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| **UNIT 8: Transformations; Constructions: triangles, nets, plan and elevation, loci, scale drawings and bearings** |

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**SPECIFICATION REFERENCES**

R2 use scale factors, scale diagrams and maps

R6 express a multiplicative relationship between two quantities as a ratio or a fraction

G2 use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); use these to construct given figures and solve loci problems; know that the perpendicular distance from a point to a line is the shortest distance to the line

G3 apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles; understand and use alternate and corresponding angles on parallel lines; derive and use the sum of angles in a triangle (e.g. to deduce and use the angle sum in any polygon, and to derive properties of regular polygons)

G5 use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS)

G7 identify, describe and construct congruent and similar shapes, including on a coordinate axis, by considering rotation, reflection, translation and enlargement (including fractional **and negative** scale factors)

G8 **describe the changes and invariance achieved by combinations of rotations, reflections and translations**

G12 identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres

G13 construct and interpret plans and elevations of 3D shapes

G15 measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings

G24 describe translations as 2D vectors

G25 apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors; …

**PRIOR KNOWLEDGE**

Students should be able to recognise 2D shapes.

Students should be able to plot coordinates in four quadrants and linear equations parallel to the coordinate axes.

**KEYWORDS**

Rotation, reflection, translation, transformation, enlargement, scale factor, vector, centre, angle, direction, mirror line, centre of enlargement, describe, distance, congruence, similar, combinations, single, corresponding, constructions, compasses, protractor, bisector, bisect, line segment, perpendicular, loci, bearing

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| **8b. Constructions, loci and bearings**(R2, G2, G3, G12, G13, G15) | **Teaching time**6-8 hours |

**OBJECTIVES**

By the end of the sub-unit, students should be able to:

* Understand and draw front and side elevations and plans of shapes made from simple solids;
* Given the front and side elevations and the plan of a solid, draw a sketch of the 3D solid;
* Use and interpret maps and scale drawings, using a variety of scales and units;
* Read and construct scale drawings, drawing lines and shapes to scale;
* Estimate lengths using a scale diagram;
* Understand, draw and measure bearings;
* Calculate bearings and solve bearings problems, including on scaled maps, and find/mark and measure bearings
* Use the standard ruler and compass constructions:
* bisect a given angle;
* construct a perpendicular to a given line from/at a given point;
* construct angles of 90°, 45°;
* perpendicular bisector of a line segment;
* Construct:
* a region bounded by a circle and an intersecting line;
* a given distance from a point and a given distance from a line;
* equal distances from two points or two line segments;
* regions which may be defined by ‘nearer to’ or ‘greater than’;
* Find and describe regions satisfying a combination of loci, including in 3D;
* Use constructions to solve loci problems including with bearings;
* Know that the perpendicular distance from a point to a line is the shortest distance to the line.

**POSSIBLE SUCCESS CRITERIA**

Able to read and construct scale drawings.

When given the bearing of a point *A* from point *B*, can work out the bearing of *B* from *A*.

Know that scale diagrams, including bearings and maps, are ‘similar’ to the real-life examples.

Able to sketch the locus of point on a vertex of a rotating shape as it moves along a line, of a point on the circumference and at the centre of a wheel.

**OPPORTUNITIES FOR REASONING/PROBLEM SOLVING**

Interpret a given plan and side view of a 3D form to be able to produce a sketch of the form.

Problems involving combinations of bearings and loci can provide a rich opportunity to link with other areas of mathematics and allow students to justify their findings.

**COMMON MISCONCEPTIONS**

Correct use of a protractor may be an issue.

**NOTES**

Drawings should be done in pencil.

Relate loci problems to real-life scenarios, including mobile phone masts and coverage.

Construction lines should not be erased.