard form; write $6 \cdot 32 \times 10^{-3}$ as an ordinary number

HC4 Use upper and lower bounds		Examples
4.1 - Inaccuracy in measurement	Candidates should be able to:	Statement a is repeated in the General measures section
	a. recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction;	**(1) A book weighs 1·7kg, correct to the nearest 0·1kg. What is the maximum weight of 12 of these books?**
	b. **use calculators, or written methods, to calculate the upper and lower bounds of calculations, in particular, when working with measurements[1];**	**(2) In money calculations, or when the display has been rounded by the calculator**
	c. **recognise limitations on the accuracy of data and measurements[2].**	

HC5 Social arithmetic		Examples
5.1 - Apply problem solving skills	Candidates should be able to:	
	a. analyse real life problems using mathematical skills;	
	b. apply mathematical skills when solving real life problems;	
	c. communicate findings from solutions to real life problems;	
	d. interpret solutions to real life problems.	
5.2 - Use percentage and repeated percentage change	Candidates should be able to:	**Contexts may include VAT, annual rate of inflation, income tax, discounts, simple interest, compound interest**
	a. solve simple percentage problems in real life situations, including increase and decrease;	**(1) Given that a meal in a restaurant costs £136 with VAT at 17·5%, its price before VAT is calculated as £136/1·175**
	b. **calculate an original amount[1] when given the transformed amount after a percentage change;**	**(2) £5000 invested at 4% compound interest for 3 years is calculated as 5000 × 1·04³**
	c. **represent repeated percentage change using a multiplier raised to a power[2].**	

HC5 Social arithmetic		Examples
5.3 - Understand and use direct and indirect proportion	Candidates should be able to:	(1) 5 books cost £23·50, find the cost of 3 books; foreign currency conversion; recipes; best value for money problems
	a. solve word problems about proportion, including using informal strategies and the unitary method of solution[1];	
	b. **calculate an unknown quantity from quantities that vary in direct or inverse proportion[2];**	**(2) A tank can be emptied using 6 pumps in 18 hours. How long will it take to empty the tank using 8 pumps?**
	c. **set up and use equations to solve word and other problems involving direct proportion[3] or inverse proportion and relate algebraic solutions to graphical representation of the equations.**	**(3) $y \propto x^2$ and $x = 4$ when $y = 8$. Find y when $x = 12$.**
5.4 - Solve real life problems involving measures	Candidates should be able to:	(1) Contexts may include interpreting timetables, costs of days out, paving patios, cost of decorating a room, contrasting costs of services
	a. explore and solve problems in real life contexts that use common measures (including time, money, mass, length, area and volume)[1];	
	b. explore and solve problems in real life contexts that use common compound measures such as speed and density;	
	c. use checking procedures, including inverse operations; work to stated levels of accuracy.	
5.5 - Exponential growth	Candidates should be able to:	**(1) The number of bacteria, N, after t hours is given by $N = 100 \times 5^{2t}$. How many bacteria are there after 3 hours?**
	a. **use calculators to explore exponential growth and decay[1] using a multiplier and the power key.**	

HC6 General algebra and coordinates		Examples
6.1 - Symbols and notation	Candidates should be able to:	These statements are repeated across all Units
	a. distinguish the different roles played by letter symbols in algebra, using the correct notational conventions for multiplying or dividing by a given number;	These examples relate specifically to Higher tier: **(1)** $x^2 + 1 = 82$
	b. know that letter symbols represent definite unknown numbers in equations[1], defined quantities or variables in formulae and general, unspecified and independent numbers in identities[2];	**(2)** $(x + 1)^2$ $x^2 + 2x + 1$ **for all values of** x **(3)** $y = 2 - 7x$; $y = \dfrac{1}{x}$ **with** x **0**
	c. know that in functions, letter symbols define new expressions or quantities by referring to known quantities[3].	**f(x) notation may be used**
6.2 - Algebraic terminology	Candidates should be able to:	This statement is repeated across all Higher Units
	a. distinguish in meaning between the words 'equation', 'formula', **'identity'** and 'expression'.	
6.3 - Use the conventions for coordinates in the plane	Candidates should be able to:	Statements a, b, c and d occur across all three Units, where an understanding of coordinates is needed to complete other sections of the work
	a. use the conventions for coordinates in the plane; plot points in all four quadrants;	
	b. 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 '1D', '2D' and '3D';	Statement b occurs across all three Units but without the inclusion of 3D coordinates, which only appear in this Unit
	c. use axes and coordinates to specify points in all four quadrants;	
	d. locate points with given coordinates.	

HC7 Algebraic manipulation		Examples
7.1 - Manipulate algebraic expressions	Candidates should be able to:	(1) $a(b + c) = ab + ac$ (2) $x + 5 - 2x - 1 = 4 - x$ (3) $9x - 3 = 3(3x - 1)$ or $x^2 - 3x = x(x - 3)$ **(4) Expand $(2x - 5)(x + 7)$** **(5) Factorise $4x^2 - 9$** **(6) Simplify $\dfrac{x^2 + 3x + 2}{x^2 - 4x - 5}$**
	a. understand that the transformation of algebraic expressions obeys and generalises the rules of general arithmetic[1],	
	b. manipulate algebraic expressions by collecting like terms[2], by multiplying a single term over a bracket, and by taking out common factors[3];	
	c. **expand the product of two linear expressions[4];**	
	d. **manipulate algebraic expressions by factorising quadratic expressions, including the difference of two squares[5];**	
	e. **simplify rational expressions[6].**	
7.2 - Use trial and improvement to solve equations	Candidates should be able to:	(1) $x^3 = x - 900; \dfrac{1}{x} = x^2 - 5$
	a. use systematic trial and improvement to find approximate solutions of equations where there is no simple analytical method of solving them[1].	
7.3 - Solve quadratic equations	Candidates should be able to:	**(1) Solve $x^2 - 4x - 5 = 0$** **(2) Solve $x^2 + 6x + 2 = 0$. Give your answers correct to 2dp.** **(3) Solve the simultaneous equations $y = 3x + 1$ and $y = x^2 + 2x - 5$**
	a. **solve simple quadratic equations by factorisation[1], completing the square and using the quadratic formula[2];**	
	b. **solve exactly, by elimination of an unknown, two simultaneous equations in two unknowns, where the first equation is linear in each unknown and the second equation is either linear in each unknown or linear in one unknown and quadratic in the other[3].**	

HC8 Real life and non-linear functions

HC8 Real life and non-linear functions		Examples
8.1 - Functions from real life	Candidates should be able to:	May include distance time graphs, mobile phone charges, electricity bills
	a. discuss and interpret graphs modelling real situations;	
	b. **construct the graphs of simple loci.**	Graphs may not be linear. Purely linear cases are dealt with in Unit A502
8.2 - Plot graphs of simple quadratic functions	Candidates should be able to:	(1) $y = x^2$; $y = 3x^2 + 4$
	a. generate points and plot graphs of simple quadratic functions[1];	(2) Solve $3x^2 + 4 = 8$ from graph of $y = 3x^2 + 4$
	b. find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function[2];	**(3) $y = x^2 - 2x + 1$**
	c. **generate points and plot graphs of more general quadratic functions[3];**	**(4) A rectangular lawn has an area of 28m² and a perimeter of 22m. Find the length and width of the lawn.**
	d. **construct quadratic and other functions from real life problems[4] and plot their corresponding graphs.**	
8.3 - Find approximate solutions of a pair of linear and quadratic functions	Candidates should be able to:	**(1) Use a graphical method to solve these simultaneous equations: $y = x + 7$ and $y = x^2 - 2x + 2$**
	a. **find the intersection points of the graphs of a linear and a quadratic function and know that these are the approximate solutions of the simultaneous equations representing the two functions[1].**	
8.4 - Construct non-linear graphs	Candidates should be able to:	**(1) Draw the graph of $y = x^3 - 5x + 2$ for $-3 \leqslant x \leqslant 3$**
	a. **plot graphs of simple cubic functions[1], the reciprocal function $y = \dfrac{1}{x}$ with $x \neq 0$, the exponential function $y = k^x$ for integer values of x and simple positive values of k and the circular functions $y = \sin x$ and $y = \cos x$;**	**(2) Given that $\sin 30° = 0\cdot 5$, find the solutions of $\sin x = 0\cdot 5$ for $0 \leqslant x \leqslant 360°$**
	b. **recognise the characteristic shapes of all these functions[2].**	
8.5 - Transform functions	Candidates should be able to:	**(1) Sketch the graph of**
	a. **apply to the graph of $y = f(x)$ the transformations $y = f(x) + a$, $y = f(ax)$, $y = f(x + a)$ and $y = af(x)$ for linear, quadratic, sine and cosine functions $f(x)$[1].**	**(a) $y = 2\sin x$** **(b) $y = \cos(x - 90°)$**

HC9 General measures		Examples
9.1 - Interpret scales and use measurements	Candidates should be able to:	Statements a to e are repeated from Unit A501
	a. interpret scales on a range of measuring instruments, including those for time and mass;	(1) Use bearings to specify direction
	b. know that measurements using real numbers depend on the choice of unit;	(2) Convert 23cm^2 to mm^2
	c. understand angle measure using the associated language[1];	(3) A water barrel holds 10 gallons. Roughly how many litres is this?
	d. convert measurements from one unit to another;	(4) How far do you go in 3 hours travelling at 40 mph?
	e. know approximate metric equivalents of pounds, feet, miles, pints and gallons[2];	
	f. recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction;	
	g. convert between area measures[2] (including square centimetres and square metres), and volume measures (including cubic centimetres and cubic metres)[3];	
	h. understand and use compound measures (including speed[4] and density).	

HC10 Area and volume		Examples
10.1 - Perimeter, area (including circles), and volume	Candidates should be able to:	See also HC5.4 - Solve real life problems involving measures
	a. find areas of rectangles, recalling the formula, understanding the connection to counting squares;	(1) Could involve semicircles, and inverse problems e.g. find the diameter if the circumference is 60cm
	b. recall and use the formulae for the area of a parallelogram and a triangle;	
	c. work out the surface area of simple shapes using the area formulae for triangles and rectangles;	(2) Could involve inverse calculations - find the length of an edge given the volume and two other edges
	d. calculate perimeters and areas of shapes made from triangles and rectangles;	**(3) Calculate the volume of a sphere of radius 1·5cm**
	e. find circumferences of circles and areas enclosed by circles, recalling relevant formulae[1];	**(4) Calculate the arc length of the sector of a circle radius 5cm subtended by an angle of 65°**
	f. find volumes of cuboids, recalling the formula and understanding the connection to counting cubes[2];	
	g. calculate volumes of right prisms and of shapes made from cubes and cuboids;	
	h. use π in exact calculations;	
	i. **calculate volumes of objects made from cubes, cuboids, pyramids, prisms and spheres[3];**	
	j. **calculate the lengths of arcs and the areas of sectors of circles[4].**	

HC10 Area and volume		Examples
10.2 - Use 2D representations of 3D shapes	Candidates should be able to:	
	a. explore the geometry of cuboids (including cubes) and objects made from cuboids;	(1) Use of isometric paper is included
	b. use 2D representations of 3D objects[1]; analyse 3D objects through 2D projections (including plan and elevation) and cross-sections;	(2) Cube, cuboid and simple pyramids
	c. draw nets of 3D objects[2];	(3) Could include cylinders
	d. solve problems involving the surface area and volume of prisms[3];	**(4) The surface area of a sphere is 114cm². Find the radius of the sphere.**
	e. construct nets of cubes, regular tetrahedra, square-based pyramids and other 3D shapes from given information;	**(5) A cone is 20cm high and has a base radius of 12cm. The top 15cm of the cone is removed. Find the volume of the remaining frustum.**
	f. **solve problems involving surface areas and volumes of prisms, pyramids, cylinders, cones and spheres[4];**	
	g. **solve problems involving more complex shapes and solids, including segments of circles and frustums of cones[5].**	
10.3 - Enlargement	Candidates should be able to:	Statements a and b are repeated from Unit A502
	a. identify the scale factor of an enlargement as the ratio of the lengths of any two corresponding line segments and apply this to triangles;	
	b. understand that enlargement preserves angle but not length;	(1) Know that sf 2 also doubles perimeter
	c. understand the implications of enlargement for perimeter[1];	(2) Know that sf 2 does not double area or volume
	d. understand the implications of enlargement for area and volume[2];	**(3) A carton of yoghurt holds 100ml. A similar carton is 1.5 times as tall. How much yoghurt does it hold?**
	e. **understand and use the effect of enlargement on areas and volumes of shapes and solids[3].**	

HC11 Extension trigonometry and Pythagoras' theorem		Examples
11.1 - Trigonometry in 2D and 3D and Pythagoras' theorem in 3D	Candidates should be able to:	(1) **Find the angle between the longest diagonal and the base of a cuboid** (2) **Find the length of the longest diagonal of a cuboid e.g. 4cm by 5cm by 3cm**
	a. **use trigonometrical relationships in 3D contexts, including finding the angles between a line and a plane[1] (but not the angle between two planes or between two skew lines);**	
	b. **use the sine and cosine rules to solve 2D and 3D problems;**	
	c. **calculate the area of a triangle using ½*ab*sin*C*;**	
	d. **use Pythagoras' theorem in 3D contexts[2].**	

HC12 The study of chance		Examples
12.1 - Probability	Candidates should be able to:	
	a. use the vocabulary of probability to interpret results involving uncertainty and prediction[1];	(1) Use impossible, certain, evens, likely, unlikely
	b. understand and use the probability scale[2];	(2) Associate 0, 0·5, 1 with impossible, evens and certain and position events on a probability scale
	c. understand and use estimates or measures of probability from theoretical models (including equally-likely outcomes), or from relative frequency;	(3) Use a sample space or list combinations systematically e.g. for 2 dice
	d. list all outcomes for single events, and for two successive events, in a systematic way[3];	(4) Given the P(A) find P(not A), and given P(A) and P(B) find P(not A or B)
	e. identify different mutually exclusive outcomes;	(5) Compare the dice experiment results to theoretical and comment on possible bias
	f. know that the sum of the probabilities of all the possible mutually exclusive outcomes is 1[4];	**Includes conditional probability**
	g. 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;	**(6) Probability of winning a match is 0·4. Probability of drawing is 0·3. Find probability of winning or drawing.**
	h. compare experimental data to theoretical probabilities[5];	**(7) Two dice are thrown. Find the probability of getting two sixes.**
	i. **know when to add or multiply probabilities:**	**(8) There are 7 black and 4 white discs in a bag. Two are selected at random. Find the probability of getting one of each colour.**
	i. **if A and B are mutually exclusive, then the probability of A or B occurring is P(A) + P(B)[6];**	
	ii. **if A and B are independent events, the probability of A and B occurring is P(A) × P(B)[7];**	
	j. **use tree diagrams to represent outcomes of compound events, recognising when events are independent[8].**	

3. Assessment of GCSE Mathematics A

3.1 Overview of the assessment in GCSE Mathematics A

GCSE Mathematics A (J562)

Unit A501/01 *Mathematics Unit A (Foundation)* 25% of the total GCSE marks 1 hour written paper 60 marks	• Each unit is externally assessed. • Candidates answer **all** questions on each paper. • In some questions, candidates will have to decide for themselves what mathematics they need to use. • In each question paper, candidates are expected to support their answers with appropriate working. • Functional elements of mathematics are assessed in this specification. The weightings are 30-40% at Foundation tier and 20-30% at Higher tier. • Candidates are permitted to use a scientific or graphical calculator for Units A501 and A503. All calculators must conform to the rules specified in the document *Instructions for Conducting Examinations,* published annually by the Joint Council for Qualifications (http://www.jcq.org.uk). • All candidates should have the usual geometric instruments available. Tracing paper can be used to aid with transformations etc, whether or not it is specified on the front of the question paper.
Unit A501/02 *Mathematics Unit A (Higher)* 25% of the total GCSE marks 1 hour written paper 60 marks	
Unit A502/01 *Mathematics Unit B (Foundation)* 25% of the total GCSE marks 1 hour written paper 60 marks	
Unit A502/02 *Mathematics Unit B (Higher)* 25% of the total GCSE marks 1 hour written paper 60 marks	
Unit A503/01 *Mathematics Unit C (Foundation)* 50% of the total GCSE marks 1·5 hour written paper 100 marks	
Unit A503/02 *Mathematics Unit C (Higher)* 50% of the total GCSE marks 2 hour written paper 100 marks	

3.2   Tiers

This scheme of assessment consists of **two** tiers: Foundation tier and Higher tier. Foundation tier papers assess Grades c to g and Higher tier papers assess Grades a* to d (e).

Learners are not required to take all units at the same tier. For example, a learner may initially sit a Foundation tier unit, then sit a Higher tier unit as the second unit, and sit the final unit at either tier.

3.3   Assessment objectives

Candidates are expected to demonstrate the following in the context of the content described:

Assessment objectives		Weighting (%)
AO1	• recall and use their knowledge of the prescribed content	45-55
AO2	• select and apply mathematical methods in a range of contexts	25-35
AO3	• interpret and analyse problems and generate strategies to solve them	15-25

AO weightings – GCSE Mathematics A

The relationship between the units and the assessment objectives in terms of **raw marks** is shown in the following grid:

Unit	AO1	AO2	AO3	Total
Unit A501/01: *Mathematics Unit A (Foundation)*	27-33	17-23	7-13	**60**
Unit A502/01: *Mathematics Unit B (Foundation)*	27-33	17-23	7-13	**60**
Unit A503/01: *Mathematics Unit C (Foundation)*	45-55	21-31	19-29	**100**

Unit	AO1	AO2	AO3	Total
Unit A501/02: *Mathematics Unit A (Higher)*	27-33	17-23	7-13	**60**
Unit A502/02: *Mathematics Unit B (Higher)*	27-33	17-23	7-13	**60**
Unit A503/02: *Mathematics Unit C (Higher)*	45-55	21-31	19-29	**100**

3.4   Grading and awarding grades

GCSE results are awarded on the scale A* to G. Units are awarded a* to g, as applicable. Grades are indicated on certificates. However, results for candidates who fail to achieve the minimum grade will be recorded as *unclassified* (U or u) and this is **not** certificated.

This GCSE is a unitised scheme. Candidates can take units across several different series provided the terminal rules are satisfied. They can also re-sit units. When working out candidates' overall grades OCR needs to be able to compare performance on the same unit in different series when different grade boundaries have been set, and between different units. OCR uses a Uniform Mark Scale to enable this to be done.

A candidate's uniform mark for each unit is calculated from the candidate's raw mark on that unit. Raw mark grade boundaries are converted to the equivalent uniform mark grade boundaries. Marks between grade boundaries are converted on a pro rata basis.

When unit results are issued, the candidate's unit grade and uniform mark are given. The uniform mark is shown out of the maximum uniform mark for the unit.

The uniform mark grade boundaries for each of the assessments are shown below:

Unit	Unit Weighting	Maximum Unit Uniform Mark	Unit Grade								
			a*	a	b	c	d	e	f	g	u
A501/01	25%	69				60	50	40	30	20	0
A501/02	25%	100	90	80	70	60	50	45			0
A502/01	25%	69				60	50	40	30	20	0
A502/02	25%	100	90	80	70	60	50	45			0
A503/01	50%	139				120	100	80	60	40	0
A503/02	50%	200	180	160	140	120	100	90			0

The written papers have a total weighting of 100%.

For Foundation tier papers, candidates achieving less than the minimum mark for Grade g will be unclassified. For Higher tier papers, candidates achieving marginally less than the minimum mark for Grade d will be awarded Grade e; those failing to achieve a Grade e will be unclassified.

A candidate's uniform mark for each unit will be combined to give a total uniform mark for the specification. The candidate's overall grade will be determined by the total uniform mark.

The following table shows the minimum total uniform mark required for each overall grade:

Qualification	Maximum Uniform Mark	Qualification Grade								
		A*	A	B	C	D	E	F	G	U
J562	400	360	320	280	240	200	160	120	80	0

3.5   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.

The grade descriptions have been produced by the regulatory authorities in collaboration with the awarding bodies.

Grade F

Candidates use some mathematical techniques, terminology, diagrams and symbols from the Foundation tier consistently, appropriately and accurately. Candidates use some different representations effectively and can select information from them. They complete straightforward calculations competently with and without a calculator. They use simple fractions and percentages, simple formulae and some geometric properties, including symmetry.

Candidates work mathematically in everyday and meaningful contexts. They make use of diagrams and symbols to communicate mathematical ideas. Sometimes, they check the accuracy and reasonableness of their results.

Candidates test simple hypotheses and conjectures based on evidence. Candidates are able to use data to look for patterns and relationships. They state a generalisation arising from a set of results and identify counter-examples. They solve simple problems, some of which are non-routine.

Grade C

Candidates use a range of mathematical techniques, terminology, diagrams and symbols consistently, appropriately and accurately. Candidates are able to use different representations effectively and they recognise some equivalent representations eg numerical, graphical and algebraic representations of linear functions; percentages, fractions and decimals. Their numerical skills are sound and they use a calculator accurately. They apply ideas of proportionality to numerical problems and use geometric properties of angles, lines and shapes.

Candidates identify relevant information, select appropriate representations and apply appropriate methods and knowledge. They are able to move from one representation to another, in order to make sense of a situation. Candidates use different methods of mathematical communication.

Candidates tackle problems that bring aspects of mathematics together. They identify evidence that supports or refutes conjectures and hypotheses. They understand the limitations of evidence and sampling, and the difference between a mathematical argument and conclusions based on experimental evidence.

They identify strategies to solve problems involving a limited number of variables. They communicate their chosen strategy, making changes as necessary. They construct a mathematical argument and identify inconsistencies in a given argument or exceptions to a generalisation.

Grade A

Candidates use a wide range of mathematical techniques, terminology, diagrams and symbols consistently, appropriately and accurately. Candidates are able to use different representations effectively and they recognise equivalent representations for example numerical, graphical and algebraic representations. Their numerical skills are sound, they use a calculator effectively and they demonstrate algebraic fluency. They use trigonometry and geometrical properties to solve problems.

Candidates identify and use mathematics accurately in a range of contexts. They evaluate the appropriateness, effectiveness and efficiency of different approaches. Candidates choose methods of mathematical communication appropriate to the context. They are able to state the limitations of an approach or the accuracy of results. They use this information to inform conclusions within a mathematical or statistical problem.

Candidates make and test hypotheses and conjectures. They adopt appropriate strategies to tackle problems (including those that are novel or unfamiliar), adjusting their approach when necessary. They tackle problems that bring together different aspects of mathematics and may involve multiple variables. They can identify some variables and investigate them systematically; the outcomes of which are used in solving the problem.

Candidates communicate their chosen strategy. They can construct a rigorous argument, making inferences and drawing conclusions. They produce simple proofs and can identify errors in reasoning.

3.6   Quality of written communication

Quality of written communication (QWC) is assessed in Units A502 and A503.

Candidates are expected to:

- ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;
- present information in a form that suits its purpose;
- use a suitable structure and style of writing.

Questions assessing QWC are indicated by an asterisk (*).

In order to help you implement this GCSE Mathematics A specification effectively, OCR offers a comprehensive package of support. This includes:

4.1   Free resources available from the OCR website

The specification and specimen assessment materials are available to download free of charge from the OCR website. Additionally, OCR provides a sample scheme of work and sample lesson plans.

Mock examination papers are available to download free of charge from OCR Interchange.

GCSE Mathematics newsletter

A newsletter for GCSE Mathematics is produced biannually and made available to centres on the OCR website.

4.2   Other resources

OCR offers centres a wealth of high quality published support with a choice of 'Official Publisher Partner' and 'Approved Publication' resources, all endorsed by OCR for use with OCR specifications.

Publisher partners

OCR works in close collaboration with publisher partners to ensure you have access to:

*   Published support materials available when you need them, tailored to OCR specifications
*   High quality resources produced in consultation with OCR subject teams, which are linked to OCR's teacher support materials

OCR — RECOGNISING ACHIEVEMENT   OXFORD UNIVERSITY PRESS
Official Publisher Partnership

Oxford University Press (OUP) is the publisher partner for OCR GCSE Mathematics A.

Oxford University Press (OUP) produces the following resources for OCR GCSE Mathematics A for first teaching from September 2010, available from Spring 2010 (unless stated otherwise):

*   Higher Student Book
*   Foundation Student Book
*   Higher Practice Book
*   Foundation Practice Book
*   Higher Teacher Guide
*   Foundation Teacher Guide
*   Interactive Teacher Guide OxBox CD-ROM
*   Assessment OxBox CD-ROM
*   Higher Revision Guide (available from Autumn 2010)
*   Foundation Revision Guide (available from Autumn 2010)

Endorsed publications

OCR endorses a range of publisher materials to provide quality support for centres delivering its qualifications. You can be confident that materials branded with OCR's 'Official Publishing Partner' or 'Approved publication' logos have undergone a thorough quality assurance process to achieve endorsement. All responsibility for the content of the publisher's materials rests with the publisher.

These endorsements do not mean that the materials are the only suitable resources available or necessary to achieve an OCR qualification.

4.3   Training

Get Ready… introducing the new specification

A series of FREE half-day training events are being run from mid-September 2009, to give you an overview of the new specification.

Get Started…towards successful delivery of the new specification

These events will run until December 2010 and will look at the new specification in more depth, with emphasis on first delivery.

•   Visit http://www.ocr.org.uk/training/ for more details.

Mill Wharf Training

Additional events are also available through our partner, Mill Wharf Training. It offers a range of courses on innovative teaching practice and whole-school issues - www.mill-wharf-training.co.uk.

4.4 OCR support services

Active Results

Active Results is available to all centres offering OCR's GCSE Mathematics specifications.

Active Results is a free results analysis service to help teachers review the performance of individual candidates or whole schools.

Devised specifically for the UK market, data can be analysed using filters on several categories such as gender and other demographic information, as well as providing breakdowns of results by question and topic.

Active Results allows you to look in greater detail at your results:

- Richer and more granular data will be made available to centres including question level data available from e-marking
- You can identify the strengths and weaknesses of individual candidates and your centre's cohort as a whole
- Our systems have been developed in close consultation with teachers so that the technology delivers what you need.

Further information on Active Results can be found on the OCR website.

OCR Mathematics support team

A direct number gives access to a dedicated and trained support team handling all queries relating to GCSE Mathematics and other Mathematics qualifications - 0300 456 3142.

OCR Interchange

OCR Interchange has been developed to help you to carry out day-to-day administration functions online, quickly and easily. The site allows you to register and enter candidates online. In addition, you can gain immediate and free access to candidate information at your convenience. Sign up at https://interchange.ocr.org.uk.

5. Access to GCSE Mathematics A

5.1 Disability Discrimination Act Information relating to Mathematics A

GCSEs often require assessment of a broad range of competences. This is because they are general qualifications and, as such, prepare candidates for a wide range of occupations and higher level courses.

The revised GCSE qualifications and subject criteria were reviewed by the regulators in order to identify whether any of the competences required by the subject presented a potential barrier to any disabled candidates. If this was the case, the situation was reviewed again to ensure that such competences were included only where essential to the subject. The findings of this process were discussed with disability groups and with disabled people.

Reasonable adjustments are made for disabled candidates in order to enable them to access the assessments and to demonstrate what they know and can do. For this reason, very few candidates will have a complete barrier to the assessment. Information on reasonable adjustments is found in *Access Arrangements, Reasonable Adjustments and Special Consideration* produced by the Joint Council (www.jcq.org.uk).

Candidates who are unable to access part of the assessment, even after exploring all possibilities through reasonable adjustments, may still be able to receive an award based on the parts of the assessment they have taken.

The access arrangements permissible for use in this specification are in line with QCDA's GCSE subject criteria equalities review and are as follows:

	Yes/No
Readers	Yes
Scribes	Yes
Practical assistants	Yes
Word processors	Yes
Transcripts	Yes
BSL interpreters	Yes
Oral language modifiers	Yes
MQ papers	Yes
Extra time	Yes

5.2 Arrangements for candidates with particular requirements

All candidates with a demonstrable need may be eligible for access arrangements to enable them to show what they know and can do. The criteria for eligibility for access arrangements can be found in the JCQ document *Access Arrangements, Reasonable Adjustments and Special Consideration.*

Candidates who have been fully prepared for the assessment but who have been affected by adverse circumstances beyond their control at the time of the examination may be eligible for special consideration. Centres should consult the JCQ document *Access Arrangements, Reasonable Adjustments and Special Consideration.*

6.1   Availability of assessment

There are **three** examination series each year, in January, June and November. First certification of this qualification is in June 2012. Thereafter, certification is available in January, June and November of each year for the duration of the qualification.

The availability of units is shown below:

Unit	Nov 2010	Jan 2011	June 2011	Nov 2011	Jan 2012	June 2012	Nov 2012	Jan 2013	June 2013	Nov 2013
A501/01: *Mathematics Unit A (Foundation)*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
A501/02: *Mathematics Unit A (Higher)*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
A502/01: *Mathematics Unit B (Foundation)*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
A502/02: *Mathematics Unit B (Higher)*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
A503/01: *Mathematics Unit C (Foundation)*						✓	✓	✓	✓	✓
A503/02: *Mathematics Unit C (Higher)*						✓	✓	✓	✓	✓

The availability in subsequent years is the same as in 2013.

6.2   Making entries

6.2.1   Making unit entries

Centres must be registered with OCR in order to make any entries, including estimated entries. It is recommended that centres apply to OCR to become a registered centre well in advance of making their first entries.

It is essential that unit entry codes are quoted in all correspondence with OCR.

Candidates must be entered for either option F or H for each unit. Centres must enter each candidate for ONE of the options. It is not possible for centres to offer both options to an individual candidate within the same series, although candidates are permitted one re-sit at the same or a different tier in another series (see 6.4).

Unit code and option	Assessment type	Unit code and title
A501 option F	Written paper	A501/01: *Mathematics Unit A (Foundation)*
A501 option H	Written paper	A501/02: *Mathematics Unit A (Higher)*
A502 option F	Written paper	A502/01: *Mathematics Unit B (Foundation)*
A502 option H	Written paper	A502/02: *Mathematics Unit B (Higher)*
A503 option F	Written paper	A503/01: *Mathematics Unit C (Foundation)*
A503 option H	Written paper	A503/02: *Mathematics Unit C (Higher)*

6.2.2 Qualification entries

Candidates must enter for qualification certification separately from unit assessment(s). If a certification entry is **not** made, no overall grade can be awarded.

Candidates must enter for:

• OCR GCSE in Mathematics A – J562

It is not necessary to stipulate Foundation or Higher as an option.

A candidate who has completed all the units required for the qualification must enter for certification in the same examination series in which the terminal rule is satisfied.

GCSE certification is available from June 2012.

6.3 Terminal rule

Candidates must take at least 40% of the assessment in the same series they enter for certification of the qualification.

A 'Guidance on Terminal Rule' document can be found on the OCR website.

6.4 Unit and qualification re-sits

Candidates may re-sit each unit once before entering for certification for a GCSE.

Candidates may enter for the qualification an unlimited number of times.

6.5 Enquiries about Results

Under certain circumstances, a centre may wish to query the result issued to one or more candidates. Enquiries about Results for GCSE units must be made immediately following the series in which the relevant unit was taken (by the Enquiries about Results deadline).

Please refer to the *JCQ Post-Results Services* booklet and the *OCR Admin Guide* for further guidance about action on the release of results. Copies of the latest versions of these documents can be obtained from the OCR website.

6.6   Shelf-life of units

Individual unit results, prior to certification of the qualification, have a shelf-life limited only by that of the qualification.

6.7   Prohibited qualifications and classification code

Every specification is assigned a national classification code indicating the subject area to which it belongs. The classification code for this specification is 2210.

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.

Centres may wish to advise candidates that, if they take two specifications with the same classification code, schools and colleges are very likely to take the view that they have achieved only one of the two GCSEs. The same view may be taken if candidates take two GCSE specifications that have different classification codes but have significant overlap of content. Candidates who have any doubts about their subject combinations should seek advice, for example from their centre or the institution to which they wish to progress.

7.1 Overlap with other qualifications

There is a small degree of overlap between the content of this specification and those for GCSE Statistics and Free Standing Mathematics Qualifications.

7.2 Progression from this qualification

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

Progression to further study from GCSE will depend upon the number and nature of the grades achieved. Broadly, candidates who are awarded mainly Grades D to G 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 A* to C at GCSE would be well prepared for study at Level 3 within the National Qualifications Framework.

This specification provides progression from the Entry Level Certificate in Mathematics specification R448.

7.3 Avoidance of bias

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

7.4 Code of practice/common criteria requirements/subject criteria

This specification complies in all respects with the current *GCSE, GCE and AEA Code of Practice* as available on the Ofqual website, *The Statutory Regulation of External Qualifications 2004,* and the subject criteria for GCSE Mathematics.

7.5 Language

This specification and associated assessment materials are in English only.

7.6   Spiritual, moral, ethical, social, legislative, economic and cultural issues

This specification offers opportunities which can contribute to an understanding of these issues in the following topics.

Issue	Opportunities for developing an understanding of the issue during the course
Spiritual issues	Spiritual development: helping candidates obtain an insight into the infinite, and explaining the underlying mathematical principles behind natural forms and patterns.
Moral issues	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 issues	Social development: 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.
Economic issues	Economic development: helping candidates make informed decisions about the management of money.
Cultural issues	Cultural development: helping candidates appreciate that mathematical thought contributes to the development of our culture and is becoming increasingly central to our highly technological future, and recognising that mathematicians from many cultures have contributed to the development of modern day mathematics.

7.7   Sustainable development, health and safety considerations and European developments, consistent with international agreements

This specification supports these issues, consistent with current EU agreements, through questions set in relevant contexts.

Sustainable development issues could be supported through questions set on carbon emissions or life expectancy, for example.

Health and safety considerations could be supported through questions on maximum safe loads or a nutrition analysis, for example.

European developments could be supported through questions on currency and foreign exchange, for example.

OCR encourages teachers to use appropriate contexts in the delivery of the subject content.

7.8   Key Skills

This specification provides opportunities for the development of the Key Skills of *Communication, Application of Number, Information Technology, Working with Others, Improving Own Learning and Performance and Problem Solving* at Levels 1 and/or 2. However, the extent to which this evidence fulfils the Key Skills criteria at these levels will be totally dependent on the style of teaching and learning adopted.

The following table indicates where opportunities may exist for at least some coverage of the various Key Skills criteria at Levels 1 and/or 2.

	C		AoN		IT		WwO		IoLP		PS	
	1	2	1	2	1	2	1	2	1	2	1	2
J562	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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.

7.9   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, knowing how to
    o enter complex calculations
    o use an extended range of function keys, including trigonometrical and statistical functions relevant to the programme of study

Questions will be set in Units A501 and A503 that will specifically test the use of calculators.

In addition, the programme of study requires candidates to:

*   Become familiar with a range of resources, including ICT such as spreadsheets, dynamic geometry, graphing software and calculators, to develop mathematical ideas.

7.10   Citizenship

Since September 2002, the National Curriculum for England at Key Stage 4 has included a mandatory programme of study for Citizenship. Parts of the programme of study for Citizenship (2007) may be delivered through an appropriate treatment of other subjects.

This section offers examples of opportunities for developing knowledge, skills and understanding of citizenship issues during this course.

This mathematics specification aids candidates in analysing **how information is used in public debate and policy formation, including information from the media and from pressure and interest groups,** through its statistical content.

The key process of **critical thinking and enquiry** can be developed, for example, where candidates have to decide for themselves how to solve a mathematical problem, or decide which information is relevant and redundant.

Need more help?

Our aim is to assist you however we can.

As well as giving you a toolkit of support services and resources to pick and choose from, we're also here to help you with specialist advice, guidance and support for those times when you simply need a more individual service.

Here's how to contact us for specialist advice:

By phone: 0300 456 3142

By email: maths@ocr.org.uk

By fax: 024 76 851633

By post: Customer Contact Centre, OCR, Progress House, Westwood Business Park, Coventry CV4 8JQ

www.ocr.org.uk

OCR customer contact centre

GCSE Maths

Dedicated Maths Support Line   0300 456 3142

Facsimile   024 76 851633

Email   maths@ocr.org.uk

PART OF THE
CAMBRIDGE ASSESSMENT
GROUP

BSI
UKAS
QUALITY
MANAGEMENT
003

FS 27093