Content mapping: GCSE Mathematics A (J562) to legacy GCSE Mathematics C (J517) Modules

GCSE Mathematics A

OCR GCSE in Mathematics: J562

This mapping document is designed to accompany the OCR GCSE Mathematics A specification J562 (for teaching from September 2010), for teachers currently using GCSE Mathematics C (J517) – Graduated Assessment.

Contents

Introduction

This document is to assist teachers using the Mathematics C (Graduated Assessment) J517 specification in starting to teach the new Mathematics A J562 specification, for first teaching from September 2010. It will help you see how the content of the three units in the new specification relates to the legacy Module Tests.

Content for the three units is listed as it appears in the Mathematics A specification but with the notes and examples column removed. "Best-fit" statements from the legacy Module Tests appear in the right-hand column.

How to use this document – an example

- Look on page 9 of this document at section 7.1 in Foundation unit A. This states:

  Candidates should be able to:
  a) use formulae from mathematics and other subjects expressed initially in words and then using letters and symbols;

  b) substitute numbers into a formula; derive a formula and change its subject.

- The related statements from the legacy J517 Module Tests are:

  - A2.2 Use word formulae in context; substitute positive integers into the formula to find the value of the subject.
  - A3.2 In context, use formulae expressed in words or symbols; substitute positive numbers into the formula to find the value of the subject.
  - A4.1 Derive a simple formula.
  - A5.1 Solve problems involving substitution of positive numbers into simple algebraic formulae.
  - A6.3 Use index notation for simple positive integer powers; substitute positive and negative numbers into expressions such as $4x - 2$, $3x^2 + 4$ and $2x^3$.
  - A7.1 Use and generate formulae in context; substitute positive and negative numbers into a formula.
  - A7.3 Change the subject of a formula in cases where the subject only appears once.

- This gives you an indication of the various levels of demand within the statement in the new specification. It allows you to assess students' progress within each statement against a familiar set of criteria, and allows you to differentiate accordingly.

Note that where ~~strikethrough~~ is used in this document, this shows that a particular aspect of a Module Test statement is not relevant.

Unit A501/01: Mathematics Unit A (Foundation)

This unit assumes the use of a calculator.

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

FA2 Number		Legacy J517 Module References
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. Statement a is repeated in Unit A503	N1.4 Solve addition, subtraction, multiplication and division problems involving whole numbers or money; interpret the calculator display. N2.1 Order positive and negative temperatures; solve problems involving temperature changes. N2.4 Solve division problems, interpreting the result. N4.1 Solve problems involving all four operations on decimal numbers with up to three decimal places using a calculator, where the operation has to be determined. N5.6 Use the four operations with positive and negative integers.
2.2 – Approximate to a specified or appropriate degree of accuracy	Candidates should be able to: 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. Statement c is repeated in Unit A502	N1.1 Write and order whole numbers up to 10 000; round numbers to the nearest 10 or 100. N5.1 Round numbers to the nearest integer, to a given power of ten, to one significant figure and to one or two decimal places; estimate answers to one- stage calculations including problems involving money and measurement.
2.3 – Use calculators effectively and efficiently, including statistical and trigonometrical functions	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 in Unit A503 (but, there, include standard form calculations)	N6.1 Use a calculator effectively and efficiently, including using the memory and bracket keys, and function keys for reciprocals, squares and powers; enter a range of measures including ‘time’; interpret the display; round off a final answer to a reasonable degree of accuracy.

FA3 Hierarchy of operations		Legacy J517 Module References
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.	F3.7 Perform calculations involving the use of brackets and the hierarchy of operations. F6.5 Perform calculations using the hierarchy of operations.
FA4 Ratio		**Legacy J517 Module References**
4.1 – Use ratio notation, including reduction to its simplest form and its various links to fraction notation	Candidates should be able to: a) use ratio notation, including reduction to its simplest form; b) know its various links to fraction notation.	N6.2 Use ratio notation, including reduction to its simplest form; solve word problems involving ratio and proportion.
4.2 – Divide a quantity in a given ratio	Candidates should be able to: a) divide a quantity in a given ratio; 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.	N4.5 Solve simple ratio and proportion problems particularly in the context of recipes. N6.2 Use ratio notation, including reduction to its simplest form; solve word problems involving ratio and proportion. N7.4 Understand and use ratios in appropriate contexts including dividing a quantity in a given ratio.

FA5 Factors, multiples and primes		Legacy J517 Module References
5.1 – Factors, multiples and primes	Candidates should be able to: a) use the concepts and vocabulary of factor (divisor), multiple, common factor, highest common factor, least common multiple, prime number and prime factor decomposition; b) find the prime factor decomposition of positive integers.	N1.2 Identify odd and even numbers; recognise numbers divisible by five and ten. N4.4 Understand the concepts and vocabulary of factor (divisor), multiple and common factor and prime number. N7.7 Use and understand the terms reciprocal, highest common factor, lowest common multiple, prime number; find the prime number decomposition of positive integers.

FA6 General algebra and coordinates		Legacy J517 Module References
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, defined quantities or variables in formulae and general, unspecified independent numbers in identities; c) know that in functions, letter symbols define new expressions or quantities by referring to known quantities. These statements are repeated across all Units	
6.2 – Algebraic terminology	Candidates should be able to: a) distinguish in meaning between the words 'equation', 'formula' and 'expression'. This statement is repeated across all Foundation Units	
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; 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.	A1.3 Use coordinates in the first quadrant. S4.4 Use axes and coordinates to specify or locate points in all four quadrants; find the coordinates of points identified by geometrical information. S7.6 ~~Understand and use 3D coordinates~~; find the coordinates of the midpoint of a line segment AB given points AB in 2D.

FA7 Sequences and formulae		Legacy J517 Module References
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; b) substitute numbers into a formula; derive a formula and change its subject.	A2.2 Use word formulae in context; substitute positive integers into the formula to find the value of the subject. A3.2 In context, use formulae expressed in words or symbols; substitute positive numbers into the formula to find the value of the subject. A4.1 Derive a simple formula. A5.1 Solve problems involving substitution of positive numbers into simple algebraic formulae. A6.3 Use index notation for simple positive integer powers; substitute positive and negative numbers into expressions such as $4x - 2$, $3x^2 + 4$ and $2x^3$. A7.1 Use and generate formulae in context; substitute positive and negative numbers into a formula. A7.3 Change the subject of a formula in cases where the subject only appears once.
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 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).	A1.1 Continue simple sequences; explain how to find the next number in a simple pattern. A2.1 Recognise and describe patterns in number. A4.2 Continue and explain patterns in number and spatial arrangements; generate terms of a sequence using term-to-term and position-to-term definitions of the sequence.
7.3 – Use linear expressions to describe the *n*th term of an arithmetic sequence	Candidates should be able to: a) use linear expressions to describe the *n*th 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)*	A7.8 Generate common integer sequences; use and justify linear expressions to describe the *n*th term of an arithmetic sequence.

FA8 Linear equations		Legacy J517 Module References
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; b) manipulate algebraic expressions by collecting like terms, by multiplying a single term over a bracket, and by taking out common factors.	A5.3 Manipulate algebraic expressions by collecting like terms. A6.1 Manipulate algebraic expressions by multiplying a single term over a bracket and by taking out single term common factors.
8.2 – Set up and solve simple equations	Candidates should be able to: a) set up simple equations; b) solve simple equations 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.	A1.2 Understand the use of symbols to represent unknowns; use simple function machines to deal with inputs and outputs, recognising basic inverse functions. A3.1 Solve simple equations involving one operation. A5.2 Solve simple linear equations in which the unknown appears on either side of the equation. A6.2 Solve linear equations with integer coefficients in which the unknown appears on both sides of the equation, or with brackets. A7.2 Form and solve equations.

FA9 General measures		Legacy J517 Module References
9.1 – Interpret scales and use measurements	Candidates should be able to: 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; d) make sensible estimates of a range of measures in everyday settings; e) convert measurements from one unit to another; f) know rough metric equivalents of pounds, feet, miles, pints and gallons. Statements a and e are repeated in Units A502 and A503 Statements b, c and f are repeated in Unit A503	S1.1 Use metres, centimetres and millimetres and convert measurements from one to another. S1.2 Read scales graduated in 2, 5, 10, 20, 25, 100, 0·1; read the time from analogue clocks. S2.1 Estimate lengths and angles by comparison. S2.2 Use kilograms and grams and convert measurements from one unit to another. S3.1 Make sensible estimates of a range of measures in everyday settings. S3.2 Use litres and millilitres and convert measurements from one unit to another; interpret scales on a range of measuring instruments. S4.1 Know rough metric equivalents of pounds, feet, miles, pints and gallons.

FA10 Constructions		Legacy J517 Module References
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.	S1.3 Measure and draw lines to the nearest millimetre; find the perimeter of simple straight-sided shapes. S1.5 Recognise regular polygons (pentagon, hexagon, octagon); ~~recognise the terms circle, centre, radius, diameter and circumference and follow instructions to construct inscribed regular polygons.~~ S2.3 Measure and draw angles to the nearest degree; distinguish between acute, obtuse, reflex and right angles. S5.1 Construct triangles using a ruler and protractor only given information about their sides and angles; use a straight edge and compasses to construct triangles with given sides including equilateral triangles. S6.3 Construct triangles and other 2D shapes using a ruler and a protractor, given information about their sides and angles; ~~construct inscribed regular polygons; construct nets of cubes, regular tetrahedra, square-based pyramids and other 2D shapes.~~
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, including; i. an equilateral triangle with a given side, ii. the midpoint and perpendicular bisector of a line segment, iii. the perpendicular from a point to a line, the perpendicular from a point on a line, and iv. the bisector of an angle.	S7.7 ~~Apply loci to spatial problems involving shapes and paths;~~ use straight edge and compasses to produce standard constructions including the midpoint and perpendicular bisector of a line segment, the perpendicular from a point to a line, and the bisector of an angle.

10.3 – Construct loci	Candidates should be able to: a) find loci, by reasoning, to produce shapes and paths.	S7.7 Apply loci to spatial problems involving shapes and paths; ~~use straight edge and compasses to produce standard constructions including the midpoint and perpendicular bisector of a line segment, the perpendicular from a point to a line, and the bisector of an angle.~~
FA11 Maps		**Legacy J517 Module References**
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.	S1.7 Understand and use the compass directions N, S, E, W, NE, NW, SE, SW. S2.6 Use and interpret street plans (including simple grid references, left and right, clockwise and anticlockwise, and compass directions). S3.4 Construct and interpret scale drawings using simple scale factors. S5.2 Use and interpret maps and scale drawings, including four-figure grid references and estimating distances and areas; use bearings to specify direction.
FA12 Pythagoras' theorem in 2D		**Legacy J517 Module References**
12.1 – Use Pythagoras' theorem	Candidates should be able to: a) understand, recall and use Pythagoras' theorem to solve simple cases in 2D.	S7.3 Understand, recall and use Pythagoras' theorem.

FA13 General data handling		Legacy J517 Module References
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.	
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.	D2.3 Extract and use information from common two-way tables including timetables.

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.	D1.3 Draw and interpret simple graphs and pictograms. D2.2 Find the mode and median value of a small set of discrete data. D3.2 Calculate the mean and the range of discrete data. D3.3 Draw and interpret simple frequency tables, charts and bar charts for discrete data. D4.2 Use the range and measures of average for discrete data. D5.2 Use and interpret the statistical measures mode, median, mean and range for discrete and continuous data, including comparing distributions. D5.3 Construct and interpret pie charts. D6.3 Use and interpret diagrams for discrete and continuous data, including frequency polygons and stem and leaf diagrams; identify the modal class; calculate the mean of grouped discrete data compare distributions and make inferences, using the shapes of the distributions and measures of average and range. D7.2 Calculate the mean from grouped continuous data.

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.	D1.3 Draw and interpret simple graphs and pictograms. D3.3 Draw and interpret simple frequency tables, charts and bar charts for discrete data. D4.2 Use the range and measures of average for discrete data. D4.3 Interpret graphs representing real data, including recognising misleading diagrams. D5.2 Use and interpret the statistical measures mode, median, mean and range for discrete and continuous data, including comparing distributions. D5.3 Construct and interpret pie charts. D6.3 Use and interpret diagrams for discrete and continuous data, including frequency polygons and stem and leaf diagrams; identify the modal class; calculate the mean of grouped discrete data compare distributions and make inferences, using the shapes of the distributions and measures of average and range.

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

HA2 Number		Legacy J517 Module References
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. Statement a is repeated in Unit A503	N1.4 addition, subtraction, multiplication and division problems involving whole numbers or money; interpret the calculator display. N2.1 Order positive and negative temperatures; solve problems involving temperature changes. N2.4 Solve division problems, interpreting the result. N4.1 Solve problems involving all four operations on decimal numbers with up to three decimal places using a calculator, where the operation has to be determined. N5.6 Use the four operations with positive and negative integers.
2.2 – Approximate to a specified or appropriate degree of accuracy	Candidates should be able to: 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. Statement a is repeated in Unit A503	N1.1 Write and order whole numbers up to 10 000; round numbers to the nearest 10 or 100. N5.1 Round numbers to the nearest integer, to a given power of ten, to one significant figure and to one or two decimal places; estimate answers to one- stage calculations including problems involving money and measurement.
2.3 – Use calculators effectively and efficiently, including statistical and trigonometrical functions	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 in Unit A503 (but, there, include standard form calculations)	N6.1 Use a calculator effectively and efficiently, including using the memory and bracket keys, and function keys for reciprocals, squares and powers; enter a range of measures including ‘time’; interpret the display; round off a final answer to a reasonable degree of accuracy.

HA3 Hierarchy of operations		Legacy J517 Module References
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.	F3.7 Perform calculations involving the use of brackets and the hierarchy of operations. F6.5 Perform calculations using the hierarchy of operations.
HA4 Ratio		**Legacy J517 Module References**
4.1 – Use ratio notation, including reduction to its simplest form and its various links to fraction notation	Candidates should be able to: a) use ratio notation, including reduction to its simplest form; b) know its various links to fraction notation.	N6.2 Use ratio notation, including reduction to its simplest form; solve word problems involving ratio and proportion.
4.2 – Divide a quantity in a given ratio	Candidates should be able to: a) divide a quantity in a given ratio; 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.	N4.5 Solve simple ratio and proportion problems particularly in the context of recipes. N6.2 Use ratio notation, including reduction to its simplest form; solve word problems involving ratio and proportion. N7.4 Understand and use ratios in appropriate contexts including dividing a quantity in a given ratio.
HA5 Factors, multiples and primes		**Legacy J517 Module References**
5.1 – Factors, multiples and primes	Candidates should be able to: a) use the concepts and vocabulary of factor (divisor), multiple, common factor, highest common factor, least common multiple, prime number and prime factor decomposition; b) find the prime factor decomposition of positive integers.	N1.2 Identify odd and even numbers; recognise numbers divisible by five and ten. N4.4 Understand the concepts and vocabulary of factor (divisor), multiple and common factor and prime number. N7.7 Use and understand the terms reciprocal, highest common factor, lowest common multiple, prime number; find the prime number decomposition of positive integers.

HA6 General algebra and coordinates		Legacy J517 Module References
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, defined quantities or variables in formulae and general, unspecified and independent numbers in identities; c) know that in functions, letter symbols define new expressions or quantities by referring to known quantities. These statements are repeated across all Units **f(*x*) notation may be used**	
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	
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; 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.	A1.3 Use coordinates in the first quadrant. S4.4 Use axes and coordinates to specify or locate points in all four quadrants; find the coordinates of points identified by geometrical information. S7.6 ~~Understand and use 3D coordinates~~; find the coordinates of the midpoint of a line segment AB given points AB in 2D. S9.2 ~~Use Pythagoras' theorem and trigonometrical relationships in 3-D contexts, including using 3-D coordinates and finding the angles between a line and a plane;~~ use Pythagoras' theorem to find the length AB given the points A and B in 2-D.

HA7 Sequences and formulae		Legacy J517 Module References
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; b) substitute numbers into a formula; derive a formula and change its subject.	A2.2 Use word formulae in context; substitute positive integers into the formula to find the value of the subject. A3.2 In context, use formulae expressed in words or symbols; substitute positive numbers into the formula to find the value of the subject. A4.1 Derive a simple formula. A5.1 Solve problems involving substitution of positive numbers into simple algebraic formulae. A6.3 Use index notation for simple positive integer powers; substitute positive and negative numbers into expressions such as $4x - 2$, $3x^2 + 4$ and $2x^3$. A7.1 Use and generate formulae in context; substitute positive and negative numbers into a formula. A7.3 Change the subject of a formula in cases where the subject only appears once.
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 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).	A1.1 Continue simple sequences; explain how to find the next number in a simple pattern. A2.1 Recognise and describe patterns in number. A4.2 Continue and explain patterns in number and spatial arrangements; generate terms of a sequence using term-to-term and position-to-term definitions of the sequence.
7.3 – Use linear expressions to describe the *n*th term of an arithmetic sequence	Candidates should be able to: a) use linear expressions to describe the *n*th term of an arithmetic sequence, justifying its form by referring to the activity or context from which it was generated.	A7.8 Generate common integer sequences; use and justify linear expressions to describe the *n*th term of an arithmetic sequence.

HA8 Linear equations		Legacy J517 Module References
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; b) manipulate algebraic expressions by collecting like terms, by multiplying a single term over a bracket, and by taking out common factors.	A5.3 Manipulate algebraic expressions by collecting like terms. A6.1 Manipulate algebraic expressions by multiplying a single term over a bracket and by taking out single term common factors.
8.2 – Set up and solve simple equations	Candidates should be able to: a) set up simple equations; b) solve simple equations 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.	A1.2 Understand the use of symbols to represent unknowns; use simple function machines to deal with inputs and outputs, recognising basic inverse functions. A3.1 Solve simple equations involving one operation. A5.2 Solve simple linear equations in which the unknown appears on either side of the equation. A6.2 Solve linear equations with integer coefficients in which the unknown appears on both sides of the equation, or with brackets. A7.2 Form and solve equations.

HA9 General measures		Legacy J517 Module References
9.1 – Interpret scales and use measurements	Candidates should be able to: 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; d) make sensible estimates of a range of measures in everyday settings; e) convert measurements from one unit to another; f) know rough metric equivalents of pounds, feet, miles, pints and gallons. Statements a and e are repeated in Units A502 and A503 Statements b, c and f are repeated in Unit A503	S1.1 Use metres, centimetres and millimetres and convert measurements from one to another. S1.2 Read scales graduated in 2, 5, 10, 20, 25, 100, 0·1; read the time from analogue clocks. S2.1 Estimate lengths and angles by comparison. S2.2 Use kilograms and grams and convert measurements from one unit to another. S3.1 Make sensible estimates of a range of measures in everyday settings. S3.2 Use litres and millilitres and convert measurements from one unit to another; interpret scales on a range of measuring instruments. S4.1 Know rough metric equivalents of pounds, feet, miles, pints and gallons.

HA10 Constructions		Legacy J517 Module References
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.	S1.3 Measure and draw lines to the nearest millimetre; find the perimeter of simple straight-sided shapes. S1.5 Recognise regular polygons (pentagon, hexagon, octagon); ~~recognise the terms circle, centre, radius, diameter and circumference and follow instructions to construct inscribed regular polygons.~~ S2.3 Measure and draw angles to the nearest degree; distinguish between acute, obtuse, reflex and right angles. S5.1 Construct triangles using a ruler and protractor only given information about their sides and angles; use a straight edge and compasses to construct triangles with given sides including equilateral triangles. S6.3 Construct triangles and other 2D shapes using a ruler and a protractor, given information about their sides and angles; ~~construct inscribed regular polygons; construct nets of cubes, regular tetrahedra, square-based pyramids and other 2D shapes.~~
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, including; i. an equilateral triangle with a given side, ii. the midpoint and perpendicular bisector of a line segment, iii. the perpendicular from a point to a line, the perpendicular from a point on a line, and iv. the bisector of an angle.	S7.7 ~~Apply loci to spatial problems involving shapes and paths~~; use straight edge and compasses to produce standard constructions including the midpoint and perpendicular bisector of a line segment, the perpendicular from a point to a line, and the bisector of an angle.
10.3 – Construct loci	Candidates should be able to:	S7.7 Apply loci to spatial problems involving shapes

	a) find loci, by reasoning, to produce shapes and paths.	and paths; ~~use straight edge and compasses to produce standard constructions including the midpoint and perpendicular bisector of a line segment, the perpendicular from a point to a line, and the bisector of an angle.~~ ~~A region bounded by a circle and an intersecting line~~

HA11 Maps		Legacy J517 Module References
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.	S1.7 Understand and use the compass directions N, S, E, W, NE, NW, SE, SW. S2.6 Use and interpret street plans (including simple grid references, left and right, clockwise and anticlockwise, and compass directions). S3.4 Construct and interpret scale drawings using simple scale factors. S5.2 Use and interpret maps and scale drawings, including four-figure grid references and estimating distances and areas; use bearings to specify direction.
HA12 Core trigonometry		**Legacy J517 Module References**
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.**	**S8.3 Understand, recall and use trigonometrical relationships in right-angled triangles and use these to solve problems, including those involving bearings.**
HA13 Pythagoras' theorem in 2D and 3D		**Legacy J517 Module References**
13.1 – Use Pythagoras' theorem	Candidates should be able to: a) understand, recall and use Pythagoras' theorem in 2D**, then 3D problems.**	S7.3 Understand, recall and use Pythagoras' theorem. S9.2 **Use Pythagoras' theorem** ~~and trigonometrical relationships~~ **in 3D contexts**~~,~~ ~~including using 3Dcoordinates and finding the angles between a line and a plane;~~ use Pythagoras' theorem to find the length AB given the points A and B in 2D.

HA14 General data handling		Legacy J517 Module References
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 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.	
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.	D2.3 Extract and use information from common two-way tables including timetables.

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.**	D1.3 Draw and interpret simple graphs and pictograms. D2.2 Find the mode and median value of a small set of discrete data. D3.2 Calculate the mean and the range of discrete data. D3.3 Draw and interpret simple frequency tables, charts and bar charts for discrete data. D4.2 Use the range and measures of average for discrete data. D5.2 Use and interpret the statistical measures mode, median, mean and range for discrete and continuous data, including comparing distributions. D5.3 Construct and interpret pie charts. D6.3 Use and interpret diagrams for discrete and continuous data, including frequency polygons and stem and leaf diagrams; identify the modal class; calculate the mean of grouped discrete data compare distributions and make inferences, using the shapes of the distributions and measures of average and range. D7.2 Calculate the mean from grouped continuous data. **D8.2 Draw and interpret cumulative frequency tables and diagrams and box plots for grouped data; find the median, quartiles, percentiles and interquartile range.** **D9.2 Draw and interpret histograms for grouped data; understand frequency density.**

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.**	D1.3 Draw and interpret simple graphs and pictograms. D3.3 Draw and interpret simple frequency tables, charts and bar charts for discrete data.D4.2 Use the range and measures of average for discrete data. D4.3 Interpret graphs representing real data, including recognising misleading diagrams. D5.2 Use and interpret the statistical measures mode, median, mean and range for discrete and continuous data, including comparing distributions. D5.3 Construct and interpret pie charts. D6.3 Use and interpret diagrams for discrete and continuous data, including frequency polygons and stem and leaf diagrams; identify the modal class; calculate the mean of grouped discrete data compare distributions and make inferences, using the shapes of the distributions and measures of average and range. **D8.2 Draw and interpret cumulative frequency tables and diagrams and box plots for grouped data; find the median, quartiles, percentiles and interquartile range.** **D8.3 Compare distributions and make inferences, using the shapes of the distributions and measures of average and spread, including median and quartiles.** **D9.2 Draw and interpret histograms for grouped data; understand frequency density.** **D10.1 Compare data sets (including grouped discrete and continuous data); draw conclusions.**

Unit A502/01: Mathematics Unit B (Foundation)

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

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

FB2 Number		Legacy J517 Module References
2.1 – Add, subtract, multiply and divide any number	Candidates should be able to: 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. Statements a and b are repeated in Unit A503	N1.3 Add and subtract two-digit numbers; multiply and divide using multiplication facts to 10 × 10, without the use of a calculator. N2.2 Solve addition and subtraction problems using numbers with up to two decimal places in the context of measurement or money, without the use of a calculator. N2.3 Solve multiplication and division problems involving multiplication of up to a two-digit number by a one-digit number, without the use of a calculator. N3.2 Multiply and divide numbers with no more than one decimal digit by an integer between 1 and 10 without the use of a calculator. N3.3 Multiply and divide any number (with up to two decimal places) by powers of ten without the use of a calculator. N4.3 Use written methods to multiply and divide a three-digit number by a two-digit number; add, subtract and multiply numbers with up to two decimal places. N6.3 Solve problems involving the four operations on decimals without the use of a calculator; convert a simple fraction to a decimal using division. N7.1 ~~Use and understand terminating and recurring decimals including exact fraction equivalents;~~ solve problems involving multiplication and division by decimals with up to two decimal places.

2.2 – Approximate to a specified or appropriate degree of accuracy	Candidates should be able to: 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. Statement a is repeated from Unit A501 (statement c)	N5.1 Round numbers to the nearest integer, to a given power of ten, to one significant figure and to one or two decimal places; estimate answers to one- stage calculations including problems involving money and measurement. N7.3 Check solutions to calculations using various methods including approximating, using inverse operations and recognising the effect of multiplying and dividing by numbers less than one and greater than one; estimate answers using appropriate techniques.

FB3 Fractions, decimals and percentages		Legacy J517 Module References
3.1 – Calculate with fractions	Candidates should be able to: a) calculate a given fraction of a given quantity, expressing the answer as a fraction; b) express a given number as a fraction of another; c) add and subtract fractions by writing them with a common denominator; d) perform short division to convert a simple fraction to a decimal; *e)* multiply and divide a fraction by an integer and by a unit fraction; f) understand and use unit fractions as multiplicative inverses; 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).	N1.5 Identify ½, ¼, ¾ of a shape; find ½, ¼, ¾ of a given quantity. N2.6 Identify fractions; recall the fraction to decimal conversions of familiar simple fractions. N3.4 Calculate a fraction of a given quantity. N5.3 ~~Understand equivalent fractions, simplifying a fraction (including mixed numbers) by cancelling all common factors~~; multiply a fraction by an integer or a unit fraction. N5.5 Express one quantity as a fraction or percentage of another. N6.3 ~~Solve problems involving the four operations on decimals without the use of a calculator~~; convert a simple fraction to a decimal using division. N6.4 Use the four operations with fractions; order fractions using a common denominator. N7.7 Use and understand the term reciprocal. N8.4 Perform calculations on fractions including the multiplication and division of mixed numbers.
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.	N1.1 Write and order whole numbers up to 10 000; round numbers to the nearest 10 or 100. N4.2 Use decimal notation and recognise that each terminating decimal is a fraction; order decimals; ~~convert simple fractions of a whole to percentages of the whole and vice versa.~~ N6.4 ~~Use the four operations with fractions~~; order fractions using a common denominator.
3.3 – Understand equivalent fractions	Candidates should be able to: a) understand equivalent fractions and simplify a fraction by cancelling all common factors.	N5.3 Understand equivalent fractions, simplifying a fraction (including mixed numbers) by cancelling all common factors; ~~multiply a fraction by an integer or a unit fraction~~

3.4 – Use decimal notation	Candidates should be able to: a) use decimal notation and recognise that each terminating decimal is a fraction; b) recognise that recurring decimals are exact fractions; c) know that some exact fractions are recurring decimals.	N4.2 Use decimal notation and recognise that each terminating decimal is a fraction; ~~order decimals; convert simple fractions of a whole to percentages of the whole and vice versa.~~ N7.1 Use and understand terminating and recurring decimals including exact fraction equivalents; ~~solve problems involving multiplication and division by decimals with up to two decimal places~~
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.	N2.5 Convert ½ and ¼ to and from percentage form and calculate 25%, 50% of simple quantities, including money; read and estimate percentages from percentage scales and scaled pie charts. N5.4 Use the equivalence between fractions, decimals and percentages in context; solve simple percentage problems including increase and decrease. N7.6 Use percentages to compare proportion; ~~solve percentage problems involving increase and decrease including using a multiplier.~~
3.6 – Interpret fractions, decimals and percentages as operators	Candidates should be able to: a) interpret percentage as the operator 'so many hundredths of'; b) convert simple fractions of a whole to percentages of the whole, and vice versa; c) understand the multiplicative nature of percentages as operators.	N2.5 Convert ½ and ¼ to and from percentage form and calculate 25%, 50% of simple quantities, including money; read and estimate percentages from percentage scales and scaled pie charts. N5.4 Use the equivalence between fractions, decimals and percentages in context; solve simple percentage problems including increase and decrease. N7.6 Use percentages to compare proportion; solve percentage problems involving increase and decrease including using a multiplier.

FB4 Indices and surds		Legacy J517 Module References
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.	N3.1 Use the terms square, positive square root; recall the squares of 2 to 12; ~~use index notation for squares~~; ~~use a calculator to find squares and square roots.~~ N5.2 Use the term cube; recall the cubes of 2, 3, 4, 5, and 10; ~~use index notation for simple integer powers.~~ N7.2 Use the terms cube root, negative square root; recall the squares to 15^2 and the corresponding square roots; recall the cubes of 2, 3, 4, 5, and 10~~; use index laws with numerical and algebraic expressions involving multiplication and division of positive integer powers~~.
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.	N3.1 …. Use index notation for squares …… N5.2 ~~Use the term cube; recall the cubes of 2, 3, 4, 5, and 10;~~ use index notation for simple integer powers. N7.2 ~~Use the terms cube root, negative square root; recall the squares to 15^2 and the corresponding square roots; recall the cubes of 2, 3, 4, 5, and 10;~~ use index laws with numerical and algebraic expressions involving multiplication and division of positive integer powers.

FB5 General algebra and coordinates		Legacy J517 Module References
5.1 – 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, defined quantities or variables in formulae and general, unspecified independent numbers in identities; c) know that in functions, letter symbols define new expressions or quantities by referring to known quantities. These statements are repeated across all Units	
5.2 – Algebraic terminology	Candidates should be able to: a) distinguish in meaning between the words ‘equation’, ‘formula’ and ‘expression’. This statement is repeated across all Foundation Units	
5.3 – 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. These points occur across all three Units, where an understanding of coordinates is needed to complete other sections of the work. However, 3D is not included in Unit A502.	A1.3 Use coordinates in the first quadrant. S4.4 Use axes and coordinates to specify or locate points in all four quadrants; find the coordinates of points identified by geometrical information. S7.6 ~~Understand and use 3D coordinates~~; find the coordinates of the midpoint of a line segment AB given points AB in 2D.

FB6 Functions and graphs		Legacy J517 Module References
6.1 – Functions from real life	Candidates should be able to: 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. Linear functions only required. These may intersect. Other real life functions are dealt with in Unit A503	A3.3 Construct and interpret simple graphs, including conversion graphs. A4.3 Interpret information presented in a range of linear ~~and non-linear graphs, including travel (distance/time) graphs; calculate speed in simple cases.~~ A6.5 Draw and interpret graphs modelling real situations.
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.	A8.4 ~~Find the exact solution of two simultaneous equations in two unknowns by eliminating a variable,~~ and interpret the equations as lines and their common solution as the point of intersection.
6.3 – Recognise and plot equations that correspond to straight-line graphs in the coordinate plane, including finding gradients	Candidates should be able to: 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; c) plot graphs of functions in which y is given explicitly in terms of x, or implicitly, where no table or axes are given.	A5.4 Use tables to plot graphs of linear functions given explicitly. A6.4 Plot graphs of linear functions in which y is given explicitly or implicitly in terms of x. A8.7 Find the gradient of straight lines given by equations of the form $y = mx + c$: understand that $y = mx + c$ represents a straight line, interpret the values of m ~~and c~~; know when lines are parallel.

FB7 Inequalities		Legacy J517 Module References
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.	A7.6 Form and solve simple linear inequalities in one variable and represent the solution set on a number line.
FB8 General measures		**Legacy J517 Module References**
8.1 – Interpret scales and use measurements	Candidates should be able to: a) interpret scales on a range of measuring instruments, including those for time and mass; b) convert measurements from one unit to another. These two statements are repeated from Unit A501	S1.1 Use metres, centimetres and millimetres and convert measurements from one to another. S1.2 Read scales graduated in 2, 5, 10, 20, 25, 100, 0·1; read the time from analogue clocks. S2.2 Use kilograms and grams and convert measurements from one unit to another. S3.2 Use litres and millilitres and convert measurements from one unit to another; interpret scales on a range of measuring instruments.

FB9 Angles and properties of shapes		Legacy J517 Module References
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.	S2.1 Estimate ~~lengths and~~ angles by comparison. S2.3 ~~Measure and draw angles to the nearest degree;~~ distinguish between acute, obtuse, reflex and right angles. S4.2 Recall and use properties of angles at a point, angles on a straight line, perpendicular lines and opposite angles at a vertex; use angle properties of equilateral, isosceles and right-angled triangles. S6.1 Use parallel lines, alternate angles and corresponding angles; ~~calculate and use the sums of the interior and exterior angles of quadrilaterals, pentagons and hexagons; calculate and use the angles of regular polygons;~~ understand simple proofs involving triangles and quadrilaterals. S7.2 Solve angle problems involving intersecting and parallel lines, ~~and polygons~~; ~~understand that the tangent at any point on a circle is perpendicular to the radius at that point.~~

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.	S1.5 ~~Recognise regular polygons (pentagon, hexagon, octagon); recognise the terms circle, centre, radius, diameter and circumference and~~ follow instructions to construct inscribed regular polygons. S4.2 ~~Recall and use properties of angles at a point, angles on a straight line, perpendicular lines and opposite angles at a vertex;~~ use angle properties of equilateral, isosceles and right-angled triangles. S5.3 Classify quadrilaterals by their geometric properties. S6.1 ~~Use parallel lines, alternate angles and corresponding angles;~~ calculate and use the sums of the interior and exterior angles of quadrilaterals, ~~pentagons and hexagons; calculate and use the angles of regular polygons;~~ understand simple proofs involving triangles and quadrilaterals. S6.2 Recall the meaning of circle, chord, tangent, arc, sector, segment; ~~find circumferences and areas enclosed by circles, recalling relevant formulae.~~ S6.3 ~~Construct triangles and other 2D shapes using a ruler and a protractor, given information about their sides and angles;~~ construct inscribed regular polygons; ~~construct nets of cubes, regular tetrahedra, square-based pyramids and other 2D shapes.~~
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.	S6.1 ~~Use parallel lines, alternate angles and corresponding angles;~~ calculate and use the sums of the interior and exterior angles of quadrilaterals, pentagons and hexagons; calculate and use the angles of regular polygons; ~~understand simple proofs involving triangles and quadrilaterals.~~

FB10 Transformations		Legacy J517 Module References
10.1 – Congruence and similarity	Candidates should be able to: a) understand congruence; b) understand similarity of plane figures.	Implied within 10.2 module criteria
10.2 – Transform 2D shapes	Candidates should be able to: a) recognise and visualise rotations, reflections and translations, including reflection symmetry of 2D and 3D shapes, and rotation symmetry of 2D shapes; b) understand that rotations are specified by a centre and an (anticlockwise) angle; c) understand that reflections are specified by a mirror line, at first using a line parallel to an axis, then a mirror line such as $y = x$ or $y = -x$; 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; 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 greater than one at first, then positive scale factors less than one; 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.	S1.6 Draw and recognise simple enlargements on grids. S2.5 Recognise and complete reflection symmetry of 2D shapes. S3.5 Understand and use positive integer scale factors for enlargements on a grid. S4.5 Understand that reflections are specified by a mirror line; transform triangles and other 2D shapes by reflection, using a line parallel to an axis. S4.6 Recognise and visualise rotation symmetry of 2D shapes; identify the order of rotation symmetry. S5.5 Understand that rotations are specified by a centre and an angle; complete the rotation symmetry of 2D shapes; measure the angle of rotation using right angles and simple fractions of a turn. S6.7 Recognise, visualise and construct enlargements of objects using positive integer and fractional scale factors; identify the centre and the scale factor of enlargement; understand the implications of enlargement for perimeter. S6.8 Transform triangles and other 2D shapes by rotation or reflection or translation using vectors; recognise and visualise rotations, reflections and translations including reflection symmetry of 2D shapes; understand the properties preserved by these transformations; understand congruence in the context of transformations. S8.2 Transform triangles and other 2D shapes by combinations of reflection, rotation (of any angle about any point) and translation, including the use of vector notation; construct enlargements using any scale factors; identify scale factors.

FB11 Bivariate data		Legacy J517 Module References
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.	D4.3 Interpret graphs representing real data, including recognising misleading diagrams. D6.2 Draw and interpret scatter graphs including using lines of best fit; have a basic understanding of correlation, identifying 'correlation' or 'no correlation'. D7.3 Interpret scatter graphs for discrete and continuous variables, including using lines of best fit; understand the vocabulary of correlation, including positive, negative and zero correlation.

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

HB2 Number		Legacy J517 Module References
2.1 – Add, subtract, multiply and divide any number	Candidates should be able to: 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. Statements a and b are repeated in Unit A503	N1.3 Add and subtract two-digit numbers; multiply and divide using multiplication facts to 10 × 10, without the use of a calculator. N2.2 Solve addition and subtraction problems using numbers with up to two decimal places in the context of measurement or money, without the use of a calculator. N2.3 Solve multiplication and division problems involving multiplication of up to a two-digit number by a one-digit number, without the use of a calculator. N3.2 Multiply and divide numbers with no more than one decimal digit by an integer between 1 and 10 without the use of a calculator. N3.3 Multiply and divide any number (with up to two decimal places) by powers of ten without the use of a calculator. N4.3 Use written methods to multiply and divide a three-digit number by a two-digit number; add, subtract and multiply numbers with up to two decimal places. N6.3 Solve problems involving the four operations on decimals without the use of a calculator; convert a simple fraction to a decimal using division. N7.1 ~~Use and understand terminating and recurring decimals including exact fraction equivalents;~~ solve problems involving multiplication and division by decimals with up to two decimal places.

2.2 – Approximate to a specified or appropriate degree of accuracy	Candidates should be able to: 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; **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.** Statement a is repeated from Unit A501 (statement c)	N5.1 Round numbers to the nearest integer, to a given power of ten, to one significant figure and to one or two decimal places; estimate answers to one- stage calculations including problems involving money and measurement. N7.3 Check solutions to calculations using various methods including approximating, using inverse operations and recognising the effect of multiplying and dividing by numbers less than one and greater than one; estimate answers using appropriate techniques. **N9.2 Check the order of magnitude of a compound calculation using estimation methods, including rounding numbers of any size to one significant figure and simplifying calculations using standard index form, without the use of a calculator.**

HB3 Fractions, decimals and percentages		Legacy J517 Module References
3.1 – Calculate with fractions	Candidates should be able to: a) calculate a given fraction of a given quantity, expressing the answer as a fraction; b) express a given number as a fraction of another; c) add and subtract fractions by writing them with a common denominator; d) perform short division to convert a simple fraction to a decimal; e) multiply and divide a fraction by an integer and by a unit fraction; f) understand and use unit fractions as multiplicative inverses; g) use efficient methods to calculate with fractions, including mixed numbers; h) recognise that, in some cases, only a fraction can express the exact answer; i) understand 'reciprocal' as multiplicative inverse and know that any non-zero number multiplied by its reciprocal is 1 (and that zero has no reciprocal, since division by zero is not defined); **j) multiply and divide a fraction by a general fraction.**	N1.5 Identify ½, ¼, ¾ of a shape; find ½, ¼, ¾ of a given quantity. N2.6 Identify fractions; recall the fraction to decimal conversions of familiar simple fractions. N3.4 Calculate a fraction of a given quantity. N5.3 ~~Understand equivalent fractions, simplifying a fraction (including mixed numbers) by cancelling all common factors;~~ multiply a fraction by an integer or a unit fraction. N5.5 Express one quantity as a fraction or percentage of another. N6.3 ~~Solve problems involving the four operations on decimals without the use of a calculator;~~ convert a simple fraction to a decimal using division. N6.4 Use the four operations with fractions; ~~order fractions using a common denominator.~~ N7.7 Use and understand the term reciprocal. **N8.4 Perform calculations on fractions including the multiplication and division of mixed numbers.**
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.	N1.1 Write and order whole numbers up to 10 000; round numbers to the nearest 10 or 100. N4.2 Use decimal notation and recognise that each terminating decimal is a fraction; order decimals; ~~convert simple fractions of a whole to percentages of the whole and vice versa.~~ N6.4 ~~Use the four operations with fractions~~; order fractions using a common denominator.
3.3 – Understand equivalent fractions	Candidates should be able to: a) understand equivalent fractions and simplify a fraction by cancelling all common factors.	N5.3 Understand equivalent fractions, simplifying a fraction (including mixed numbers) by cancelling all common factors; ~~multiply a fraction by an integer or a unit fraction~~

3.4 – Use decimal notation	Candidates should be able to: a) use decimal notation and recognise that each terminating decimal is a fraction; b) recognise that recurring decimals are exact fractions; 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.**	N4.2 Use decimal notation and recognise that each terminating decimal is a fraction; ~~order decimals; convert simple fractions of a whole to percentages of the whole and vice versa.~~ N7.1 Use and understand terminating and recurring decimals including exact fraction equivalents; ~~solve problems involving multiplication and division by decimals with up to two decimal places.~~ **N10.2 Convert a recurring decimal to a fraction and vice versa; use prime factors to identify fractions which represent terminating decimals; ~~simplify expressions involving powers or surds including rationalising a denominator.~~**
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.	N2.5 Convert ½ and ¼ to and from percentage form and calculate 25%, 50% of simple quantities, including money; read and estimate percentages from percentage scales and scaled pie charts. N5.4 Use the equivalence between fractions, decimals and percentages in context; solve simple percentage problems including increase and decrease. N7.6 Use percentages to compare proportion; ~~solve percentage problems involving increase and decrease including using a multiplier.~~

3.6 – Interpret fractions, decimals and percentages as operators	Candidates should be able to: a) interpret percentage as the operator ‘so many hundredths of’; b) convert simple fractions of a whole to percentages of the whole, and vice versa; c) understand the multiplicative nature of percentages as operators.	N2.5 Convert ½ and ¼ to and from percentage form and calculate 25%, 50% of simple quantities, including money; read and estimate percentages from percentage scales and scaled pie charts. N5.4 Use the equivalence between fractions, decimals and percentages in context; solve simple percentage problems including increase and decrease. N7.6 Use percentages to compare proportion; solve percentage problems involving increase and decrease including using a multiplier.

HB4 Indices and surds		Legacy J517 Module References
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.	N3.1 Use the terms square, positive square root; recall the squares of 2 to 12; ~~use index notation for squares~~; ~~use a calculator to find squares and square roots.~~ N5.2 Use the term cube; recall the cubes of 2, 3, 4, 5, and 10; ~~use index notation for simple integer powers.~~ N7.2 Use the terms cube root, negative square root; recall the squares to 15^2 and the corresponding square roots; recall the cubes of 2, 3, 4, 5, and 10~~; use index laws with numerical and algebraic expressions involving multiplication and division of positive integer powers~~.
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 $n^{½} = \sqrt{n}$ and $n^{⅓} = \sqrt[3]{n}$ 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.**	N3.1 Use index notation for squares. N5.2 ~~Use the term cube; recall the cubes of 2, 3, 4, 5, and 10;~~ use index notation for simple integer powers. N7.2 ~~Use the terms cube root, negative square root; recall the squares to 15^2 and the corresponding square roots; recall the cubes of 2, 3, 4, 5, and 10;~~ use index laws with numerical and algebraic expressions involving multiplication and division of positive integer powers. **N9.3 Use fractional, negative and zero powers in simplifying numerical expressions, including using inverse operations**.

4.3 – Use surds in exact calculations	Candidates should be able to: a) use surds in exact calculations without a calculator; b) rationalise a denominator.	**N10.2** ~~Convert a recurring decimal to a fraction and vice versa; use prime factors to identify fractions which represent terminating decimals;~~ **simplify expressions involving powers or surds including rationalising a denominator.**
HB5 General algebra and coordinates		**Legacy J517 Module References**
5.1 – 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, defined quantities or variables in formulae and general, unspecified and independent numbers in identities; c) know that in functions, letter symbols define new expressions or quantities by referring to known quantities. These statements are repeated across all Units f(x) notation may be used	
5.2 – 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	
5.3 – Use the conventions for coordinates in the plane	Candidates should be able to: b) use the conventions for coordinates in the plane; plot points in all four quadrants; c) 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'; d) use axes and coordinates to specify points in all four quadrants; e) locate points with given coordinates. These points occur across all three Units, where an understanding of coordinates is needed to complete other sections of the work. However, 3D is not included in Unit A502.	A1.3 Use coordinates in the first quadrant. S4.4 Use axes and coordinates to specify or locate points in all four quadrants; find the coordinates of points identified by geometrical information. S7.6 ~~Understand and use 3D coordinates~~; find the coordinates of the midpoint of a line segment AB given points AB in 2D.

HB6 Functions and graphs		Legacy J517 Module References
6.1 – Functions from real life	Candidates should be able to: 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. Linear functions only required. These may intersect. Other real life functions are dealt with in Unit A503	A3.3 Construct and interpret simple graphs, including conversion graphs. A4.3 Interpret information presented in a range of linear ~~and non-linear graphs, including travel (distance/time) graphs; calculate speed in simple cases.~~ A6.5 Draw and interpret graphs modelling real situations.
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.**	**A8.4 Find the exact solution of two simultaneous equations in two unknowns by eliminating a variable**, and interpret the equations as lines and their common solution as the point of intersection.
6.3 – Recognise and plot equations that correspond to straight-line graphs in the coordinate plane, including finding gradients	Candidates should be able to: 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; *(know that the lines represented by $y = 5x$ and $y = 3 + 5x$ are parallel, each having gradient 5)* c) plot graphs of functions in which y is given explicitly in terms of x, or implicitly, where no table or axes are given.	A5.4 Use tables to plot graphs of linear functions given explicitly. A6.4 Plot graphs of linear functions in which y is given explicitly or implicitly in terms of x. A8.7 Find the gradient of straight lines given by equations of the form $y = mx + c$: understand that $y = mx + c$ represents a straight line, interpret the values of m and c; know when lines are parallel.

6.4 – Straight-line graphs and the equation $y = mx + c$	Candidates should be able to: **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 and lines perpendicular to each other.**	A8.7 Find the gradient of straight lines given by equations of the form $y = mx + c$: understand that $y = mx + c$ represents a straight line, interpret the values of m and c; know when lines are parallel. **A9.4 Find gradients of straight lines perpendicular to each other and write equations of straight lines in the form $y = mx + c$.**
HB7 Inequalities		**Legacy J517 Module References**
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.**	A7.6 Form and solve simple linear inequalities in one variable and represent the solution set on a number line. **A8.6 Solve linear inequalities in one variable; solve several linear inequalities in two variables and find the solution set.**
HB8 General measures		**Legacy J517 Module References**
8.1 – Interpret scales and use measurements	Candidates should be able to: a) interpret scales on a range of measuring instruments, including those for time and mass; b) convert measurements from one unit to another. These two statements are repeated from Unit A501	S1.1 Use metres, centimetres and millimetres and convert measurements from one to another. S1.2 Read scales graduated in 2, 5, 10, 20, 25, 100, 0·1; read the time from analogue clocks. S2.2 Use kilograms and grams and convert measurements from one unit to another. S3.2 Use litres and millilitres and convert measurements from one unit to another; interpret scales on a range of measuring instruments.

HB9 Angles and properties of shapes		Legacy J517 Module References
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.	S2.1 Estimate ~~lengths and~~ angles by comparison. S2.3 ~~Measure and draw angles to the nearest degree;~~ distinguish between acute, obtuse, reflex and right angles. S4.2 Recall and use properties of angles at a point, angles on a straight line, perpendicular lines and opposite angles at a vertex; use angle properties of equilateral, isosceles and right-angled triangles. S6.1 Use parallel lines, alternate angles and corresponding angles; ~~calculate and use the sums of the interior and exterior angles of quadrilaterals, pentagons and hexagons; calculate and use the angles of regular polygons;~~ understand simple proofs involving triangles and quadrilaterals. S7.2 Solve angle problems involving intersecting and parallel lines, ~~and polygons~~; ~~understand that the tangent at any point on a circle is perpendicular to the radius at that point.~~

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.	S1.5 Recognise regular polygons (pentagon, hexagon, octagon); recognise the terms circle, centre, radius, diameter and circumference and follow instructions to construct inscribed regular polygons. S4.2 ~~Recall and use properties of angles at a point, angles on a straight line, perpendicular lines and opposite angles at a vertex;~~ use angle properties of equilateral, isosceles and right-angled triangles. S5.3 Classify quadrilaterals by their geometric properties. S6.1 ~~Use parallel lines, alternate angles and corresponding angles;~~ calculate and use the sums of the interior and exterior angles of quadrilaterals, ~~pentagons and hexagons; calculate and use the angles of regular polygons;~~ understand simple proofs involving triangles and quadrilaterals. S6.2 Recall the meaning of circle, chord, tangent, arc, sector, segment; ~~find circumferences and areas enclosed by circles, recalling relevant formulae.~~ S6.3 Construct triangles and other 2D shapes using a ruler and a protractor, given information about their sides and angles; construct inscribed regular polygons; construct nets of cubes, regular tetrahedra, square-based pyramids and other 2D shapes.
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.	S6.1 ~~Use parallel lines, alternate angles and corresponding angles;~~ calculate and use the sums of the interior and exterior angles of quadrilaterals, pentagons and hexagons; calculate and use the angles of regular polygons; ~~understand simple proofs involving triangles and quadrilaterals~~

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°.	S9.1 Use and prove angle and tangent properties of circles, including the alternate segment theorem.

HB10 Transformations		Legacy J517 Module References
10.1 – Congruence and similarity	Candidates should be able to: a) understand congruence; b) understand similarity of plane figures.	Implied within S10.2 module statement
10.2 – Transform 2D shapes	Candidates should be able to: a) recognise and visualise rotations, reflections and translations, including reflection symmetry of 2D and 3D shapes, and rotation symmetry of 2D shapes; b) understand that rotations are specified by a centre and an (anticlockwise) angle; c) understand that reflections are specified by a mirror line, at first using a line parallel to an axis, then a mirror line such as $y = x$ or $y = -x$; 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; 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 greater than one at first, then positive scale factors less than one, **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.	S1.6 Draw and recognise simple enlargements on grids. S2.5 Recognise and complete reflection symmetry of 2D shapes. S3.5 Understand and use positive integer scale factors for enlargements on a grid. S4.5 Understand that reflections are specified by a mirror line; transform triangles and other 2D shapes by reflection, using a line parallel to an axis. S4.6 Recognise and visualise rotation symmetry of 2D shapes; identify the order of rotation symmetry. S5.5 Understand that rotations are specified by a centre and an angle; complete the rotation symmetry of 2D shapes; measure the angle of rotation using right angles and simple fractions of a turn. S6.7 Recognise, visualise and construct enlargements of objects using positive integer and fractional scale factors; identify the centre and the scale factor of enlargement; understand the implications of enlargement for perimeter. S6.8 Transform triangles and other 2D shapes by rotation or reflection or translation using vectors; recognise and visualise rotations, reflections and translations including reflection symmetry of 2D shapes; understand the properties preserved by these transformations; understand congruence in the context of transformations. S8.2 Transform triangles and other 2D shapes by combinations of reflection, rotation (of any angle about any point) and translation, including the use of vector notation; construct enlargements using any scale factors; identify scale factors. **S9.4 Use negative scale factors.**

HB11 Vectors		Legacy J517 Module References
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.**	**S10.5 Understand and use vector notation; calculate, and represent graphically the sum of two vectors, the difference of two vectors and a scalar multiple of a vector; calculate the resultant of two vectors; understand and use the commutative and associative properties of vector addition; solve simple geometrical problems in 2D using vector methods.**
HB12 Bivariate data		**Legacy J517 Module References**
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.	D4.3 Interpret graphs representing real data, including recognising misleading diagrams. D6.2 Draw and interpret scatter graphs including using lines of best fit; have a basic understanding of correlation, identifying 'correlation' or 'no correlation'. D7.3 Interpret scatter graphs for discrete and continuous variables, including using lines of best fit; understand the vocabulary of correlation, including positive, negative and zero correlation.

Unit A503/01: Mathematics Unit C (Foundation)

This unit assumes the use of a calculator

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

FC2 Number		Legacy J517 Module References
2.1 – Add, subtract, multiply and divide any number	Candidates should be able to: 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. Statement c is repeated from Unit A501 Statements a, b, d, e, f , g and h are repeated from Unit A502	See A501 and A502 module references
2.2 – Approximate to a specified or appropriate degree of accuracy	Candidates should be able to: a) round to the nearest integer, to any number of decimal places, specified or appropriate, and to any number of significant figures; b) understand the calculator display, knowing when to interpret the display, when the display has been rounded by the calculator, and not to round during the intermediate steps of a calculation; c) give solutions in the context of the problem to an appropriate degree of accuracy, interpreting the solution shown on a calculator display, and recognising limitations on the accuracy of data and measurements. These statements build on the work in Unit A501	See A501 module references

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 measures; d) understand the calculator display, knowing when to interpret the display, when the display has been rounded by the calculator, and not to round during the intermediate steps of a calculation. Statements a, b and d are repeated from Unit A501	See A501 module references. 2.3c implied within various criteria
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.	A6.3 Use index notation for simple positive integer powers; substitute positive and negative numbers into expressions such as $4x - 2$, $3x^2 + 4$ and $2x^3$.
FC3 Use upper and lower bounds		**Legacy J517 Module References**
3.1 – Inaccuracy in measurement	Candidates should be able to: a) recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction. This statement is repeated in the General measures section	S7.1 Know that measurements using real numbers depend on the choice of unit; recognise that a measurement given to the nearest whole unit may be inaccurate by up to one half in either direction.

FC4 Social arithmetic		Legacy J517 Module References
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: a) solve simple percentage problems in real life situations, including increase and decrease. Contexts may include finding % profit/loss, interest, tax, discount	N5.4 Use the equivalence between fractions, decimals and percentages in context; solve simple percentage problems including increase and decrease. N5.5 Express one quantity as a fraction or percentage of another. N7.6 Use percentages to compare proportion; solve percentage problems involving increase and decrease including using a multiplier.
4.3 – Understand and use direct and indirect proportion	Candidates should be able to: a) solve word problems about proportion, including using informal strategies and the unitary method of solution.	N7.5 Calculate an unknown quantity from quantities that vary in direct proportion.
4.4 – Solve real life problems involving measures	Candidates should be able to: a) explore and solve problems in real life contexts that use common measures (including time, money, mass, length, area and volume); 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. Contexts may include interpreting timetables, costs of days out, paving patios, cost of decorating a room, contrasting costs of services	N1.6 Work out finishing times and intervals (up to one hour) for times given in multiples of five minutes, without the use of a calculator. N3.6 Work out starting times, finishing times and intervals without the use of a calculator. S7.8 Understand and use rates and compound measures, including speed and density. Also implied within other criteria.

FC5 General algebra and coordinates		Legacy J517 Module References
5.1 – 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, defined quantities or variables in formulae and general, unspecified independent numbers in identities; c) know that in functions, letter symbols define new expressions or quantities by referring to known quantities. These statements are repeated across all Units	
5.2 – Algebraic terminology	Candidates should be able to: a) distinguish in meaning between the words 'equation', 'formula' and 'expression'. This statement is repeated across all Foundation Units	
5.3 – 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, b, 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	[A1.3 Use coordinates in the first quadrant.] S4.4 Use axes and coordinates to specify or locate points in all four quadrants; find the coordinates of points identified by geometrical information. S7.6 Understand and use 3D coordinates; ~~find the coordinates of the midpoint of a line segment AB given points AB in 2D.~~

FC6 Algebraic manipulation		Legacy J517 Module References
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, b) manipulate algebraic expressions by collecting like terms, by multiplying a single term over a bracket, and by taking out common factors. These statements are repeated from Unit A 502	A5.3 Manipulate algebraic expressions by collecting like terms. A6.1 Manipulate algebraic expressions by multiplying a single term over a bracket and by taking out single term common factors.
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.	N4.6 Solve problems using a range of skills including simple trial and improvement. A7.7 Use trial and improvement to find approximate solutions of equations.
FC7 Real life and non-linear functions		**Legacy J517 Module References**
7.1 – Functions from real life	Candidates should be able to: a) discuss and interpret graphs modelling real situations. May include distance time graphs, mobile phone charges, electricity bills Graphs may not be linear. Purely linear cases are dealt with in Unit A502	A4.3 Interpret information presented in a range of linear and non-linear graphs, including travel (distance/time) graphs; calculate speed in simple cases. A6.4 Draw and interpret graphs modelling real situations.
7.2 – Plot graphs of simple quadratic functions	Candidates should be able to: a) generate points and plot graphs of simple quadratic functions; b) find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function.	A7.5 Generate points and plot graphs of quadratic functions; find approximate solutions to a quadratic equation from the graph of the corresponding quadratic function.

FC8 General measures		Legacy J517 Module References
8.1 – Interpret scales and use measurements	Candidates should be able to: 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; d) convert measurements from one unit to another; e) know approximate metric equivalents of pounds, feet, miles, pints and gallons; 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); h) understand and use compound measures (including speed and density). Statements a to e are repeated from Unit A501	S1.1 Use metres, centimetres and millimetres and convert measurements from one to another. S1.2 Read scales graduated in 2, 5, 10, 20, 25, 100, 0·1;[read the time from analogue clocks.] S2.2 Use kilograms and grams and convert measurements from one unit to another. S2.3 Measure and draw angles to the nearest degree; distinguish between acute, obtuse, reflex and right angles. S3.2 Use litres and millilitres and convert measurements from one unit to another; interpret scales on a range of measuring instruments. S4.1 Know rough metric equivalents of pounds, feet, miles, pints and gallons. S7.1 Know that measurements using real numbers depend on the choice of unit; recognise that a measurement given to the nearest whole unit may be inaccurate by up to one half in either direction. S7.5 (Solve problems involving the surface area and volume of prisms, including cylinders;) convert between area measures and volume measures. S7.8 Understand and use rates and compound measures, including speed and density.

FC9 Area and volume		Legacy J517 Module References
9.1 – Perimeter, area (including circles), and volume	Candidates should be able to: 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; f) find volumes of cuboids, recalling the formula and understanding the connection to counting cubes; g) calculate volumes of right prisms and of shapes made from cubes and cuboids; h) use π in exact calculations. See also FC4.4 – Solve real life problems involving measures	S1.3 Measure and draw lines to the nearest millimetre; find the perimeter of simple straight-sided shapes. S1.4 Find areas of simple shapes (including irregular shapes) by counting squares, and volumes of simple shapes by counting cubes. S4.3 Find the area of a rectangle. S5.4 ~~Explore the geometry of cuboids (including cubes) and shapes made from cuboids;~~ find the volumes of cuboids, recalling the formula; ~~draw and interpret the net of a cuboid.~~ S6.4 Recall the meaning of circle, chord, tangent, arc, sector, segment; find circumferences and areas enclosed by circles, recalling relevant formulae. S6.5 Recall and use the formula for the area of a parallelogram and a triangle; use the formula for the area of a trapezium; calculate perimeters and areas of shapes made from triangles and rectangles; find the surface area of simple shapes using the area formulae for triangles and rectangles. S7.4 Calculate volumes of shapes made from cubes and cuboids. S7.5 Solve problems involving area and circumference of circles; use π in exact calculations.

9.2 – Use 2D representations of 3D shapes	Candidates should be able to: a) explore the geometry of cuboids (including cubes) and objects made from cuboids; b) use 2D representations of 3D objects; analyse 3D objects through 2D projections (including plan and elevation) and cross-sections; c) draw nets of 3D objects; d) solve problems involving the surface area and volume of prisms; e) construct nets of cubes, regular tetrahedra, square-based pyramids and other 3D shapes from given information.	S2.4 Recognise simple solids and their nets. S3.3 Use 2D representations of 2D shapes including views and isometric drawings. S5.4 Explore the geometry of cuboids (including cubes) and shapes made from cuboids; find the volumes of cuboids, recalling the formula; draw and interpret the net of a cuboid. S6.2 ~~Recall and use the formula for the area of a parallelogram and a triangle; use the formula for the area of a trapezium; calculate perimeters and areas of shapes made from triangles and rectangles~~; find the surface area of simple shapes using the area formulae for triangles and rectangles. S6.3 ~~Construct triangles and other 2D shapes using a ruler and a protractor, given information about their sides and angles; construct inscribed regular polygons~~; construct nets of cubes, regular tetrahedra, square-based pyramids and other 2D shapes S6.6 Analyse 2D shapes through 2D projections and cross-sections, including plans and elevations. (Include surface area of cylinder).

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; b) understand that enlargement preserves angle but not length; c) understand the implications of enlargement for perimeter; d) understand the implications of enlargement for area and volume. Statements a and b are repeated from Unit A502	S1.6 Draw and recognise simple enlargements on grids. S3.5 Understand and use positive integer scale factors for enlargements on a grid. S6.7 Recognise, visualise and construct enlargements of objects using positive integer and fractional scale factors; identify the centre and the scale factor of enlargement; understand the implications of enlargement for perimeter. S8.4 Understand similarity of triangles and other plane figures and use this to make geometrical inferences. (Know that sf 2 doubles perimeter but does not double area or volume – formal treatment not required.)

FC10 The study of chance		Legacy J517 Module References
10.1 – Probability	Candidates should be able to: a) use the vocabulary of probability to interpret results involving uncertainty and prediction; b) understand and use the probability scale; c) understand and use estimates or measures of probability from theoretical models (including equally-likely outcomes), or from relative frequency; d) list all outcomes for single events, and for two successive events, in a systematic way; e) identify different mutually-exclusive outcomes; f) know that the sum of the probabilities of all the possible mutually exclusive outcomes is 1; 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.	D1.1 Understand and use the vocabulary of probability, including terms such as 'fair', 'evens', 'certain', 'likely', 'unlikely' and 'impossible'. D1.2 Find all possible ways of listing up to four objects. D2.1 Understand and use the probability scale. D3.1 Understand and use measures of probability from equally likely outcomes. D4.1 Understand and use estimates and measures of probability. D5.1 List all outcomes for single events, and for two successive events, in a systematic way; find probabilities. Use the fact that the probability of not happening is 1 – probability of happening. D6.1 Identify different mutually-exclusive outcomes and know that the sum of the probabilities of all these outcomes is one. D7.1 Solve probability problems involving theoretical models or relative frequency. Statement g is implied within other criteria.

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

HC2 Number		Legacy J517 Module References
2.1 – Add, subtract, multiply and divide any number	Candidates should be able to: 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; **i) multiply and divide a fraction by a general fraction.** Statement c is repeated from Unit A501 Statements a, b, d, e, f, g, h and i are repeated from Unit A502	See A501 and A502 module references
2.2 – Approximate to a specified or appropriate degree of accuracy	Candidates should be able to: a) round to the nearest integer, to any number of decimal places, specified or appropriate, and to any number of significant figures; b) understand the calculator display, knowing when to interpret the display, when the display has been rounded by the calculator, and not to round during the intermediate steps of a calculation; c) give solutions in the context of the problem to an appropriate degree of accuracy, interpreting the solution shown on a calculator display, and recognising limitations on the accuracy of data and measurements. These statements build on the work in Unit A501	See A501 module references

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 measures; d) understand the calculator display, knowing when to interpret the display, when the display has been rounded by the calculator, and not to round during the intermediate steps of a calculation; **e) use an extended range of function keys, including trigonometrical and statistical functions;** f) **use calculators for reverse percentage calculations.** Statements a, b and d are repeated from Unit A501	See A501 module references. 2.3c,e, f implied within various criteria.
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.	A6.3 Use index notation for simple positive integer powers; substitute positive and negative numbers into expressions such as $4x - 2$, $3x^2 + 4$ and $2x^3$.

HC3 Standard index form		Legacy J517 Module References
3.1 – Standard index form	Candidates should be able to: **b) use and express standard index form expressed in conventional notation and on a calculator display;** **c) order with numbers written in standard form;** **d) calculate with standard index form;** **e) convert between ordinary and standard index form representations, converting to standard index form to make sensible estimates for calculations involving multiplication and/or division.**	**N8.3 Use standard index form expressed in conventional notation and on a calculator display; convert between ordinary and standard index form representations; calculate with standard index form; check solutions by converting to standard index form.** **N9.2 ~~Check the order of magnitude of a compound calculation using estimation methods, including rounding numbers of any size to one significant figure and~~ simplifying calculations using standard index form, without the use of a calculator.**
HC4 Use upper and lower bounds		**Legacy J517 Module References**
4.1 – Inaccuracy in measurement	Candidates should be able to: a) recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction; **b) use calculators, or written methods, to calculate the upper and lower bounds of calculations, in particular, when working with measurements;** **c) recognise limitations on the accuracy of data and measurements.** Statement a is repeated in the General measures section	S7.1 Know that measurements using real numbers depend on the choice of unit; recognise that a measurement given to the nearest whole unit may be inaccurate by up to one half in either direction. **S9.1 Use calculators or written methods to calculate the upper and lower bounds of calculations, particularly in the context of measurement.**

HC5 Social arithmetic		Legacy J517 Module References
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: a) solve simple percentage problems in real life situations, including increase and decrease; **b) calculate an original amount when given the transformed amount after a percentage change;** **c) represent repeated percentage change using a multiplier raised to a power.** Contexts may include VAT, annual rate of inflation, income tax, discounts, simple interest, compound interest	N5.4 Use the equivalence between fractions, decimals and percentages in context; solve simple percentage problems including increase and decrease. N5.5 Express one quantity as a fraction or percentage of another. N7.6 Use percentages to compare proportion; solve percentage problems involving increase and decrease including using a multiplier. **N8.1 Solve efficiently problems involving percentage increase and decrease; calculate the original amount when given the transformed amount after a percentage change.** **N8.2 Solve problems involving repeated proportional or percentage changes, including compound interest; represent repeated proportional change using a multiplier raised to a power.**
5.3 – Understand and use direct and indirect proportion	Candidates should be able to: a) solve word problems about proportion, including using informal strategies and the unitary method of solution; **b) calculate an unknown quantity from quantities that vary in direct or inverse proportion;** **c) set up and use equations to solve word and other problems involving direct proportion or inverse proportion and relate algebraic solutions to graphical representation of the equations.**	N7.5 Calculate an unknown quantity from quantities that vary in direct proportion. **A9.2 Form and use equations to solve word and other problems involving direct or inverse proportion (for example, $y \propto x$, $y \propto x^2$, $y \propto 1/x$, $y \propto 1/x^2$) including relating algebraic solutions to graphical representations of the equations.**

5.4 – Solve real life problems involving measures	Candidates should be able to: a) explore and solve problems in real life contexts that use common measures (including time, money, mass, length, area and volume) ; 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. Contexts may include interpreting timetables, costs of days out, paving patios, cost of decorating a room, contrasting costs of services	N1.6 Work out finishing times and intervals (up to one hour) for times given in multiples of five minutes, without the use of a calculator. N3.6 Work out starting times, finishing times and intervals without the use of a calculator. S7.8 Understand and use rates and compound measures, including speed and density. N7.3 Check solutions to calculations using various methods including approximating, using inverse operations and recognising the effect of multiplying and dividing by numbers less than one and greater than one; estimate answers using appropriate techniques. Also implied within other criteria.
5.5 – Exponential growth	Candidates should be able to: **a) use calculators to explore exponential growth and decay using a multiplier and the power key.**	**N10.1 Use calculators to explore exponential growth and decay**.

HC6 General algebra and coordinates		Legacy J517 Module References
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, defined quantities or variables in formulae and general, unspecified and independent numbers in identities; c) know that in functions, letter symbols define new expressions or quantities by referring to known quantities. These statements are repeated across all Units **f(*x*) notation may be used**	
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	
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, b, 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	S4.4 Use axes and coordinates to specify or locate points in all four quadrants; find the coordinates of points identified by geometrical information. S7.6 Understand and use 3D coordinates; ~~find the coordinates of the midpoint of a line segment AB given points AB in 2D.~~

HC7 Algebraic manipulation		Legacy J517 Module References
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, b) manipulate algebraic expressions by collecting like terms, by multiplying a single term over a bracket, and by taking out common factors; **c) expand the product of two linear expressions;** d) **manipulate algebraic expressions by factorising quadratic expressions, including the difference of two squares;** e) **simplify rational expressions.**	A5.3 Manipulate algebraic expressions by collecting like terms. A6.1 Manipulate algebraic expressions by multiplying a single term over a bracket and by taking out single term common factors. **A7.4 Expand the product of two linear expressions.** **A8.2 Multiply expressions of the form (x + 3)(x – 7) and simplify the resulting expression);** ~~solve quadratic equations of the form x^2 +/– … by factorisation, including the difference of two squares.~~ **A9.3 Manipulate algebraic expressions by expanding the product of two linear expressions, by taking out common factors and by cancelling common factors in rational expressions; factorise quadratic expressions, including the difference of two squares;** ~~solve quadratic equations of the form $ax^2 + bx + c = 0$ by factorisation~~ **A10.1 …….simplify expressions involving powers or surds including rationalising a denominator.**
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.	N4.6 Solve problems using a range of skills including simple trial and improvement. A7.7 Use trial and improvement to find approximate solutions of equations.

7.3 – Solve quadratic equations	Candidates should be able to: **a) solve simple quadratic equations by factorisation, completing the square and using the quadratic formula;** 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.**	**A8.2** ~~Multiply expressions of the form (x + 3)(x – 7) and simplify the resulting expression);~~ **solve quadratic equations of the form x^2 +/– … by factorisation, including the difference of two squares.** **A9.3** ~~Manipulate algebraic expressions by expanding the product of two linear expressions, by taking out common factors and by cancelling common factors in rational expressions; factorise quadratic expressions, including the difference of two squares;~~ **solve quadratic equations of the form $ax^2 + bx + c = 0$ by factorisation.** **A10.2 Solve quadratic equations by completing the square and using the quadratic formula.** **A10.3 Solve exactly, by elimination of an unknown, two simultaneous equations in two unknowns, one of which is linear, the other equation quadratic in one unknown** ~~or of the form $x^2 + y^2 = r^2$.~~

HC8 Real life and non-linear functions		Legacy J517 Module References
8.1 – Functions from real life	Candidates should be able to: a) discuss and interpret graphs modelling real situations; **b) construct the graphs of simple loci.** May include distance time graphs, mobile phone charges, electricity bills Graphs may not be linear. Purely linear cases are dealt with in Unit A502	A4.3 Interpret information presented in a range of linear and non-linear graphs, including travel (distance/time) graphs; calculate speed in simple cases. A6.4 Draw and interpret graphs 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; b) find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function; **c) generate points and plot graphs of more general quadratic functions;** d) **construct quadratic and other functions from real life problems and plot their corresponding graphs.**	A7.5 Generate points and plot graphs of quadratic functions; find approximate solutions to a quadratic equation from the graph of the corresponding quadratic function. **At Higher extend to** **eg $y = x^2 – 2x + 1$** **eg 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.**	**A10.5** ~~Construct graphs of exponential function, and of the circle $x^2 + y^2 = r^2$;~~ **solve problems involving the intersection of straight lines with a curve** ~~(including a circle).~~
8.4 – Construct non-linear graphs	Candidates should be able to: **a) plot graphs of simple cubic functions, 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 $y = \cos x$;** b) **recognise the characteristic shapes of all these functions.**	**A8.5 Plot graphs of simple cubic functions and the reciprocal function $y = 1/x$ with $x \neq 0$; recognise the characteristic shapes of these functions.** **A10.5 Construct graphs of exponential function**~~, and of the circle $x^2 + y^2 = r^2$; solve problems involving the intersection of straight lines with a curve (including a circle)~~. **S10.4 Draw, sketch and describe the graphs of trigonometric functions for angles of any size** (including transformations involving scalings in either or both the x and y directions).

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 $f(x)$.**	**A10.4 Apply to the graph of $y = f(x)$ the transformations $y = f(x) + a$, $y = f(ax)$, $y = f(x + a)$, $y = af(x)$, for linear, quadratic, sine and cosine functions $f(x)$.**

HC9 General measures		Legacy J517 Module References
9.1 – Interpret scales and use measurements	Candidates should be able to: 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; d) convert measurements from one unit to another; e) know approximate metric equivalents of pounds, feet, miles, pints and gallons; 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); h) understand and use compound measures (including speed and density). Statements a to e are repeated from Unit A501	S1.1 Use metres, centimetres and millimetres and convert measurements from one to another. S1.2 Read scales graduated in 2, 5, 10, 20, 25, 100, 0·1; [read the time from analogue clocks.] S2.2 Use kilograms and grams and convert measurements from one unit to another. S2.3 Measure and draw angles to the nearest degree; distinguish between acute, obtuse, reflex and right angles. S3.2 Use litres and millilitres and convert measurements from one unit to another; interpret scales on a range of measuring instruments. S4.1 Know rough metric equivalents of pounds, feet, miles, pints and gallons. S7.1 Know that measurements using real numbers depend on the choice of unit; recognise that a measurement given to the nearest whole unit may be inaccurate by up to one half in either direction. S7.5 (Solve problems involving the surface area and volume of prisms, including cylinders) convert between area measures and volume measures. S7.8 Understand and use rates and compound measures, including speed and density.

HC10 Area and volume		Legacy J517 Module References
10.1 – Perimeter, area (including circles), and volume	Candidates should be able to: 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; f) find volumes of cuboids, recalling the formula and understanding the connection to counting cubes; 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;** **j) calculate the lengths of arcs and the areas of sectors of circles.**	S1.3 Measure and draw lines to the nearest millimetre; find the perimeter of simple straight-sided shapes. S1.4 Find areas of simple shapes (including irregular shapes) by counting squares, and volumes of simple shapes by counting cubes. S4.3 Find the area of a rectangle. S5.4 ~~Explore the geometry of cuboids (including cubes) and shapes made from cuboids;~~ find the volumes of cuboids, recalling the formula; ~~draw and interpret the net of a cuboid.~~ S6.4 Recall the meaning of circle, chord, tangent, arc, sector, segment; find circumferences and areas enclosed by circles, recalling relevant formulae. S6.5 Recall and use the formula for the area of a parallelogram and a triangle; use the formula for the area of a trapezium; calculate perimeters and areas of shapes made from triangles and rectangles; find the surface area of simple shapes using the area formulae for triangles and rectangles. S7.4 Calculate volumes of shapes made from cubes and cuboids. S7.5 Solve problems involving area and circumference of circles; use π in exact calculations. **S9.3 Solve problems involving the lengths of arcs, areas of sectors and the volume of pyramids, cones and spheres.** **S10.1 Solve problems involving surface areas and volumes of pyramids, cylinders, cones and spheres.**

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; analyse 3D objects through 2D projections (including plan and elevation) and cross-sections; c) draw nets of 3D objects; d) solve problems involving the surface area and volume of prisms; 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;** **g) solve problems involving more complex shapes and solids, including segments of circles and frustums of cones.**	S2.4 Recognise simple solids and their nets. S3.3 Use 2D representations of 2D shapes including views and isometric drawings. S5.4 Explore the geometry of cuboids (including cubes) and shapes made from cuboids; find the volumes of cuboids, recalling the formula; draw and interpret the net of a cuboid. S6.2 ~~Recall and use the formula for the area of a parallelogram and a triangle; use the formula for the area of a trapezium; calculate perimeters and areas of shapes made from triangles and rectangles~~; find the surface area of simple shapes using the area formulae for triangles and rectangles. (Include surface area of cylinder). S6.3 ~~Construct triangles and other 2D shapes using a ruler and a protractor, given information about their sides and angles; construct inscribed regular polygons~~; construct nets of cubes, regular tetrahedra, square-based pyramids and other 2D shapes S6.6 Analyse 2D shapes through 2D projections and cross-sections, including plans and elevations. **S9.3 Solve problems involving the lengths of arcs, areas of sectors and the volume of pyramids, cones and spheres.** **S10.1 Solve problems involving surface areas and volumes of pyramids, cylinders, cones and spheres, and problems involving more complex shapes including segments of circles and frustums of cones.**

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; d) understand the implications of enlargement for area and volume; **e) understand and use the effect of enlargement on areas and volumes of shapes and solids.** Statements a and b are repeated from Unit A502	S1.6 Draw and recognise simple enlargements on grids. S3.5 Understand and use positive integer scale factors for enlargements on a grid. S6.7 Recognise, visualise and construct enlargements of objects using positive integer and fractional scale factors; identify the centre and the scale factor of enlargement; understand the implications of enlargement for perimeter. (Know that sf 2 doubles perimeter but does not double area or volume – Formal treatment not required.) S8.4 Understand similarity of triangles and other plane figures and use this to make geometrical inferences. **S9.4 Understand and use the effect of enlargement on length, area and volume of shapes and solids**, including the use of negative scale factors.
HC11 Extension trigonometry and Pythagoras' theorem		**Legacy J517 Module References**
11.1 – Trigonometry in 2D and 3D and Pythagoras' theorem in 3D	Candidates should be able to: **a) use trigonometrical relationships in 3D contexts, including finding the angles between a line and a plane (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.**	**S9.2 Use Pythagoras' theorem and trigonometrical relationships in 2D contexts, including using 2D coordinates and finding the angles between a line and a plane**; ~~use Pythagoras' theorem to find the length AB given the points A and B in 2D.~~ **S10.3 Calculate the area of a triangle using ½absinC; use the sine and cosine rules to solve 2D and 2D problems.**

HC12 The study of chance		Legacy J517 Module References
12.1 – Probability	Candidates should be able to: a) use the vocabulary of probability to interpret results involving uncertainty and prediction; b) understand and use the probability scale; c) understand and use estimates or measures of probability from theoretical models (including equally-likely outcomes), or from relative frequency; d) list all outcomes for single events, and for two successive events, in a systematic way; e) identify different mutually-exclusive outcomes; f) know that the sum of the probabilities of all the possible mutually exclusive outcomes is 1; 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; **i) know when to add or multiply probabilities:** **j) if A and B are mutually exclusive, then the probability of A or B occurring is P(A) + P(B);** **k) if A and B are independent events, the probability of A and B occurring is P(A) x P(B);** **l) use tree diagrams to represent outcomes of compound events, recognising when events are independent.**	D1.1 Understand and use the vocabulary of probability, including terms such as 'fair', 'evens', 'certain', 'likely', 'unlikely' and 'impossible'. D1.2 Find all possible ways of listing up to four objects. D2.1 Understand and use the probability scale. D3.1 Understand and use measures of probability from equally likely outcomes. D4.1 Understand and use estimates and measures of probability. D5.1 List all outcomes for single events, and for two successive events, in a systematic way; find probabilities. Use the fact that the probability of not happening is 1 – probability of happening. D6.1 Identify different mutually-exclusive outcomes and know that the sum of the probabilities of all these outcomes is one. D7.1 Solve probability problems involving theoretical models or relative frequency. **D8.1 Use tree diagrams to represent outcomes of combined events, recognising when events are independent; find probabilities.** **D9.1 Solve structured problems involving the addition or multiplication of two probabilities.** **D10.3 Solve problems involving the addition or multiplication of two probabilities**. 10.1g implied within other criteria.