UNIT 3 (Core) SHAPE AND SPACE

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

Context
This unit revises and develops mathematical concepts in Shape and Space. 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. Fundamental properties of angles and geometrical shapes are studied together with solving trigonometrical problems in two dimensions. 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
26	Use and interpret the geometrical terms: point, line, parallel, bearing, right angle, acute, obtuse and reflex angles, perpendicular, similarity, congruence; use and interpret vocabulary of triangles, quadrilaterals, circles and polygons.	This section is best covered as different topics are met. The geometrical terms can then be used in the context of solving problems.	
29	Calculate unknown angles using the following geometrical properties: (a) angles at a point, (b) angles on a straight line and intersecting straight lines (c) angles formed within parallel lines, (d) angle properties of triangles and quadrilaterals, (e) angle properties of regular polygons.	Revise basic angle properties by drawing simple diagrams which illustrate (a), (b) and (c). Define acute, obtuse and reflex angles; equilateral, isosceles and scalene triangles. Define the terms (irregular) polygon and regular polygon. Use examples that include: triangles, quadrilaterals, pentagons, hexagons and octagons. By dividing an n-sided polygon into a number of triangles show that the sum of the interior angles is 180(n - 2) degrees. Show also that each exterior angle is $\frac{360°}{n}$. Solve a variety of problems that use these formulae. **Class activity:** Draw a table of information for regular polygons. Use as headings: number of sides, name, exterior angle, sum of interior angles, interior angle.	Classifying angles at http://www.math.com/school/subject3/lessons/S3U1L4GL.html
31	Carry out calculations involving the perimeter and area of a rectangle and triangle, the circumference and area of a circle, the area of a parallelogram and a trapezium.	Revise, using straightforward examples, how to calculate the circumference and area of a circle, and the perimeter and area of a rectangle and a triangle. Extend this to calculating the area of a parallelogram and a trapezium. **Class activity:** Using isometric dot paper investigate the area of shapes that have a perimeter of 5, 6, 7, …. units.	Calculating areas of parallelograms and trapeziums at http://www.bbc.co.uk/schools/gcsebitesize/maths/shape/index.shtml

32	Apply Pythagoras' theorem and the sine, cosine and tangent ratios for acute angles to the calculation of a side or of an angle of a right-angled triangle (angles will be quoted in, and answers required in, degrees and decimals to one decimal place).	Use simple examples involving the sine, cosine and tangent ratios to calculate the length of an unknown side of a right-angled triangle given an angle and the length of one side. **Class activity:** Use trigonometry to calculate the height of a building or tree. You will need to discuss how to measure the angle of elevation practically. Use simple examples involving inverse ratios to calculate an unknown angle given the length of two sides of a right-angled triangle. Revise Pythagoras' theorem using straightforward examples. **Class activity:** Solve problems in context using Pythagoras' theorem and trigonometric ratios (include work with any shape that may be partitioned into right-angled triangles).	Revise Pythagoras' theorem at http://www.bbc.co.uk/schools/gcsebitesize/maths/shapeih/index.shtml Try the investigation at http://nrich.maths.org/public/leg.php
32	Interpret and use three-figure bearings measured clockwise from the north (i.e. 000^{o} - 360^{o}).	Discuss how bearings are measured and written. Use simple examples to show how to calculate bearings, e.g. calculate the bearing of *B* from *A* if you know the bearing of *A* from *B*. **Class activity:** Use a map to determine distance and direction between two places, etc.	Maps of the world at http://www.theodora.com/maps
26 31	Use and interpret vocabulary of simple solid figures including nets. Carry out calculations involving the volume of a cuboid, prism and cylinder and the surface area of a cuboid and a cylinder.	Illustrate common solids, e.g. cube, cuboid, tetrahedron, cylinder, cone, sphere, prism, pyramid, etc. Define the terms vertex, edge and face. Starting with simple examples draw the nets of various solids. Show, for example, that the net of a cube can be drawn in different ways. **Class activity:** Draw nets on card and make various geometrical shapes. Use nets to illustrate how to calculate the surface area of a cuboid, and a cylinder. Use straightforward examples to illustrate how to calculate the volume of a cuboid and various prisms (cross-sectional area x length). **Class activity:** Find the surface area and volume of various composite shapes. **Class activity:** An A4 sheet of paper can be rolled into a cylinder in two ways. Which gives the biggest volume? If the area of paper remains constant but the length and width can vary investigate what width and length gives the maximum cylinder volume.	Explore geometric solids and their properties at http://www.illuminations.nctm.org/imath/3-5/GeometricSolids/ Calculating volumes and surface areas at http://www.bbc.co.uk/schools/gcsebitesize/maths/shapeih/index.shtml