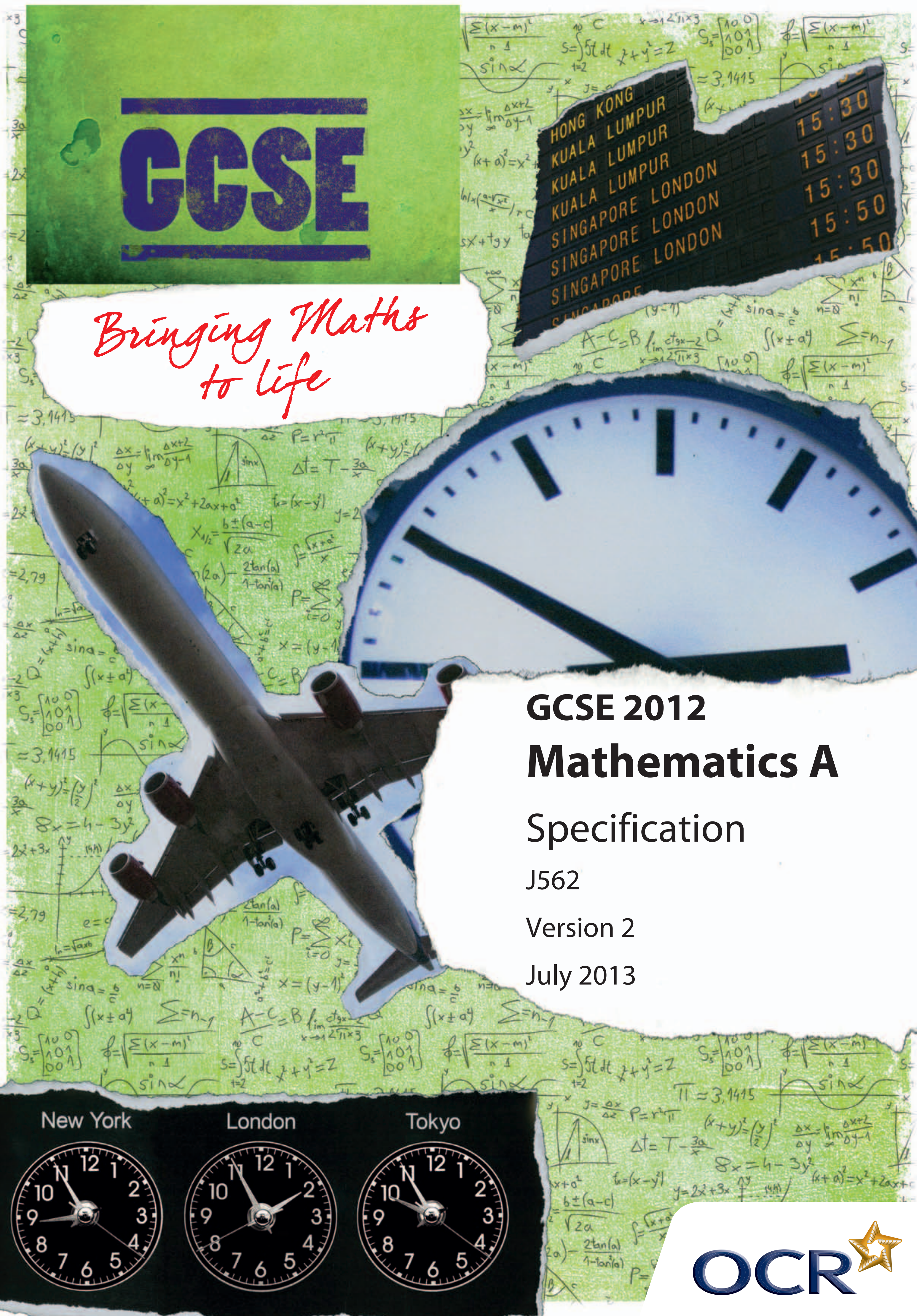

GCSE 2012

Mathematics A

Specification

J562

Version 2

July 2013

OCR

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Contents

1 Introduction to GCSE Mathematics A

1.1 Overview of GCSE Mathematics A

Unit A501/01 *Mathematics Unit A (Foundation)*		Unit A501/02 *Mathematics Unit A (Higher)*
Written paper 1 hour 60 marks 25% of the qualification Calculator permitted	**or**	Written paper 1 hour 60 marks 25% of the qualification Calculator permitted

AND

Unit A502/01 *Mathematics Unit B (Foundation)*		Unit A502/02 *Mathematics Unit B (Higher)*
Written paper 1 hour 60 marks 25% of the qualification Calculator **not** permitted	**or**	Written paper 1 hour 60 marks 25% of the qualification Calculator **not** permitted

AND

Unit A503/01 *Mathematics Unit C (Foundation)*		Unit A503/02 *Mathematics Unit C (Higher)*
Written paper 1 hour 30 mins 100 marks 50% of the qualification Calculator permitted	**or**	Written paper 2 hours 100 marks 50% of the qualification Calculator permitted

1.2 Guided learning hours

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

1.3 Aims and learning outcomes

GCSE specifications in Mathematics should encourage learners to be inspired, moved and changed by following a broad, coherent, satisfying and worthwhile course of study. They should help learners to develop confidence in, and a positive attitude towards, mathematics and to recognise the importance of mathematics in their own lives and to society. Specifications should prepare learners to make informed decisions about the use of technology, the management of money, further learning opportunities and career choices.

The aims of this specification are to enable candidates to:

- develop knowledge, skills and understanding of mathematical methods and concepts
- acquire and use problem-solving strategies
- select and apply mathematical techniques and methods in mathematical, everyday and real-world situations
- reason mathematically, make deductions and inferences and draw conclusions
- interpret and communicate mathematical information in a variety of forms appropriate to the information and context.

1.4 Prior learning

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

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
- Hierarchy of operations
- Ratio
- Factors, multiples and primes
- General algebra and coordinates
- Sequences and formulae
- Equations and expressions
- General measures
- Constructions
- Maps
- Pythagoras' theorem in 2D
- Data handling

Unit A501/02:
Mathematics Unit A (Higher)

- General problem solving skills
- Number
- Hierarchy of operations
- Ratio
- Factors, multiples and primes
- General algebra and coordinates
- Sequences and formulae
- Equations and expressions
- 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:	
	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 • Write 13 066 using words • Write 13 066 correct to the nearest 100 • Write 13·066 correct to 1 decimal place
	a. use their previous understanding of integers and place value to deal with arbitrarily large positive numbers;	
	b. round numbers to a given power of 10;	
	c. round to the nearest integer, to a given number of decimal places and to one significant figure.	
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) • Calculate $1{\cdot}6^3, \sqrt{7{\cdot}29}$ $\frac{2{\cdot}6 - 0{\cdot}8}{0{\cdot}2}$, $\sqrt[3]{6{\cdot}1^2 - 0{\cdot}81}$ • When using money interpret a calculator display of 2·6 as £2·60
	a. use calculators effectively and efficiently;	
	b. know how to enter complex calculations and use function keys for reciprocals, squares and powers;	
	c. enter a range of calculations, including those involving measures.	

FA3 Hierarchy 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 $\frac{(6+8)^2}{2{\cdot}5^2 - 1{\cdot}5^2}$

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;	• 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).	

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 (2) Write 96 as a product of prime factors using indices
	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).	

FA6 General algebra and coordinates		Examples
6.1 - Symbols and notation	Candidates should be able to:	These statements are repeated across all Foundation Units (1) $5x + 1 = 16$ (2) $V = IR$ (3) $y = 2x$
	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(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: 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.	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

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: 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].	(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 $y = mx + c$
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; b. generate common integer sequences (including sequences of odd or even integers, squared integers, powers of 2, powers of 10, triangular numbers).	(1) Write down the first two terms of the sequence whose nth term is $3n - 5$
7.3 - Use linear expressions to describe the nth term of an arithmetic sequence	Candidates should be able to: 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.	Foundation also includes simple sequence of odd or even numbers, squared integers and sequences derived from diagrams

FA8 Equations and expressions		Examples
8.1 - Manipulate algebraic expressions	Candidates should be able to: 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).	(1) $a(b + c) = ab + ac$ (2) $x + 5 - 2x - 1 = 4 - x$ (3) $9x - 3 = 3(3x - 1)$ or $x^2 - 3x = x(x - 3)$
8.2 - Set up and solve simple equations	Candidates should be able to: 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.	(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) $11 - 4x = 2$; $3(2x + 1) = 8$; $2(1 - x) = 6(2 + x)$; $3x^2 = 48$; $3 = \frac{12}{x}$

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 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;	(1) Use bearings to specify direction
	b. know that measurements using real numbers depend on the choice of unit;	(2) Given a picture of a building and an adult man, estimate the height of the building in metres
	c. understand angle measure using the associated language[(1)];	(3) A water barrel holds 10 gallons. Roughly how many litres is this?
	d. make sensible estimates of a range of measures in everyday settings[(2)];	
	e. convert measurements from one unit to another;	
	f. know approximate 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: 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)].	(1) Use a ruler and protractor to construct triangle ABC with AB = 5cm, BC = 6cm and angle ABC = 30°
10.2 - Use straight edge and a pair of compasses to do constructions	Candidates should be able to: a. use straight edge and a pair of compasses to do standard 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)].	(1) Use a ruler and a pair of compasses to construct a triangle with sides 4cm, 8cm and 9cm (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. find loci, by reasoning, to produce shapes and paths.	A region bounded by a circle and an intersecting line

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:	
	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 • Write 13 066 using words • Write 13 066 correct to the nearest 100 • Write 13·066 correct to 1 decimal place
	a. use their previous understanding of integers and place value to deal with arbitrarily large positive numbers;	
	b. round numbers to a given power of 10;	
	c. round to the nearest integer, to a given number of decimal places and to one significant figure.	
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) • Calculate $1{\cdot}6^3, \sqrt{7{\cdot}29}, \frac{2{\cdot}6-0{\cdot}8}{0{\cdot}2}, \sqrt[3]{6{\cdot}1^2-0{\cdot}81}$ • When using money interpret a calculator display of 2·6 as £2·60
	a. use calculators effectively and efficiently;	
	b. know how to enter complex calculations and use function keys for reciprocals, squares and powers;	
	c. enter a range of calculations, including those involving measures.	

HA3 Hierarchy 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 $\frac{(6+8)^2}{2{\cdot}5^2 - 1{\cdot}5^2}$

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:	• Write the ratio 24:60 in its simplest form
	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:	(1) Divide £120 in the ratio 3:7
	a. divide a quantity in a given ratio(1);	(2) 8 calculators cost £59·52. How much do 3 calculators cost?
	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).	

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 (2) Write 96 as a product of prime factors using indices
	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).	

HA6 General algebra and coordinates		Examples
6.1 - Symbols and notation	Candidates should be able to:	These statements are repeated across all Higher Units These examples relate specifically to Higher tier:
	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) $x^2 + 1 = 82$**
	b. know that letter symbols represent definite unknown numbers in equations[(1)], defined quantities or variables in formulae **and general, unspecified independent numbers in identities[(2)];**	**(2) $(x + 1)^2 \equiv x^2 + 2x + 1$ for all values of x**
	c. know that in functions, letter symbols define new expressions or quantities by referring to known quantities[(3)].	**(3) $y = 2 - 7x$; $y = \frac{1}{x}$ with $x \neq 0$** **f(x) notation may be used e.g.** • **Find f(4) when $f(x) = x^2 - 2x$.** • **What is f(2x) when $f(x) = 3x + 1$?** • **$f(x) = 4x - 3$; find the values a and b if $f(x + 2) = ax + b$.**
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'.	**Find the values of a and b in the identity $4x + 2(3x + 1) \equiv ax + b$.**
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;	
	d. locate points with given coordinates[(1)];	(1) Plot (3, 6) and (2, -4) on the grid provided
	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: 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].	(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 $y = mx + c$
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; b. generate common integer sequences (including sequences of odd or even integers, squared integers, powers of 2, powers of 10, triangular numbers).	(1) Write down the first two terms of the sequence whose nth term is $3n - 5$
7.3 - Use linear expressions to describe the nth term of an arithmetic sequence	Candidates should be able to: 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.	Foundation also includes simple sequence of odd or even numbers, squared integers and sequences derived from diagrams

HA8 Equations and expressions		Examples
8.1 - Manipulate algebraic expressions	Candidates should be able to: 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).	(1) $a(b + c) = ab + ac$ (2) $x + 5 - 2x - 1 = 4 - x$ (3) $9x - 3 = 3(3x - 1)$ or $x^2 - 3x = x(x - 3)$
8.2 - Set up and solve simple equations	Candidates should be able to: 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.	(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) $11 - 4x = 2$; $3(2x + 1) = 8$; $2(1 - x) = 6(2 + x)$; $3x^2 = 48$; $3 = \frac{12}{x}$

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 (1) Use bearings to specify direction (2) Given a picture of a building and an adult man, estimate the height of the building in metres (3) A water barrel holds 10 gallons. Roughly how many litres is this?
	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);	
	d. make sensible estimates of a range of measures in everyday settings(2);	
	e. convert measurements from one unit to another;	
	f. know approximate 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 (2) Construct the locus of points equidistant from P and Q (3) AB and BC
	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).	
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:	
	a. **understand, recall and use trigonometrical relationships in right-angled triangles, and use these to solve problems, including those involving bearings.**	• **Use sin, cos and tan to find lengths and angles in right angled and isosceles triangles**

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

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; 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.	(1) Including random and stratified sampling

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:	Statements a, b, c, e and f are repeated in Unit A503 (Number)
	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;	(1) Multiplication by $\frac{1}{5}$ is equivalent to division by 5
	e. multiply and divide a fraction by an integer and by a unit fraction;	
	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:	
	a. use decimal notation and recognise that each terminating decimal is a fraction(1);	(1) $0{\cdot}137 = \frac{137}{1000}$
	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:	
	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).	

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 Foundation 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) $V = IR$
	c. know that in functions, letter symbols define new expressions or quantities by referring to known quantities[(3)].	(3) $y = 2x$
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 statements 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';	
	c. use axes and coordinates to specify points in all four quadrants;	
	d. locate points with given coordinates[(1)].	(1) Plot (3, 6) and (2, -4) on the grid provided

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;	(1) Includes the order of rotation symmetry of a shape
	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);	(2) Includes reflection in *x*-axis or *y*-axis or in a given mirror line
	d. understand that translations are specified by a column vector;	
	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;	
	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);	(4) Includes enlarging a shape on a grid and enlarging a shape by a scale factor given the centre of enlargement
	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:	Statements a, b, c, e, f and j are repeated in Unit A503 (Number)
	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;	
	f. understand and use unit fractions as multiplicative inverses[1];	(1) Multiplication by $\frac{1}{5}$ is equivalent to division by 5
	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;	**(2)** $\mathbf{3\frac{2}{3} \times 2\frac{1}{4}}$
	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[2].**	
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) $0{\cdot}137 = \frac{137}{1000}$
	b. recognise that recurring decimals are exact fractions;	**(2) Convert $0{\cdot}\dot{3}$ to a fraction**
	c. know that some exact fractions are recurring decimals;	
	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 $n^{\frac{1}{2}} = \sqrt{n}$ and $n^{\frac{1}{3}} = \sqrt[3]{n}$ 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 Higher 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 and independent numbers in identities(2);**	**(1)** $x^2 + 1 = 82$ **(2)** $(x + 1)^2 \equiv x^2 + 2x + 1$ **for all values of** x
	c. know that in functions, letter symbols define new expressions or quantities by referring to known quantities[(3)].	**(3)** $y = 2 - 7x$; $y = \frac{1}{x}$ **with** $x \neq 0$ **f(x) notation may be used e.g.** • **Find f(4) when** $f(x) = x^2 - 2x$. • **What is** $f(2x)$ **when** $f(x) = 3x + 1$? • $f(x) = 4x - 3$; **find the values** a **and** b **if** $f(x + 2) = ax + b$.
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'.	**Find the values of** a **and** b **in the identity** $4x + 2(3x + 1) \equiv ax + b$.
5.3 - Use the conventions for coordinates in the plane	Candidates should be able to:	These statements 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';	
	c. use axes and coordinates to specify points in all four quadrants;	
	d. locate points with given coordinates[(1)].	(1) Plot (3, 6) and (2, -4) on the grid provided

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)** **(2) Know that the line with equation $y = \frac{x}{5}$ is perpendicular to these lines and has gradient $\frac{1}{5}$**
	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;**	
	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;	(1) Includes the order of rotation symmetry of a shape
	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);	(2) Includes reflection in *x*-axis or *y*-axis or in a given mirror line
	d. understand that translations are specified by a column vector;	
	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;	
	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:	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;	

FC1 General problem solving skills		Examples
	Candidates should be able to:	
	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; 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:	Statements a and b are repeated from Unit A502 Statements d, e, f, g and h are repeated from Unit A502 (Fractions, decimals and percentages) (1) Multiplication by $\frac{1}{5}$ is equivalent to division by 5
	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[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 (1) Round 345·46 to the nearest integer, 1 decimal place, 2 significant figures (2) Know that 3·5 on a calculator means 3·50 in money context (3) Know that 3·66666667 on a calculator is a recurring decimal
	a. round to the nearest integer, to any number of decimal places, specified or appropriate, and to any number of significant figures[1];	
	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;	
	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.	

FC2 Number		Examples
2.3 - Use calculators effectively and efficiently	Candidates should be able to: a. use calculators effectively and efficiently; b. know how to enter complex calculations and use function keys for reciprocals, squares and powers; c. enter a range of calculations, including those involving measures.	Statements a to c are repeated from Unit A501 • Calculate $1{\cdot}6^3, \sqrt{7{\cdot}29}$, $\frac{2{\cdot}6-0{\cdot}8}{0{\cdot}2}$, $\sqrt[3]{6{\cdot}1^2-0{\cdot}81}$ • When using money interpret a calculator display of 2·6 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 Foundation 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) $V = IR$
	c. know that in functions, letter symbols define new expressions or quantities by referring to known quantities[(3)].	(3) $y = 2x$
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, 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;	Statement b occurs across all three Units but without the inclusion of 3D coordinates, which only appear in this Unit
	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';	
	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:	
	a. understand that the transformation of algebraic expressions obeys and generalises the rules of general arithmetic(1);	(1) $a(b + c) = ab + ac$
	b. manipulate algebraic expressions by collecting like terms(2), by multiplying a single term over a bracket, and by taking out common factors(3).	(2) $x + 5 - 2x - 1 = 4 - x$ (3) $9x - 3 = 3(3x - 1)$ or $x^2 - 3x = x(x - 3)$
6.2 - Use trial and improvement to solve equations	Candidates should be able to:	
	a. use systematic trial and improvement to find approximate solutions of equations where there is no simple analytical method of solving them(1).	(1) $x^3 = x - 900$; $\frac{1}{x} = x^2 - 5$

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
	a. discuss and interpret graphs modelling real situations.	Graphs may not be linear. Purely linear cases are dealt with in Unit A502
7.2 - Plot graphs of simple quadratic functions	Candidates should be able to:	
	a. generate points and plot graphs of simple quadratic functions(1);	(1) $y = x^2$; $y = 3x^2 + 4$
	b. find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function(2).	(2) Solve $3x^2 + 4 = 8$ from graph of $y = 3x^2 + 4$

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 (1) Use bearings to specify direction (2) Convert $23cm^2$ to mm^2 (3) A water barrel holds 10 gallons. Roughly how many litres is this? (4) How far do you go in 3 hours travelling at 40 mph?
	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);	
	d. convert measurements from one unit to another;	
	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 (1) Could involve semicircles, and inverse problems e.g. find the diameter if the circumference is 60cm (2) Could involve inverse calculations - find the length of an edge given the volume and two other edges
	a. find areas of rectangles, recalling the formula, understanding the connection to counting squares;	
	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;	
	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:	(1) Use of isometric paper is included (2) Cube, cuboid and simple pyramids (3) Could include cylinders
	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);	
	c. draw nets of 3D objects(2);	
	d. solve problems involving the surface area and volume of prisms(3);	
	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:	
	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;	(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);	
	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;	
	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:	Statements a and b are repeated from Unit A502 Statements d, e, f, g, h and i are repeated from Unit A502 (Fractions, decimals and percentages) (1) Multiplication by $\frac{1}{5}$ is equivalent to division by 5 **(2)** $\mathbf{3\frac{2}{3} \times 2\frac{1}{4}}$
	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(1);	
	i. **multiply and divide a fraction by a general fraction(2).**	
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 (1) Round 345·46 to the nearest integer, 1 decimal place, 2 significant figures (2) Know that 3·5 on a calculator means 3·50 in money context (3) Know that 3·66666667 on a calculator is a recurring decimal
	a. round to the nearest integer, to any number of decimal places, specified or appropriate, and to any number of significant figures(1);	
	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;	
	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.	

HC2 Number		Examples
2.3 - Use calculators effectively and efficiently, including statistical and trigonometrical functions	Candidates should be able to:	Statements a to c are repeated from Unit A501
	a. use calculators effectively and efficiently(1);	**(1)** Calculate 1.6^3, $\sqrt{7.29}$, $\frac{2.6-0.8}{0.2}$, $\sqrt[3]{6.1^2-0.81}$
	b. know how to enter complex calculations and use function keys for reciprocals, squares and powers;	
	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)** $\frac{5 \times \sin 35}{\sin 62}$
	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)** $(2{\cdot}4 \times 10^7) \times (5 \times 10^3)$ $= 1{\cdot}2 \times 10^{11}$ OR $(2{\cdot}4 \times 10^7) \div (5 \times 10^3)$ $= 4{\cdot}8 \times 10^3$
	b. **order with numbers written in standard form;**	
	c. **calculate standard index form(1);**	
	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.**	**(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 × $1{\cdot}04^3$**
	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);	**(2) A tank can be emptied using 6 pumps in 18 hours. How long will it take to empty the tank using 8 pumps?**
	b. **calculate an unknown quantity from quantities that vary in direct or inverse proportion(2);**	**(3) $y \propto x^2$ and $x = 4$ when $y = 8$. Find y when $x = 12$.**
	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.**	
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: 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)].	These statements are repeated across all Higher 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) $y = 2 - 7x$; $y = \frac{1}{x}$ with $x \neq 0$** **f(x) notation may be used e.g.** • **Find f(4) when $f(x) = x^2 - 2x$.** • **What is f(2x) when $f(x) = 3x + 1$?** • **$f(x) = 4x - 3$; find the values a and b if $f(x + 2) = ax + b$.**
6.2 - Algebraic terminology	Candidates should be able to: a. distinguish in meaning between the words ‘equation’, ‘formula’, ‘**identity**’ and ‘expression’.	This statement is repeated across all Higher Units **Find the values of a and b in the identity $4x + 2(3x + 1) \equiv ax + b$.**
6.3 - Use the conventions for coordinates in the plane	Candidates should be able to: 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’; c. use axes and coordinates to specify points in all four quadrants; d. locate points with given coordinates.	Statements a, c and d occur across all three Units, where an understanding of coordinates is needed to complete other sections of the work. Statement b occurs across all three Units but without the inclusion of 3D coordinates, which only appear in this Unit

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

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. Graphs may not be linear. Purely linear cases are dealt with in Unit A502
	a. discuss and interpret graphs;	
	b. **construct the graphs of simple loci, modelling real situations.**	
8.2 - Plot graphs of simple quadratic functions	Candidates should be able to:	
	a. generate points and plot graphs of simple quadratic functions(1);	(1) $y = x^2$; $y = 3x^2 + 4$
	b. find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function(2);	(2) Solve $3x^2 + 4 = 8$ from graph of $y = 3x^2 + 4$
	c. **generate points and plot graphs of more general quadratic functions(3);**	**(3) $y = x^2 - 2x + 1$**
	d. **construct quadratic and other functions from real life problems(4) and plot their corresponding graphs.**	**(4) A rectangular lawn has an area of 28m^2 and a perimeter of 22m. Find the length and width of the lawn.**
8.3 - Find approximate solutions of a pair of linear and quadratic functions	Candidates should be able to:	
	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).**	**(1) Use a graphical method to solve these simultaneous equations: $y = x + 7$ and $y = x^2 - 2x + 2$**
8.4 - Construct non-linear graphs	Candidates should be able to:	
	a. **plot graphs of simple cubic functions(1), the reciprocal function $y = \frac{1}{x}$ 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 $y = \cos x$;**	**(1) Draw the graph of $y = x^3 - 5x + 2$ for $-3 \leqslant x \leqslant 3$**
	b. **recognise the characteristic shapes of all these functions(2).**	**(2) Given that $\sin 30° = 0{\cdot}5$, find the solutions of $\sin x = 0{\cdot}5$ for $0 \leqslant x \leqslant 360°$**
8.5 - Transform functions	Candidates should be able to:	
	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).**	**(1) Sketch the graph of (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 (1) Use bearings to specify direction (2) Convert 23cm^2 to mm^2 (3) A water barrel holds 10 gallons. Roughly how many litres is this? (4) How far do you go in 3 hours travelling at 40 mph?
	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);	
	d. convert measurements from one unit to another;	
	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;	(2) Could involve inverse calculations - find the length of an edge given the volume and two other edges
	c. work out the surface area of simple shapes using the area formulae for triangles and rectangles;	**(3) Calculate the volume of a sphere of radius 1·5cm**
	d. calculate perimeters and areas of shapes made from triangles and rectangles;	**(4) Calculate the arc length of the sector of a circle radius 5cm subtended by an angle of 65°**
	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;	
	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; b. use 2D representations of 3D objects(1); analyse 3D objects through 2D projections (including plan and elevation) and cross-sections; c. draw nets of 3D objects(2); d. solve problems involving the surface area and volume of prisms(3); e. construct nets of cubes, regular tetrahedra, square-based pyramids and other 3D shapes from given information; 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).**	(1) Use of isometric paper is included (2) Cube, cuboid and simple pyramids (3) Could include cylinders **(4) The surface area of a sphere is 114cm^2. Find the radius of the sphere.** **(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.**
10.3 - Enlargement	Candidates should be able to: 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; c. understand the implications of enlargement for perimeter(1); d. understand the implications of enlargement for area and volume(2); e. **understand and use the effect of enlargement on areas and volumes of shapes and solids(3).**	(1) Know that sf 2 also doubles perimeter (2) Know that sf 2 does not double area or volume **(3) A carton of yoghurt holds 100ml. A similar carton is 1·5 times as tall. How much yoghurt does it hold?**

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:	(1) Use impossible, certain, evens, likely, unlikely (2) Associate 0, 0·5, 1 with impossible, evens and certain and position events on a probability scale (3) Use a sample space or list combinations systematically e.g. for 2 dice (4) Given the P(A) find P(not A), and given P(A) and P(B) find P(not A or B) (5) Compare the dice experiment results to theoretical and comment on possible bias **Includes conditional probability** **(6) Probability of winning a match is 0·4. Probability of drawing is 0·3. Find probability of winning or drawing.** **(7) Two dice are thrown. Find the probability of getting two sixes.** **(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.**
	a. use the vocabulary of probability to interpret results involving uncertainty and prediction(1);	
	b. understand and use the probability scale(2);	
	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);	
	e. identify different mutually exclusive outcomes;	
	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;	
	h. compare experimental data to theoretical probabilities(5);	
	i. **know when to add or multiply probabilities:** **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).**	

Assessment of GCSE Mathematics A

3

3.1 Overview of the assessment in GCSE Mathematics A

For GCSE Mathematics A candidates must take all three units.

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.
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 hour 30 mins 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

All written papers are set in one of two tiers: Foundation tier and Higher tier. Foundation tier papers assess grades g to c and Higher tier papers assess grades d to a*. An allowed grade e may be awarded on the Higher tier papers.

Candidates may enter for either the Foundation tier or Higher tier in each of the units. For example, a candidate 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 (AOs)

Candidates are expected to demonstrate their ability to:

	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 anaylse problems and generate strategies to solve them	15-25

AO weightings – GCSE Mathematics A
The relationship between the units and the assessment objectives of the scheme of assessment 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. Grades are indicated on certificates. However, results for candidates who fail to achieve the minimum grade (G or g) will be recorded as unclassified (U or u) and this is not certificated.

Most GCSEs are unitised schemes. 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 may 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. The raw mark boundary marks are converted to the equivalent uniform mark boundary. 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, e.g. 70/100.

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

(GCSE) Unit Weighting	Maximum Unit Uniform Mark	Unit Grade								
		a*	a	b	c	d	e	f	g	u
25% F	69	-	-	-	60	50	40	30	20	0
25% H	100	90	80	70	60	50	45	-	-	0
50% F	139	-	-	-	120	100	80	60	40	0
50% H	200	180	160	140	120	100	90	-	-	0

Higher tier candidates who fail to gain a 'd' grade may achieve an "allowed e". Higher tier candidates who miss the allowed grade 'e' will be graded as 'u'.

A candidate's uniform marks for each unit are aggregated and grades for the specification are generated on the following scale:

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

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

The candidate's grade will be determined by the total uniform mark.

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 e.g. 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 an appropriate style of writing and, where applicable, specialist terminology.

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

4 Support for GCSE Mathematics A

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 following materials will be available on the OCR website:

- GCSE Mathematics A specification
- specimen assessment materials for each unit
- sample schemes of work and lesson plans

Additional sample assessment materials for each unit can be found on OCR Interchange.

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.

4.2.1 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:

- 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
- Foundation Revision Guide

4.2.2 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

OCR will offer a range of support activities for all practitioners throughout the lifetime of the qualification to ensure they have the relevant knowledge and skills to deliver the qualification.

Please see Event Booker for further information.

4.4 OCR support services

4.4.1 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.

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.

4.4.2 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.

4.4.3 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 on the OCR website.

Equality and Inclusion in GCSE Mathematics A 5

5.1 Equality Act information relating to GCSE 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 qualification 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* 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 Ofqual's GCSE subject criteria equalities review and are as follows:

	Yes/No	Type of Assessment
Readers	Yes	All assessments
Scribes	Yes	All assessments
Practical assistants	Yes	All assessments
Word processors	Yes	All assessments
Transcripts	Yes	All assessments
BSL interpreters	Yes	All assessments
Oral language modifiers	Yes	All assessments
Modified question papers	Yes	All assessments
Extra time	Yes	All assessments

5.2 Arrangements for candidates with particular requirements (including Special Consideration)

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. As above, centres should consult the JCQ document *Access Arrangements, Reasonable Adjustments and Special Consideration*.

6 Administration of GCSE Mathematics A

The sections below explain in more detail the rules that apply from the June 2014 examination series onwards.

6.1 Availability of assessment from 2014

There will be:

- one examination series available each year in June to **all** candidates
- one re-take opportunity available in November each year for candidates who have already certificated in GCSE Mathematics with any awarding body.

	Unit A501	Unit A502	Unit A503	Certification availability
June 2014	✓	✓	✓	✓
November 2014	Re-take only	Re-take only	Re-take only	Re-take only
June 2015	✓	✓	✓	✓
November 2015	Re-take only	Re-take only	Re-take only	Re-take only

6.2 Certification rules

For GCSE Mathematics A, a 100% terminal rule applies. Candidates must enter for all their units in the series in which the qualification is certificated.

6.3 Rules for re-taking a qualification

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

Where a candidate re-takes a qualification, all units must be re-entered and **all** units must be re-taken in the same series as the qualification is re-certificated. The new results for these units will be used to calculate the new qualification grade. Any results previously achieved cannot be re-used.

6.4 Making entries

6.4.1 Unit entries

Centres must be approved to offer OCR qualifications before they can make any entries, including estimated entries. It is recommended that centres apply to OCR to become an approved centre well in advance of making their first entries. Centres must have made an entry for a unit in order for OCR to supply the appropriate forms and administrative materials.

It is essential that correct unit entry codes are used when making unit entries.

For units A501, A502 and A503 candidates must be entered for either component 01 (Foundation tier) or 02 (Higher tier) using the appropriate unit entry code from the table below. It is not possible for a candidate to take both components for a particular unit within the same series; however, different units may be taken at different tiers.

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

6.4.2 Certification entries

Candidates must be entered 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:

- GCSE Mathematics A certification code J562.

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 and by the relevant enquiries about results deadline for that series.

Please refer to the *JCQ Post-Results Services* booklet and the *OCR Admin Guide: 14–19 Qualifications* for further guidance on enquiries about results and deadlines. Copies of the latest versions of these documents can be obtained from the OCR website.

6.6 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, 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, either from their centre or from the institution to which they wish to progress.

Other information about GCSE Mathematics A

7

7.1 Overlap with other qualifications

There is a small degree of overlap between the content of this specification and that 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. Special focus is given to the 9 strands of the Equality Act with the aim of ensuring both direct and indirect discrimination is avoided.

7.4 Regulatory requirements

This specification complies in all respects with the current: *General Conditions of Recognition; GCSE, GCE, Principal Learning and Project Code of Practice and the GCSE subject criteria for Mathematics*. All documents are available on the Ofqual website.

7.5 Language

This specification and associated assessment materials are in English only. Only answers written in English will be assessed.

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 and Communication 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		ICT		WwO		IoLP		PS	
	1	2	1	2	1	2	1	2	1	2	1	2
J562	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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
  - enter complex calculations
  - 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.

Your checklist

Our aim is to provide you with all the information and support you need to deliver our specifications.

- ✓ Bookmark **www.ocr.org.uk/gcse2012**
- ✓ Be among the first to hear about support materials and resources as they become available. Register for email updates at **www.ocr.org.uk/updates**
- ✓ Book your inset training place online at **www.ocreventbooker.org.uk**
- ✓ Learn more about active results at **www.ocr.org.uk/activeresults**
- ✓ Join our social network community for teachers at **www.social.ocr.org.uk**

Need more help?

Here's how to contact us for specialist advice:

Phone: **0300 456 3142**

Email: **maths@ocr.org.uk**

Online: **http://answers.ocr.org.uk**

Fax: **01223 552627**

Post: **Customer Contact Centre, OCR, Progress House, Westwood Business Park, Coventry CV4 8JQ**

What to do next

Become an approved OCR centre – if your centre is completely new to OCR and has not previously used us for any examinations, visit **www.ocr.org.uk/centreapproval** to become an approved OCR centre.

HOW TO GET IN TOUCH

OCR Mathematics support team

If you'd like to find out more about our Mathematics qualifications, please call our dedicated and trained mathematics support team on **0300 456 3142**

They are available from 8am–5.30pm, Monday – Friday. You can also email us at **maths@ocr.org.uk**

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