Key focus

This LO covers ruler-and-compass construction and the loci that result from a distance condition. Students first learn the four base loci – a fixed distance from a point (circle), a fixed distance from a line (a pair of parallel lines), equidistant from two points (perpendicular bisector), and equidistant from two lines (angle bisector) – then practise the two compass constructions that produce the bisector loci exactly, before combining two loci to solve compound problems and describing shaded regions as the inequality version of a boundary locus.

Suggested teaching sequence

1. Introduce the word *locus* as the set of all points satisfying a stated rule, and connect it to a everyday idea (e.g. all the places a dog on a lead can reach).
2. Establish the four base loci: fixed distance from a point (circle), fixed distance from a line (a pair of parallel lines either side, with semicircular ends if the line is a segment), equidistant from two points (perpendicular bisector), and equidistant from two lines (angle bisector).
3. Model the perpendicular bisector construction: strike equal-radius arcs (radius more than half of AB) from both A and B, mark where they cross above and below the segment, and draw the line through both crossing points.
4. Model the angle bisector construction: strike an arc from the vertex crossing both arms, then equal-radius arcs from those two crossing points, and draw the ray from the vertex through where the second pair of arcs meet.
5. Emphasise construction accuracy: the compass width must stay fixed while a single arc or circle is drawn, and changing it partway through breaks the equidistance guarantee.
6. Introduce shaded regions as the inequality version of a boundary locus: ”within” or ”closer than” a distance shades inside a circle or on one side of a bisector, while the locus itself (an equality) is just the boundary line or curve.
7. Move to compound loci: draw each locus for a two-condition problem separately, then read off the intersection point(s). Discuss how many solutions exist when the two loci do not meet, touch once, or cross twice.
8. Note that bearings (measured clockwise from north) and SSS/SAS/ASA triangle construction are related ruler-and-protractor skills taught in the separate Compass direction objective, not this one.

Core examples to model

- Single locus: the locus of points exactly 3 cm from point P is a circle, centre P, radius 3 cm.
- Single locus: the locus of points exactly 2 m from line l is a pair of lines, each 2 m from l, one on either side.
- Perpendicular bisector: if C lies on the perpendicular bisector of AB and $CA = 7$ cm, then $CB = 7$ cm too.
- Angle bisector: a point on the bisector of an $80°$ angle is equidistant from both arms, and the

bisector splits the angle into two $40°$ angles.

- Region: "within 2 km of the town hall" shades the disc inside (and on) the circle of radius 2 km centred at the town hall.
- Compound locus: a point equidistant from towns A and B, and exactly 4 km from lake L, is found by intersecting the perpendicular bisector of AB with the circle of radius 4 km centred at L – at most two solutions, where the line crosses the circle.

Watch for

- Changing the compass width partway through a single arc or circle: this breaks the fixed-distance guarantee that makes the construction valid.
- Compass radius too small for a perpendicular bisector: the arcs from A and B must use a radius more than half of AB, or they will not reach far enough to cross.
- Confusing a locus (a line or curve, an equality) with a region (a shaded area, an inequality) – "exactly 3 cm from P" is a circle; "within 3 cm of P" is the shaded disc.
- Drawing only a full circle when a one-sided arc is what the problem actually asks for (e.g. positions on only one side of a boundary).
- Assuming two loci always cross twice: they may not meet at all (no solution), touch once (exactly one solution), or cross twice (two solutions) – always check the diagram.
- Forgetting that the internal and external bisectors of an angle are always perpendicular to each other, regardless of the original angle's size.

Checks for understanding

- Can students name the correct locus (circle, parallel lines, perpendicular bisector, or angle bisector) from a plain-language distance condition?
- Can they construct a perpendicular bisector and an angle bisector accurately with compass and straightedge, explaining why each step guarantees the equidistant property?
- Can they distinguish a locus (boundary) from a region (shaded area satisfying an inequality)?
- Can they solve a compound locus problem by drawing both loci and identifying the intersection point(s)?
- Can they reason about how many solutions a compound locus problem has, including the no-solution and touches-once cases?
- Do they know that bearings and SSS/SAS/ASA construction belong to the separate Compass direction objective, not this one?