

## 2.2 Unit A501/01: Maths Unit A (Foundation)

This unit assumes the use of a calculator.

| FA1 General problem solving skills   |  | Examples  |
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| 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   | <p>Candidates should be able to:</p> <ol style="list-style-type: none"><li>select and use suitable problem solving strategies and efficient techniques to solve numerical problems;</li><li>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;</li><li>break down a complex calculation into simpler steps before attempting to solve it and justify their choice of methods;</li><li>use notation and symbols correctly and consistently within a problem;</li><li>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;</li><li>interpret and discuss numerical information presented in a variety of forms;</li><li>present and interpret solutions in the context of the original problem;</li><li>review and justify their choice of mathematical presentation;</li><li>understand the importance of counter-example and identify exceptional cases when solving problems;</li><li>show step-by-step deduction in solving a problem;</li><li>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.</li></ol> | Statements a to k are repeated across all Units |

**FA2 Number**

2.1 - Add, subtract, multiply and divide any number

Candidates should be able to:

- understand and use positive numbers and negative integers, both as positions and translations on a number line;
- add, subtract, multiply and divide integers and then any number;
- multiply or divide any number by powers of 10;
- multiply or divide any positive number by a number between 0 and 1;
- 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:

- use their previous understanding of integers and place value to deal with arbitrarily large positive numbers;
- round numbers to a given power of 10;
- 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:

- use calculators effectively and efficiently;
- know how to enter complex calculations and use function keys for reciprocals, squares and powers;
- 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

**FA3 Hierarchy 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:

- use brackets and the hierarchy of operations.

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

| <b>FA4 Ratio</b>  |   |   |
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| 4.1 - Use ratio notation, including reduction to its simplest form and its various links to fraction notation | Candidates should be able to: <ul style="list-style-type: none"> <li>a. use ratio notation, including reduction to its simplest form;</li> <li>b. know its various links to fraction notation.</li> </ul>   | <ul style="list-style-type: none"> <li>• Write the ratio 24:60 in its simplest form</li> </ul>  |
| 4.2 - Divide a quantity in a given ratio  | Candidates should be able to: <ul style="list-style-type: none"> <li>a. divide a quantity in a given ratio<sup>(1)</sup>;</li> <li>b. determine the original quantity by knowing the size of one part of the divided quantity;</li> <li>c. solve word problems about ratio, including using informal strategies and the unitary method of solution<sup>(2)</sup>.</li> </ul>  | <p>(1) Divide £120 in the ratio 3:7</p> <p>(2) 8 calculators cost £59.52. How much do 3 calculators cost?</p>   |
| <b>FA5 Factors, multiples and primes</b>  |   |   |
| 5.1 - Factors, multiples and primes   | Candidates should be able to: <ul style="list-style-type: none"> <li>a. use the concepts and vocabulary of factor (divisor), multiple, common factor, highest common factor, least common multiple, prime number and prime factor decomposition<sup>(1)</sup>;</li> <li>b. find the prime factor decomposition of positive integers<sup>(2)</sup>.</li> </ul>   | <p>(1) Write down a multiple of 7, a prime number and a factor of 104 that lie between 25 and 30</p> <p>(2) Write 96 as a product of prime factors using indices</p>  |
| <b>FA6 General algebra and coordinates</b>  |   |   |
| 6.1 - Symbols and notation  | Candidates should be able to: <ul style="list-style-type: none"> <li>a. distinguish the different roles played by letter symbols in algebra, using the correct notational conventions for multiplying or dividing by a given number;</li> <li>b. know that letter symbols represent definite unknown numbers in equations<sup>(1)</sup>, defined quantities or variables in formulae<sup>(2)</sup> and general, unspecified independent numbers in identities<sup>(3)</sup>;</li> <li>c. know that in functions, letter symbols define new expressions or quantities by referring to known quantities<sup>(4)</sup>.</li> </ul> | <p>These statements are repeated across all Units</p> <p>(1) <math>5x + 1 = 16</math></p> <p>(2) <math>V = IR</math></p> <p>(3) <math>3x + 2x = 5x</math> for all values of <math>x</math></p> <p>(4) <math>y = 2x</math></p> |
| 6.2 - Algebraic terminology   | Candidates should be able to: <ul style="list-style-type: none"> <li>a. distinguish in meaning between the words 'equation', 'formula' and 'expression'.</li> </ul>   | This statement is repeated across all Foundation Units  |

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| 6.3 - Use the conventions for coordinates in the plane   | <p>Candidates should be able to:</p> <ol style="list-style-type: none"> <li>use the conventions for coordinates in the plane; plot points in all four quadrants;</li> <li>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';</li> <li>use axes and coordinates to specify points in all four quadrants;</li> <li>locate points with given coordinates<sup>(1)</sup>;</li> <li>find the coordinates of the midpoint of the line segment AB, given points A and B, then calculate the length AB.</li> </ol> | <p>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.</p> <p>(1) Plot (3, 6) and (2, -4) on the grid provided</p> |
| <b>FA7 Sequences and formulae</b>  |   |   |
| 7.1 - Derive a formula, substitute numbers into a formula and change the subject of a formula          | <p>Candidates should be able to:</p> <ol style="list-style-type: none"> <li>use formulae from mathematics and other subjects expressed initially in words and then using letters and symbols<sup>(1)</sup>;</li> <li>substitute numbers into a formula; derive a formula and change its subject<sup>(2)</sup>.</li> </ol>   | <p>(1) Formulae for the area of a triangle, the area enclosed by a circle, wage earned = hours worked × rate per hour</p> <p>(2) Find <math>r</math> given that <math>C = \pi r</math>, find <math>x</math> given <math>y = mx + c</math></p>           |
| 7.2 - Generate terms of a sequence using term-to-term and position-to-term definitions of the sequence | <p>Candidates should be able to:</p> <ol style="list-style-type: none"> <li>generate terms of a sequence using term-to-term and position-to-term<sup>(1)</sup> definitions of the sequence;</li> <li>generate common integer sequences (including sequences of odd or even integers, squared integers, powers of 2, powers of 10, triangular numbers).</li> </ol>   | <p>(1) Write down the 1<sup>st</sup> two terms of the sequence whose <math>n</math>th term is <math>3n-5</math></p>   |
| 7.3 - Use linear expressions to describe the $n$ th term of an arithmetic sequence                     | <p>Candidates should be able to:</p> <ol style="list-style-type: none"> <li>use linear expressions to describe the <math>n</math>th term of an arithmetic sequence, justifying its form by referring to the activity or context from which it was generated.</li> </ol>   | <p>Foundation also includes simple sequence of odd or even numbers, squared integers and sequences derived from diagrams</p>  |

**FA8 Linear equations**

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| 8.1 - Manipulate algebraic expressions  | Candidates should be able to:<br>a. understand that the transformation of algebraic expressions obeys and generalises the rules of generalised arithmetic <sup>(1)</sup> ;<br>b. manipulate algebraic expressions by collecting like terms <sup>(2)</sup> , by multiplying a single term over a bracket, and by taking out common factors <sup>(3)</sup> .  | (1) $a(b + c) = ab + ac$<br>(2) $x + 5 - 2x - 1 = 4 - x$<br>(3) $9x - 3 = 3(3x - 1)$<br>or $x^2 - 3x = x(x - 3)$   |
| 8.2 - Set up and solve simple equations | Candidates should be able to:<br>a. set up simple equations <sup>(1)</sup> ;<br>b. solve simple equations <sup>(2)</sup> by using inverse operations or by transforming both sides in the same way;<br>c. solve linear equations, with integer coefficients, in which the unknown appears on either side or on both sides of the equation;<br>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.<br>(2) $11 - 4x = 2$ ; $3(2x + 1) = 8$ ;<br>$2(1 - x) = 6(2 + x)$ ; $3x^2 = 48$ ; $3 = \frac{12}{x}$ |

**FA9 General measures**

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| 9.1 - Interpret scales and use measurements | Candidates should be able to:<br>a. interpret scales on a range of measuring instruments, including those for time and mass;<br>b. know that measurements using real numbers depend on the choice of unit;<br>c. understand angle measure using the associated language <sup>(1)</sup> ;<br>d. make sensible estimates of a range of measures in everyday settings <sup>(2)</sup> ;<br>e. convert measurements from one unit to another;<br>f. know rough metric equivalents of pounds, feet, miles, pints and gallons <sup>(3)</sup> . | Statements a and e are repeated in Unit A502<br>Statements a, b, c, e and f are repeated in Unit A503<br>(1) Use bearings to specify direction<br>(2) Given a picture of a building and an adult man, estimate the height of the building in metres<br>(3) A water barrel holds 10 gallons. Roughly how many litres is this? |
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**FA10 Constructions**

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| 10.1 - Draw triangles and other 2D shapes using a ruler and protractor | Candidates should be able to:<br>a. measure and draw lines to the nearest millimetre, and angles to the nearest degree;<br>b. draw triangles and other 2D shapes using a ruler and protractor, given information about their side lengths and angles <sup>(1)</sup> . | (1) Use a ruler and a pair of compasses to construct triangle ABC with $AB = 5\text{cm}$ , $BC = 6\text{cm}$ and angle $ABC = 30^\circ$ |
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| 10.2 - Use straight edge and a pair of compasses to do constructions              | Candidates should be able to: <ul style="list-style-type: none"> <li>a. use straight edge and a pair of compasses to do standard constructions<sup>(1)</sup>, including; <ul style="list-style-type: none"> <li>i. an equilateral triangle with a given side,</li> <li>ii. the midpoint and perpendicular bisector of a line segment<sup>(2)</sup>,</li> <li>iii. the perpendicular from a point to a line, the perpendicular from a point on a line, and</li> <li>iv. the bisector of an angle<sup>(3)</sup>.</li> </ul> </li> </ul>  | (1) Use a ruler and a pair of compasses to construct a triangle with sides 4cm, 8cm and 9cm<br>(2) Construct the locus of points equidistant from P and Q<br>(3) AB and BC |
| 10.3 - Construct loci   | Candidates should be able to: <ul style="list-style-type: none"> <li>a. find loci, by reasoning to produce shapes and paths.</li> </ul>  | A region bounded by a circle and an intersecting line  |
| <b>FA11 Maps</b>  |  |  |
| 11.1 - Maps, bearings and drawings  | Candidates should be able to: <ul style="list-style-type: none"> <li>a. use and interpret maps and scale drawings;</li> <li>b. use bearings to specify direction and to solve problems.</li> </ul>   |  |
| <b>FA12 Pythagoras' theorem in 2D</b>   |  |  |
| 12.1 - Use Pythagoras' theorem  | Candidates should be able to: <ul style="list-style-type: none"> <li>a. understand, recall and use Pythagoras' theorem to solve simple cases in 2D.</li> </ul>   |  |
| <b>FA13 General data handling</b>   |  |  |
| 13.1 - Understand and use statistical problem solving process/handling data cycle | Candidates should be able to: <ul style="list-style-type: none"> <li>a. carry out each of the four aspects of the handling data cycle to solve problems: <ul style="list-style-type: none"> <li>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;</li> <li>ii. collect data from a variety of suitable sources, including experiments and surveys, and primary and secondary sources;</li> <li>iii. process and represent the data: turn the raw data into usable information that gives insight into the problem;</li> <li>iv. interpret and discuss the data: answer the initial question by drawing conclusions from the data.</li> </ul> </li> </ul> |  |

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| 13.2 - Experimenting | <p>Candidates should be able to:</p> <ol style="list-style-type: none"> <li>a. discuss how data relate to a problem, identify possible sources of bias and plan to minimise it;</li> <li>b. identify key questions that can be addressed by statistical methods;</li> <li>c. design an experiment or survey and decide what primary and secondary data to use;</li> <li>d. design and use data-collection sheets for grouped discrete and continuous data;</li> <li>e. gather data from secondary sources, including printed tables and lists from ICT-based sources;</li> <li>f. design and use two-way tables for discrete and grouped data.</li> </ol> |  |
| 13.3 - Processing    | <p>Candidates should be able to:</p> <ol style="list-style-type: none"> <li>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;</li> <li>b. calculate mean, range and median of small data sets with discrete then continuous data;</li> <li>c. identify the modal class for grouped data;</li> <li>d. find the median for large data sets and calculate an estimate of the mean for large data sets with grouped data.</li> </ol>   |  |
| 13.4 - Interpreting  | <p>Candidates should be able to:</p> <ol style="list-style-type: none"> <li>a. look at data to find patterns and exceptions;</li> <li>b. interpret a wide range of graphs and diagrams and draw conclusions;</li> <li>c. interpret social statistics including index numbers, and survey data;</li> <li>d. compare distributions and make inferences, using the shapes of distributions and measures of average and range;</li> <li>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.</li> </ol>               |  |