

UNIT A3

Recommended Prior Knowledge Units A1, A2, N2

Context This unit continues to develop algebraic manipulation skills and introduces graphs of straight lines.

Outline Drawing and interpreting straight line graphs, including the concept of gradient, lead to finding the equation of a straight line graph. In the manipulation section, working with algebraic fractions is introduced and students also progress to constructing equations from given situations.

	Learning Outcomes	Suggested Teaching Activities	Resources
20	Construct tables of values and draw graphs of functions of the form $y = ax + b$; interpret graphs of linear functions; find the gradient of a straight line graph.	Show the students how to construct tables of values and use them to draw a straight line graph.	http://www.ex.ac.uk/cimt/mepres/book8/bk8_14.pdf deals comprehensively with straight line graphs.
21	Calculate the gradient of a straight line from the coordinates of two points on it; interpret and obtain the equation of a straight line graph in the form $y = mx + c$.	Activity: Ask groups of students to draw families of graphs and compare the results e.g. one group to draw $y = x$, $y = 2x$, $y = 3x$ etc, one to draw $y = x$, $y = x + 1$, $y = x - 2$, one to draw $y = 2x$, $y = -0.5x$, $y = -4x$, $y = 0.25x$ etc as a lead in to work on the equation of a straight line, gradient, intercept, and parallel (and perpendicular) lines. If possible, use computers for this activity, using graph-drawing programs such as Autograph or Omnigraph.	Or students could use the free applet at http://www.rfbarrow.btinternet.co.uk/htmks3/Linear1.htm .
23	Manipulate simple algebraic fractions.	Check that students are competent at using the four rules for fractions (see unit N2). Then introduce simple algebraic fractions with numerical denominators: simplify where possible, add and subtract them, multiply by an integer.	http://www.bbc.co.uk/scotland/education/bitesize/standard/mathsl1/algebra/fractions_rev1.shtml has work on algebraic fractions, including those with letters in the denominator.
25	Solve fractional linear equations with numerical denominators.	Apply these manipulating skills to solving equations containing such fractions.	There are a few equations with fractions at http://www.ex.ac.uk/cimt/mepres/allgcse/bkb10.pdf .

22	Construct equations from given situations.	Move on to constructing formulae, then substituting in the subject and solving the resulting equation. Some of the formulae situations you used in unit A1 may be suitable for the work on constructing formulae.	Constructing formulae is in section 2.2 at http://www.ex.ac.uk/cimt/mepres/allgcse/bka2.pdf
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UNIT D3

Recommended Prior Knowledge Units D1, D2.

Context This unit moves on from the discrete data studied in D2 to representing continuous data in classes of equal intervals and to calculating the mean of such distributions.

Outline This unit includes constructing and interpreting frequency diagrams with equal intervals and identifying the modal class. It moves on to calculating the mean of a grouped frequency distribution.

	Learning Outcomes	Suggested Teaching Activities	Resources
35	<p>Collect, classify and tabulate continuous data into classes of equal intervals.</p> <p>Construct and use bar graphs (histograms with equal intervals) and frequency polygons</p> <p>Calculate the mean for a grouped frequency distribution; identify the modal class from a grouped frequency distribution.</p>	<p>Give the students a list of raw continuous data, such as their heights from unit S1, and ask them how the data could be organised and displayed. Introduce the idea of using equal class intervals to enable some comparisons. Show them how to describe a class interval formally e.g. $170 < h \leq 175$ for a height of h cm and how to find the mid-point of a class.</p> <p>Show them how to draw bar graphs (histograms of equal width where the vertical scale is the frequency) and frequency polygons (where the data is plotted at the mid-point of the class). Identify the modal class. Give the students practice at constructing and interpreting these types of diagram.</p> <p>Give the students a grouped frequency distribution and discuss with them how the mean can be found (you may wish to revise first finding the mean of a discrete frequency distribution as studied in D2). Emphasise that for a grouped frequency distribution, the calculation gives only an</p>	<p>Questions and examples are at http://www.ex.ac.uk/cimt/mepres/allgcse/bkb8.pdf</p> <p>Raw data may be extracted from sites such as http://www.censusatschool.ntu.ac.uk/, sites giving athletic records, etc.</p>

		<p>estimate of the mean.</p> <p>Activity: ask students to write down an estimate of the length, in metres, of their classroom. Collect these, ask students to group and tabulate them and calculate the mean. The room can then be measured and the results compared. A poster could be made of the results of this activity, showing also diagrams representing the data.</p>	
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UNIT N3

Recommended Prior Knowledge Units N1, N2, A2.

Context Having learnt basic number skills for all types of real number, these skills are now applied to ordering quantities by magnitude and to estimating and rounding.

Outline Ideas of inequalities and ordering numbers are dealt with first. Then rounding skills are developed and applied to estimates and checking procedures, whilst efficient use of the calculator assists in accurate calculations.

	Learning Outcomes	Suggested Teaching Activities	Resources
7	Order quantities by magnitude and demonstrate familiarity with the symbols =, ≠, >, <, ≥, ≤.	<p>Give a list of numbers in different forms, such as 63%, 0.54, 5/11 and 5/8. Ask the students to write the numbers in order of size, smallest first and discuss how this can be done [e.g. converting them all to decimals] Discuss different strategies e.g. some students may know that $5/8 = 62.5\%$.</p> <p>Use the opportunity to demonstrate the equality and inequality symbols and encourage students to use them.</p>	<p>The NRich site has problems to solve on comparing and ordering numbers at http://nrich.maths.org/public/leg.php?group_id=1&code=5004</p>
10	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	<p>Teach students how to round, using a number line to position the unrounded numbers, to the nearest 100, nearest 10, to 1 decimal place etc, 3 significant figures etc. Show the students which are the vital digits to look at in each case. Use the convention of rounding halfway positions up, e.g. 8.5 rounding to 9 to the nearest unit. Discuss that rounding to the nearest number is not always appropriate e.g. if calculating the number of cans of paint required, an answer of 3.2 would need to round up to 4.</p>	<p>Section 6.3 is about rounding at http://www.ex.ac.uk/cimt/mepres/allgcse/bka6.pdf. Section 6.4 is about estimates and 6.6 about using a calculator efficiently (see also unit A2).</p>
14	Use an electronic calculator efficiently; apply appropriate checks of accuracy	<p>Apply rounding skills to making estimates</p>	

		<p>e.g. to use 1 significant figure estimates to check calculations made with a calculator. Encourage students to think in advance of a calculation what size of answer they should expect. Teach students how to use their calculator efficiently for complex calculations using brackets, square roots, powers etc, continuing the work begun in unit A2.</p> <p>Students could work in pairs – one writing a calculation and using their calculator to evaluate it whilst the other works out an estimate.</p>	
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UNIT S3

Recommended Prior Knowledge Units N1, S1, S2

Context Students apply the measuring skills learnt in S1 to formal geometrical constructions and scale drawings. They will need for this some of the geometrical terms learnt in S2. Simple scale drawings provide an introduction to the formal study of ratio and proportion in N4. Pythagoras' theorem is introduced, using the square roots learnt in N1.

Outline Formal geometrical constructions and simple scale drawings, including the use of bearings, are both studied in this unit. (If desired, scale drawings could be studied first and used as an introduction to formal constructions without a protractor.) Having found the unknown side of a right-angled triangle by construction, the method for calculating it by using Pythagoras' theorem is then introduced.

	Learning Outcomes	Suggested Teaching Activities	Resources
28	Construct simple geometrical figures from given data, angle bisectors and perpendicular bisectors using protractors or set squares as necessary; read and make scale drawings. (Where it is necessary to construct a triangle given the three sides, ruler and compasses only must be used.)	<p>Re-visit the symmetry properties of a rhombus and a kite and show that these are the basis for constructing perpendicular and angle bisectors.</p> <p>Give students practice in constructing triangles from different data, given three sides, a side and two angles, or two sides and an angle. Constructing the circumcircle and the incircle of triangles can be used as an activity to give further practice in constructing perpendicular and angle bisectors. Include also construction of some other geometrical figures, such as some quadrilaterals. (Polygons are studied in S4)</p>	<p>The first page at http://www.bbc.co.uk/schools/gcsebitesize/maths/shapeih/locirev3.shtml has an interactive demonstration of how to do these constructions [the second page gives an example using loci, which are studied in S5].</p> <p>http://www.mathforum.org/library/topics/constructions has links for teachers about constructions, giving background and ideas</p>
12	Use scales in practical situations	Apply the construction skills to making scale drawings, using simple scales only (harder scales will be met in N4, when ratio and proportion are studied). Include drawings giving the position of places, using three-figure bearings.	
29	Interpret and use three-figure bearings measured clockwise from the north (i.e. $000^\circ - 360^\circ$).		http://www.ex.ac.uk/cimt/mepres/allgcse/bka3.pdf has work on bearings and scale drawings at section 3.7.

34	Apply Pythagoras' theorem to the calculation of a side of a right-angled triangle.	Constructing right-angled triangles can be used as an introduction to Pythagoras' theorem.	another introductory approach is at http://www.bbc.co.uk/schools/gcsebitesize/maths/shapeih/pythagorastheoremrev2.shtml
21	Calculate the length and the coordinates of the midpoint of a line segment from the coordinates of its endpoints.	<p>You may wish to use a dissection method to show students that the two squares on the smaller sides can be pieced together to form the square on the hypotenuse. (A formal proof is not required but may be shown to students after similarity has been studied in S6.)</p> <p>Give practice to the students in finding the hypotenuse and another side, using triangles in different orientations. Apply the theorem also to questions in context, such as how far up a wall a ladder reaches.</p> <p>Also apply the theorem to line segments given the end-points, including also how to find the mid-point of a line segment [if unit S3 is studied before A3, this could be included with the work on straight-line graphs in unit A3].</p>	and further examples can be found at http://www.digitalbrain.com/document.server/subjects/ks4mat/su4/mod2e/content.htm#1