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

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

This unit assumes the use of a calculator.

HA1 General problem solving skills		**Examples**
These skills should underpin and influence the learning experiences of all candidates in mathematics. They will be assessed within this paper.		
1.1 - Solve problems using mathematical skills	Candidates should be able to: 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

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HA2 Number		
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
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 • Write 13 066 using words • Write 13 066 correct to the nearest 100 • Write 13·066 correct to 1 decimal place
2.3 - Use calculators effectively and efficiently, including statistical and trigonometrical functions	Candidates should be able to: 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) • Calculate $1{\cdot}6^3$, $\sqrt{7\cdot 29}$, $\frac{2\cdot 6-0\cdot 8}{0\cdot 2}$, $\sqrt[3]{6\cdot 1^2-0\cdot 81}$ • When using money interpret a calculator display of 2·6 as £2·60
HA3 Hierachy of operations		
3.1 - Understand and use number operations and the relationships between them, including inverse operations and hierarchy of operations	Candidates should be able to: a. use brackets and the hierarchy of operations.	• Calculate $\frac{(6+8)^2}{2\cdot 5^2-1\cdot 5^2}$

HA4 Ratio		
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.	• Write the ratio 24:60 in its simplest form
4.2 - Divide a quantity in a given ratio	Candidates should be able to: a. divide a quantity in a given ratio(1); b. determine the original quantity by knowing the size of one part of the divided quantity; c. solve word problems about ratio, including using informal strategies and the unitary method of solution(2).	(1) Divide £120 in the ratio 3:7 (2) 8 calculators cost £59·52. How much do 3 calculators cost?
HA5 Factors, multiples and primes		
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(1); b. find the prime factor decomposition of positive integers(2).	(1) Write down a multiple of 7, a prime number and a factor of 104 that lie between 25 and 30 (2) Write 96 as a product of prime factors using indices
HA6 General algebra and coordinates		
6.1 - Symbols and notation	Candidates should be able to: a. distinguish the different roles played by letter symbols in algebra, using the correct notational conventions for multiplying or dividing by a given number; b. know that letter symbols represent definite unknown numbers in equations(1), defined quantities or variables in formulae, general, unspecified and independent numbers in identities(2); c. know that in functions, letter symbols define new expressions or quantities by referring to known quantities(3).	These statements are repeated across all Units These examples relate specifically to Higher tier: **(1) $x^2 + 1 = 82$** **(2) $(x + 1)^2 \equiv x^2 + 2x + 1$ for all values of x** **(3) $y = 2 - 7x$; $y = \frac{1}{x}$ with $x \neq 0$** **f(x) notation may be used**

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6.2 - Algebraic terminology	Candidates should be able to: a. distinguish in meaning between the words 'equation', 'formula' and 'expression'; b. **know the meaning of and use the words 'equation', 'formula', 'identity' and 'expression'.**	
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 using the terms '1D' and '2D'; c. use axes and coordinates to specify points in all four quadrants; d. locate points with given coordinates(1); e. find the coordinates of the midpoint of the line segment AB, given points A and B, then calculate the length AB.	Statements a, b, c and d occur across all three Units, where an understanding of coordinates is needed to complete other sections of the work. However, 3D is not included in Unit A501. (1) Plot (3, 6) and (2, -4) on the grid provided
HA7 Sequences and formulae		
7.1 - Derive a formula, substitute numbers into a formula and change the subject of a formula	Candidates should be able to: a. use formulae from mathematics and other subjects expressed initially in words and then using letters and symbols(1); b. substitute numbers into a formula; derive a formula and change its subject(2).	(1) Formulae for the area of a triangle, the area enclosed by a circle, wage earned = hours worked $\times$ rate per hour (2) Find r given that $C = \pi r$, find x given $y = mx + c$
7.2 - Generate terms of a sequence using term-to-term and position-to-term definitions of the sequence	Candidates should be able to: a. generate terms of a sequence using term-to-term and position-to-term(1) definitions of the sequence; b. generate common integer sequences (including sequences of odd or even integers, squared integers, powers of 2, powers of 10, triangular numbers).	(1) Write down the 1st two terms of the sequence whose nth term is $3n-5$
7.3 - Use linear expressions to describe the nth term of an arithmetic sequence	Candidates should be able to: a. use linear expressions to describe the nth term of an arithmetic sequence, justifying its form by referring to the activity or context from which it was generated.	Foundation also includes simple sequence of odd or even numbers, squared integers and sequences derived from diagrams

HA8 Linear equations		
8.1 – Manipulate algebraic expressions	Candidates should be able to: a. understand that the transformation of algebraic expressions obeys and generalises the rules of generalised arithmetic(1); b. manipulate algebraic expressions by collecting like terms(2), by multiplying a single term over a bracket, and by taking out common factors(3).	(1) $a(b + c) = ab + ac$ (2) $x + 5 – 2x – 1 = 4 – x$ (3) $9x – 3 = 3(3x – 1)$ or $x^2 – 3x = x(x – 3)$
8.2 – Set up and solve simple equations	Candidates should be able to: a. set up simple equations(1); b. solve simple equations(2) by using inverse operations or by transforming both sides in the same way; c. solve linear equations, with integer coefficients, in which the unknown appears on either side or on both sides of the equation; d. solve linear equations that require prior simplification of brackets, including those that have negative signs occurring anywhere in the equation, and those with a negative solution.	(1) Richard is x years, Julie is twice as old and their combined age is 24 years. Write an equation to show this information. (2) $11 – 4x = 2$; $3(2x + 1) = 8$; $2(1 – x) = 6(2 + x)$; $3x^2 = 48$; $3 = \frac{12}{x}$
HA9 General measures		
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(1); d. make sensible estimates of a range of measures in everyday settings(2); e. convert measurements from one unit to another; f. know rough metric equivalents of pounds, feet, miles, pints and gallons(3).	Statements a and e are repeated in Unit A502 Statements a, b, c, e and f are repeated in Unit A503 (1) Use bearings to specify direction (2) Given a picture of a building and an adult man, estimate the height of the building in metres (3) A water barrel holds 10 gallons. Roughly how many litres is this?

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HA10 Constructions		
10.1 – Draw triangles and other 2D shapes using a ruler and protractor	Candidates should be able to: a. measure and draw lines to the nearest millimetre, and angles to the nearest degree; b. draw triangles and other 2D shapes using a ruler and protractor, given information about their side lengths and angles(1).	(1) Use a ruler and a pair of compasses to construct triangle ABC with AB = 5cm, BC = 6cm and angle ABC = 30°
10.2 – Use straight edge and a pair of compasses to do constructions	Candidates should be able to: a. use straight edge and a pair of compasses to do standard constructions(1), including; i. an equilateral triangle with a given side, ii. the midpoint and perpendicular bisector of a line segment(2), iii. the perpendicular from a point to a line, the perpendicular from a point on a line, and iv. the bisector of an angle(3).	(1) Use a ruler and a pair of compasses to construct a triangle with sides 4cm, 8cm and 9cm (2) Construct the locus of points equidistant from P and Q (3) AB and BC
10.3 – Construct loci	Candidates should be able to: a. find loci, by reasoning to produce shapes and paths.	A region bounded by a circle and an intersecting line
HA11 Maps		
11.1 – Maps, bearings and drawings	Candidates should be able to: a. use and interpret maps and scale drawings; b. use bearings to specify direction and to solve problems.	
HA12 Core trigonometry		
12.1 – Solve 2D problems	Candidates should be able to: a. **understand, recall and use trigonometrical relationships in right-angled triangles, and use these to solve problems, including those involving bearings.**	**Use sin, cos and tan to find lengths and angles in right-angled and isosceles triangles**
HA13 Pythagoras' theorem in 2D and 3D		
13.1 – Use Pythagoras' theorem	Candidates should be able to: a. understand, recall and use Pythagoras' theorem in 2D**, then 3D problems(1).**	**(1) Find the length of the 'body' diagonal in a cuboid**

HA14 General data handling		
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.	
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.	

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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.	