

UNIT 9 (Extended) GEOMETRY

Recommended Prior Knowledge

It is strongly recommended that candidates have a thorough knowledge and understanding of the topics Unit 1 and Unit 8.

Context

This unit draws on basic geometrical ideas to establish a deeper understanding.

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 loci and symmetry is completed together with work on circle theorems. In addition, candidates learn how to construct various geometrical figures using a straight edge and a pair of compasses only. 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 |
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| 30 | Use the following loci and the method of intersecting loci for sets of points in two dimensions: (a) which are at a given distance from a given point, (b) which are at a given distance from a given straight line, (c) which are equidistant from two given points, (d) which are equidistant from two given intersecting straight lines. | Draw simple diagrams to illustrate (a), (b), (c) and (d). Use the convention of a broken line to represent a boundary which is not included in the locus of points. Class activity: A rectangular card is 'rolled' along a flat surface. Trace out the locus of one of the vertices of the rectangle as it moves. | |
| 28 | Recognise rotational and line symmetry (including order of rotational symmetry) in two dimensions and properties of triangles, quadrilaterals and circles directly related to their symmetries. Recognise symmetry properties of the prism (including cylinder) and the pyramid (including cone); use the following symmetry properties of circles: (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. | Discuss the conditions for congruent triangles. Point out that in naming triangles which are congruent it is usual to state letters in corresponding order, i.e. $\triangle ABC$ is congruent to $\triangle EFG$ implies that the angle at A is the same as the angle at E. Define the terms line of symmetry and order of rotational symmetry for two dimensional shapes. Revise the symmetries of triangles (equilateral, isosceles) and quadrilaterals (square, rectangle, rhombus, parallelogram, trapezium, kite). Class activity: Investigate tessellations. Produce an Escher-type drawing. Define the terms plane of symmetry and order of rotational symmetry for three dimensional shapes. Use diagrams to illustrate the symmetries of cuboids (including a cube), prisms (including a cylinder), pyramids (including a cone) and spheres. Draw simple diagrams to illustrate the circle symmetry | For information and activities about congruent triangles and shapes, search for 'congruent' at http://www.learn.co.uk |

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| | | properties (a), (b) and (c). Solve a variety of problems. | |
| 29 | Calculate unknown angles using the following geometrical properties: (a) angle in a semi-circle, (b) angle between tangent and radius of a circle, (c) angle at the centre of a circle is twice the angle at the circumference, (d) angles in the same segment are equal, (e) angles in opposite segments are supplementary; cyclic quadrilaterals | Use diagrams to introduce the angle properties (a) to (e). Solve a variety of problems that involve the angle properties. Class activity: Investigate cyclic quadrilaterals. For example, explain why all rectangles are cyclic quadrilaterals. What other quadrilateral is always cyclic? Is it possible to draw a parallelogram that is cyclic? etc. | |
| 27 | Measure lines and angles; construct a triangle given the three sides using ruler and compasses only; construct other simple geometrical figures from given data using protractors and set squares as necessary; construct angle bisectors and perpendicular bisectors using straight edges and compasses only; read and make scale drawings. | Class activity: Reinforce accurate measurement of lines and angles through various exercises. For example, each student draws two lines that intersect. Measure the length of each line to the nearest millimetre and one of the angles to the nearest degree. Each student should then measure another student's drawing and compare answers. Show how to: construct a triangle using a ruler and compasses only, given the lengths of all three sides; bisect an angle using a straight edge and compasses only; construct a perpendicular bisector using a straight edge and compasses only. Class activity: Construct a range of simple geometrical figures from given data, investigate a nine-point circle, etc. Use a straightforward example to revise the topic of scale drawing. Show how to calculate the scale of a drawing given a length on the drawing and the corresponding real length. Point out that measurements should not be included on a scale drawing and that the scale of a drawing is usually written in the form $1 : n$. Class activity: Draw various situations to scale and interpret results. For example, draw a plan of a room in your house to scale and use it to determine the area of carpet needed to cover the floor, plan an orienteering course, etc. | Information and ideas for teachers on geometric constructions at http://www.mathforum.org/library/topics/constructions/ |