

## UNIT 2 (Core) FURTHER NUMBER AND ALGEBRA

### Recommended Prior Knowledge

It is strongly recommended that candidates have a thorough knowledge and understanding of the topics in Unit 1.

### Context

The unit draws on the skills that candidates have developed whilst studying the topics in Unit 1. Further mathematical concepts in Number and Algebra are explored, many aspects of which are drawn upon in later units. Candidates should use calculators where appropriate; however, it is recommended that regular non-calculator work is completed to strengthen candidates' mental arithmetic.

### Outline

The topics in this unit may be studied sequentially. There is some element of choice, however, and Centres may wish to teach topics in a different order. Work on indices, standard form, accuracy, direct and inverse proportion, measures of rate, personal and household finance, expanding brackets and factorisation is completed together with further work on solving equations and drawing graphs. With all sections it is expected that candidates will be set questions of varying difficulty to complete for themselves. The unit gives candidates the opportunity to work investigatively and thus establish the skills needed for the submission of coursework.

Learning Outcomes		Suggested Teaching Activities	Resources
23	Use and interpret positive, negative and zero indices.	<p><b>Class activity:</b> Revise writing an integer as a product of primes, writing answers using index notation.</p> <p>Use simple examples to illustrate the rules of indices. Introduce negative indices, e.g.</p> $2^{-1} = 2^{(2-3)} = \frac{2^2}{2^3} = \frac{1}{2} \quad \text{and} \quad 2^0 = 2^{(3-3)} = \frac{2^3}{2^3} = 1.$	
5	Order quantities by magnitude and demonstrate familiarity with the symbols =, ≠, >, <, ≥, ≤.	<p>Use a number line to describe simple inequalities and ranges of values e.g. <math>x \geq 3</math>, <math>-2 \leq x &lt; 5</math>, etc.</p> <p><b>Class activity:</b> Given a list of quantities (e.g. a list of fractions and decimals), order them by magnitude making use of inequality signs.</p>	For ordering quantities, search for 'ordering fractions' or ordering decimals' at <a href="http://www.learn.co.uk">http://www.learn.co.uk</a>
6/12	Use the standard form $A \times 10^n$ where $n$ is a positive or negative integer, and $1 \leq A < 10$ .	<p>Use a range of examples to show how to write numbers in standard form and vice-versa. Interpret how a calculator displays standard form.</p> <p><b>Class activity:</b> Use the four rules of calculation with numbers in standard form.</p>	
13	Use current units of mass, length, area, volume, and capacity in practical situations and express quantities in terms of larger or smaller units.	Use practical examples to illustrate how to convert between: millimetres, centimetres, metres and kilometres; grams, kilograms and tonnes; millilitres, centilitres and litres. Use standard form where appropriate.	

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8	Make estimates of numbers, quantities and lengths, give approximations to specified numbers of significant figures and decimal places and round off answers to reasonable accuracy in the context of a given problem.	Revise rounding numbers to the nearest 10, 100, 1000, etc., or to a set number of decimal places. Explain carefully how to round a number to a given number of significant figures.	Revision of estimating and rounding at <a href="http://www.math.com/school/subject1/lessons/S1U1L3GL.html">http://www.math.com/school/subject1/lessons/S1U1L3GL.html</a>
12	Use an electronic calculator efficiently; apply appropriate checks of accuracy.	Use rounding to 1sf to estimate the answer to a calculation. Check answers with a calculator. <b>Class activity:</b> Investigate the percentage error produced by rounding in calculations using addition/subtraction and multiplication/division. (Percentage error will need to be discussed beforehand)	
9	Give appropriate upper and lower bounds for data given to a specified accuracy (e.g. measured lengths).	Use straightforward examples to determine upper and lower bounds for data. For example, a length, $l$ , measured as 3cm to the nearest millimetre has lower bound 2.95cm and upper bound 3.05cm. Show how this information can be written using inequality signs e.g. $2.95\text{cm} \leq l < 3.05\text{cm}$ . <b>Class activity:</b> Investigate upper and lower bounds for quantities calculated from given formulae by specifying the accuracy of the input data.	
10	Demonstrate an understanding of the elementary ideas and notion of direct and inverse proportion.	Draw a graph to determine whether two quantities are in proportion.  Solve problems involving direct or inverse proportion using the ratio or unitary method.  The idea of similar shapes can be introduced here.  <b>Class activity:</b> Investigate the ratio of the length of one side of an A5 sheet of paper to that of the corresponding side of an A4 sheet of paper.	
19	Interpret and obtain the equation of a straight line graph in the form $y=mx+c$ ; determine the equation of a straight line parallel to a given line	<b>Class activity:</b> Revise drawing a graph of $y=mx+c$ from a table of values.  Starting with a straight line graph show how its equation ( $y=mx+c$ ) can be obtained.	
10	Demonstrate an understanding of common measures of rate; use scales in practical situations, calculate average speed.	Introduce the formula relating speed, distance and time. Solve simple numerical problems (which should involve converting between units e.g. find speed in m/s given distance in kilometres and time in hours).	
15	Calculate using money and convert from one currency to another.	Solve straightforward problems involving exchange rates. Up-to-date information from a daily newspaper is useful.	Exchange rates can be found at <a href="http://cnfn.cnn.com/markets/currencies/">http://cnfn.cnn.com/markets/currencies/</a>
17	Interpret and use graphs in practical situations including travel graphs and conversion graphs, draw graphs from given data.	Draw and use straight line graphs to convert between different units e.g. between metric and imperial units or between different currencies.  Solve straightforward problems using compound measures	

		<p>e.g. problems involving rate of flow.</p> <p>Draw and use distance-time graphs to calculate average speed (link to calculating gradients in Unit 1). Interpret information shown in travel graphs. Draw travel graphs from given data.  <b>Class activity:</b> Draw a travel graph for the journey to and from school. Answer a set of questions about the journey, e.g. what is the average speed on the journey to school?</p>	
16	Use given data to solve problems on personal and household finance involving earnings, simple interest, compound interest, discount, profit and loss; extract data from tables and charts.	<p>Solve simple problems using practical examples where possible, taking information from published tables or advertisements. (It is worth introducing a range of simple words and concepts here to describe different aspects of finance, e.g. tax, percentage profit, deposit, loan, etc.)</p> <p>Use the formula <math>I = PRT</math> to solve a variety of problems involving simple interest.  <b>Class activity:</b> Research the cost of borrowing money from different banks (or money lenders).</p>	Information about interest rates can be found from most banks. They usually have their own web site in the format <a href="http://www.bank name.com/">http://www.bank name.com/</a>
21	Manipulate directed numbers; use brackets and extract common factors.	<p><b>Class activity:</b> Revise transforming simple formulae (use examples similar to those used in Unit 1).</p> <p>Use straightforward examples (with both positive and negative numbers) to illustrate expanding brackets. Extend this technique to multiplying two brackets together - use a 2x2 grid to help understanding.  <b>Class activity:</b> Use algebra to show that the solution to the following problem is always 2. "Think of a number, add 7, multiply by 3, subtract 15, multiply by <math>\frac{1}{3}</math>, take away the number you first thought of." Investigate similar problems.</p> <p>Use straightforward examples (with both positive and negative numbers) to illustrate factorising simple expressions.</p>	
24	Solve simultaneous linear equations in two unknowns.	<p>Revise how to solve linear equations (including expressions with brackets).</p> <p>Use straightforward examples to illustrate how to solve simultaneous equations by elimination and by substitution.  <b>Class activity:</b> Approximate the solution to simultaneous linear equations by graphical means.</p>	
18	Construct tables of values for functions of the form $\pm x^2 + ax + b$ , $a/x$ ( $x \neq 0$ ) where $a$ and $b$ are integral constants; draw and interpret such graphs; solve linear and quadratic equations approximately by graphical methods.	<p>Draw quadratic functions from a table of values.</p> <p>Show how the solutions to a quadratic equation may be approximated using a graph. Extend this work to show how the solution(s) to pairs of equations (e.g. <math>y = x^2 - 2x - 3</math> and <math>y = x</math>) can be estimated using a graph.  <b>Class activity:</b> Computer packages such as Omnigraph or</p>	

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