

UNIT A4

Recommended Prior Knowledge Units A1, A2, A3

Context This unit builds on earlier work on manipulative algebra, particularly on expanding brackets and solving linear equations, introducing further concepts.

Outline From solving linear equations, the students move on to solving linear inequalities. Then simultaneous linear equations are introduced. Finally, the students meet quadratic expressions, learning to expand the product of two brackets.

	Learning Outcomes	Suggested Teaching Activities	Resources
25	Solve simple linear inequalities.	Revise solving linear equations and then move on to replacing an equation with an inequality, teaching the students to use the inequality throughout their solution. Practise solving linear inequalities.	sections 16.1 and 16.2 of http://www.ex.ac.uk/cimt/mepres/allgcse/bkc16.pdf http://www.bbc.co.uk/schools/gcsebitesize/maths/algebraih/index.shtml has worked examples and questions to practise on inequalities and other algebra topics
25	Solve simultaneous linear equations in two unknowns.	Introduce simultaneous equations by giving the students a puzzle such as '3 bananas and 2 apples cost *, one banana and one apple cost **. Find the cost of a banana.' using local fruits and prices. Usually some students are able to solve this logically, by doubling the second set of information then subtracting. Then express the information algebraically and show them how to set out the solution, using the same processes. Continue then with further work on simultaneous equations, including those where both equations have to be multiplied and those where addition is needed rather than subtraction. To give further practice in constructing and solving equations, students could work in pairs, making up similar word problems leading to simultaneous equations and	section 10.8 of http://www.ex.ac.uk/cimt/mepres/allgcse/bkb10.pdf Keep the students' ideas for future years, to build up your bank of resources!

		then solving them algebraically for each other.	
23	Expand products of algebraic expressions.	Revise work on expanding and simplifying such as $3x(x + 4)$ and then $2(x + 5) - 3(4x - 1)$. Then move on to introducing expansion and simplifying quadratic expressions such as $(x + 5)(x - 3)$ and then $(3x - 4)(2x - 7)$	section 10.7 of http://www.ex.ac.uk/cimt/mepres/allgcse/bkb10.pdf

UNIT D4

Recommended Prior Knowledge Unit N2

Context The concepts of probability are introduced.

Outline Ideas of probability used in everyday life, including experimental and theoretical probabilities, are used to establish the idea of probability being on a scale from 0 to 1, expressed as a fraction or decimal. The probabilities of a single event are calculated.

	Learning Outcomes	Suggested Teaching Activities	Resources
36	Calculate the probability of a single event as either a fraction or a decimal (not a ratio)	<p>Introduce elementary ideas of probability using familiar contexts, for example the probability of obtaining a red ball when a ball is chosen from a bag without looking, or a weather forecaster saying there is a 20% chance of rain today. Introduce the idea of 'at random', and that probabilities are on a scale from 0 to 1.</p> <p>To help the students to grasp the concepts, some probability experiments are a good idea, to demonstrate the difference between theoretical and experimental probability, and short and long-term trends. For instance, students could work in pairs, with several pairs doing the same experiment, to compare their results and then pool them to obtain larger samples. Possible experiments include taking balls or coloured pencils out of a bag, throwing dice, choosing cards numbered on one side, tossing coins, dropping a drawing pin and seeing whether it lands point down or point up etc.</p> <p>After comparing and discussing the results,</p>	<p>http://www.ex.ac.uk/cimt/mepres/allgcse/bka5.pdf is a chapter on probability, with sections 5.1 and 5.2 suitable for this unit [see unit D7 for compound events].</p> <p>http://www.mathgoodies.com/lessons/vol6/intro_probability.html is an introductory lesson on probability</p> <p>http://www.harcourtschool.com/elab/act_5_11.html is a probability experiment with a dice</p>

		go on to calculate the probability of a single event in different contexts. Establish also and use the fact that the sum of probabilities of all the outcomes is 1.	
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UNIT N4

Recommended Prior Knowledge Units N1, N2, N3, A3, S1, S3

Context Earlier work done on money conversion and simple scale drawings is followed here by more work on ratio and proportion and rates, including speed.

Outline Basic ideas of proportion are dealt with first, followed by formal work on ratio. Speed is introduced and then applied numerically and in travel graphs. Other rates are also dealt with numerically and by conversion graphs.

	Learning Outcomes	Suggested Teaching Activities	Resources
12	Demonstrate an understanding of the elementary ideas and notation of ratio, direct and inverse proportion and common measures of rate; divide a quantity in a given ratio; use scales in practical situations, calculate average speed.	<p>Introduce proportion by using a traditional local recipe with quantities for 4 people, asking students for the quantities needed for 8 people, 6 people etc. Do further work on proportion such as how many cans of paint are needed to paint a fence, knowing the area which can be painted using 1 litre. Include some inverse proportion, such as the fixed cost of hiring a coach, finding the cost per person if 50 people go in the coach or only 40 do.</p> <p>Move on to comparing quantities as ratios, using ratio notation. Include work on scales and scale drawings, following on from the work in S3, using harder scales. Do work on solving problems with ratios, including simplifying ratios and dividing a quantity in a given ratio.</p> <p>Students could be asked to investigate the 'Golden section' ratio</p> <p>Formally define speed and use it to solve problems involving constant speeds. [This may be combined with the work on travel graphs in the next section.] Use problems</p>	<p>Cookery books or recipes on websites. For instance there are links to over 500 sites giving Asian recipes at http://www.cbel.com/asian_recipes/</p> <p>Use local maps if possible.</p> <p>http://www.ex.ac.uk/cimt/mepres/allgcse/bkc15.pdf has work on ratio and proportion and scale drawings</p> <p>For the 'Golden section' see http://www.mcs.surrey.ac.uk/Personal/R.Knott/Fibonacci/fib.html</p>

		involving other rates, for example the volume of water per minute flowing through a tap.	
19	Demonstrate familiarity with cartesian coordinates in two dimensions; interpret and use graphs in practical situations including travel graphs and conversion graphs; draw graphs from given data.	<p>Start with a reminder of the money conversion graphs met in N2 and then use other conversion graphs such as miles / kilometres and Fahrenheit / Celsius temperatures or other conversions with which your students are familiar. Include drawing these graphs as well as reading off them and interpreting them to find conversion rates.</p> <p>Use a travel graph of someone's journey to school, perhaps stopping on the way, then going straight home at the end of the day, plotting distance from home against time. You can use this for reading off, calculating speed and interpreting zero and negative gradients etc, relating back to the work on gradients done in A2. Then use other travel graphs, including drawing two journeys on the same graph and interpreting where they cross.</p>	<p>Up to date currency conversions are at sites such as http://www.xe.com/ucc/</p> <p>http://tife.org.uk/numeracy/secondary/algebra/travelgraphs.ppt is an example of a travel graph at this level http://smard.cqu.edu.au/Database/Junior/Algebra/Coordinate_Geometry/Gradient.doc is a worksheet on graphs and includes a bath graph as well as a travel graph</p>

UNIT S4

Recommended Prior Knowledge Units S1, S2, A3

Context Earlier work on triangles and quadrilaterals is extended to work on polygons in general. Circles are introduced.

Outline The vocabulary and angle and symmetry properties of polygons are met and used. The focus then moves to circles, introducing the necessary terminology and looking at symmetry properties before establishing the formulae for the circumference and area of a circle.

	Learning Outcomes	Suggested Teaching Activities	Resources
27	Use and interpret the geometrical terms: interior and exterior angles, regular and irregular polygons, pentagons, hexagons, octagons, decagons.	Use a picture of a paving design including triangles, quadrilaterals and other polygons to ask students what shapes they can identify. Move on to introducing the names of different polygons and identifying line and rotational symmetries (met in S2) of regular and some irregular polygons.	Islamic designs are a rich source of examples of use of polygons as are tiled floors in some public buildings. See the gallery at http://www.salaam.co.uk/themeofthefmonth/march02_index.php?l=3 and other websites listed in unit S2
31	Calculate unknown angles and give simple explanations using the following geometrical properties: (f) angle properties of polygons including angle sum.	Show students how to construct regular polygons with their vertices on circles by dividing the angle at the centre by the number of sides and constructing radii. A poster can be made showing different regular polygons constructed in this way and they can be used as a lead in to the work on angle properties of polygons. For instance, exterior and interior angles can be measured from these and then reasoning used to establish how the results could be obtained without measuring.	http://www.ex.ac.uk/cimt/mepres/allgcse/bka3.pdf has work on polygons in section 3.5
27	Use and interpret the vocabulary of circles.	Having used circles and their radii in the first section of this unit, draw a circle and extend the students' vocabulary to include diameter, tangent, chord, circumference, arc, sector, segment, showing these on the	
30	Use the following symmetry properties of circles:		

	<p>(a) equal chords are equidistant from the centre (b) the perpendicular bisector of a chord passes through the centre (c) tangents from an external point are equal in length</p>	<p>drawing.</p> <p>Ask students to draw a circle with two tangents meeting at a point. Join this point to the centre and draw in the radii to the points of contact of the tangent, and the chord joining these points. Discuss the symmetries of this diagram and hence obtain and explain the required symmetry and angle facts. Then solve angle and length problems using these. For instance, Pythagoras' theorem (unit S3) may be used to find the length of a chord, given the radius and its distance from the centre.</p>	
31	<p>Calculate unknown angles and give simple explanations using the following geometrical properties: (h) angle between tangent and radius of a circle</p>		
33	<p>Solve problems including the circumference and area of a circle</p>	<p>Ask students to measure the diameter and circumference [use string or a flexible tape for the latter] of various circular objects in the classroom or at home, such as cans, flowerpots. Get them to draw a graph of their results with a line of best fit and to use the work done in A3 to obtain the equation of this line. This gives them an estimate for $C = \pi d$. A practical demonstration of the area formula may be obtained by cutting a circle into say 16 sectors and putting these together alternately to form an approximate rectangle, one sector being cut in half for the ends. This rectangle has width r and length = half the circumference, so leading to $A = \frac{1}{2} Cr$ and hence $A = \pi r^2$. Then solve circumference and area problems involving the whole circle (the area of sectors etc is in S7)</p>	<p>Articles giving more background about the formulae for area and circumference, and π, may be found for example at http://www-gap.dcs.st-and.ac.uk/~history/HistTopics/Pi_through_the_ages.html</p> <p>see http://www.geocities.com/thesciencefiles/circle/area.html</p> <p>section 7.7 of http://www.ex.ac.uk/cimt/mepres/allgcse/bkb7.pdf</p>

