

Loci

Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

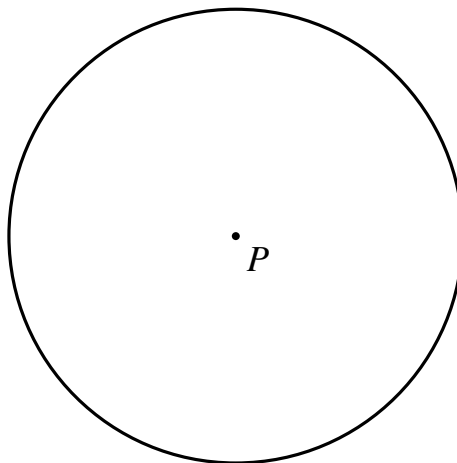
Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (1 mark)

Draw the locus of all points that are exactly 3 cm from the point P .

All the points exactly 3 cm from P make a circle.

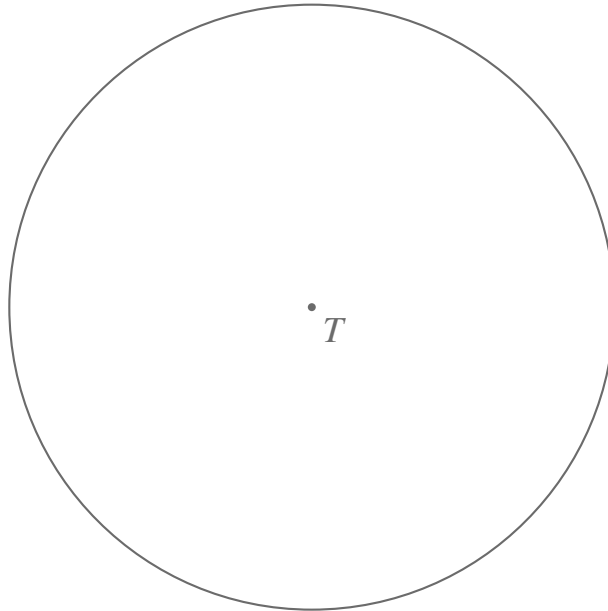
Put the compasses on P , open them to 3 cm, and draw the circle.



Answer: Circle, centre P , radius 3 cm

2 (1 mark)

Omar is asked to draw the locus of points that are 4 km from the town T .
The scale of the map is 1 cm represents 2 km.
Omar draws this circle.



Omar has made a mistake.
What mistake has he made?

Measure the radius of Omar's circle: it is 4 cm.

On the map, 4 km is $4 \div 2 = 2$ cm.

So the circle should have radius 2 cm, not 4 cm.

Omar has used the real distance (4) in cm instead of using the scale.

Answer: He used a radius of 4 cm; it should be 2 cm ($4 \text{ km} \div 2$)

Tip: Always change real distances to map distances with the scale before you set your compasses.

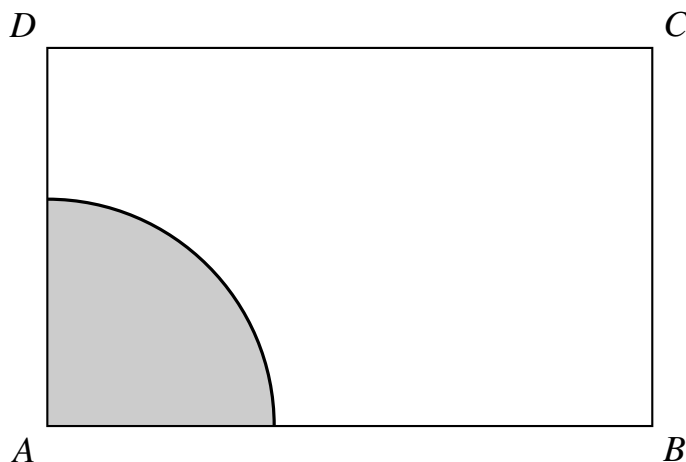
3 (2 marks)

Shade the region inside the rectangle that is less than 3 cm from A .

Points exactly 3 cm from A lie on a circle, centre A , radius 3 cm.

Only a quarter of this circle is inside the rectangle.

“Less than 3 cm” means the region **inside** the arc. Shade it.



Answer: Quarter circle of radius 3 cm at A, shaded

Tip: Use a radius of exactly 3 cm, and remember to shade. Many students draw the arc but do not show the region.

Marks: 1 mark for an arc of radius 3 cm centred at A. 1 mark for shading the correct region.

4 (2 marks)

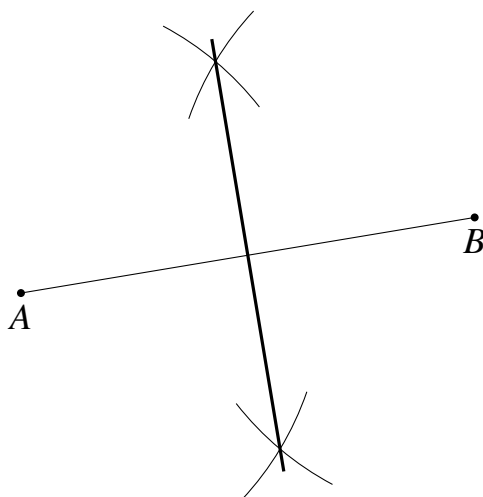
Draw the locus of points that are the same distance from A as from B.
You must show your construction arcs.

Points the same distance from two points lie on the **perpendicular bisector** of the line joining them.

Open the compasses to more than half of AB.

Draw equal arcs from A and from B, on both sides of AB.

Join the two points where the arcs cross.



Answer: Perpendicular bisector of AB

Tip: “Same distance from two points” means perpendicular bisector. Do not draw circles around A and B .

Marks: 1 mark for correct construction arcs. 1 mark for the correct line.

5 (2 marks)

The diagram shows a plan of a garden in the shape of a triangle XYZ .

A straight hedge is planted in the garden.

It starts at the corner Y and ends on the side XZ .

Every point on the hedge is the same distance from side YX as from side YZ .

Use ruler and compasses to construct the line of the hedge.

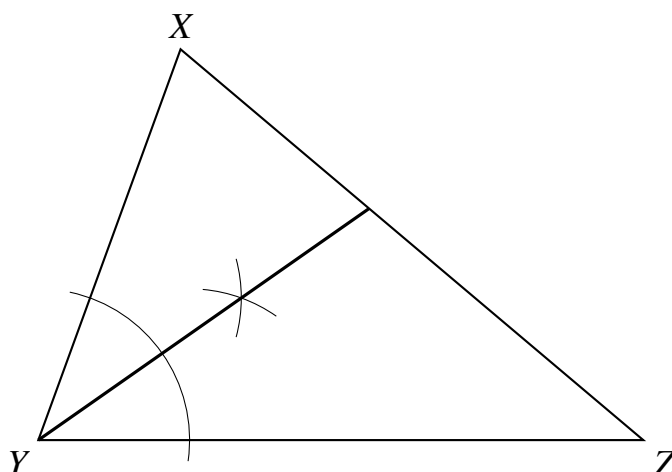
Points the same distance from two lines that meet lie on the **angle bisector**.

So the hedge is the bisector of angle XYZ .

Draw an arc from Y crossing YX and YZ .

From each crossing point, draw equal arcs that cross.

Draw a line from Y through where they cross, as far as side XZ .



Answer: Bisector of angle XYZ, from Y to side XZ, with construction arcs

Tip: Same distance from two **lines** means angle bisector. A perpendicular bisector of a side is a common wrong answer.

Marks: 1 mark for correct construction arcs. 1 mark for the correct bisector.

6 (3 marks)

Construct the region that lies within 2 cm of the line.

Along the side of the line, the edge of the region is a straight line 2 cm away.

Draw a line parallel to the line, 2 cm above it, and another 2 cm below it.

Around each end, the edge is a semicircle of radius 2 cm, centred on that end.

Use compasses to draw the two semicircles and join them to the parallel lines.

Shade the region inside.



Answer: Stadium shape: parallel lines 2 cm away joined by semicircles at the ends

Tip: Do not use a rectangle: the ends must be rounded (semicircles).

Marks: 1 mark for parallel lines 2 cm from the line. 1 mark for a semicircle of radius 2 cm at each end. 1 mark for showing the correct region.

7 (2 marks)

The diagram shows the positions of two wifi routers, A and B , in an office.
The scale is 1 cm represents 2 m.

The signal from router A reaches up to 6 m.

The signal from router B reaches up to 8 m.

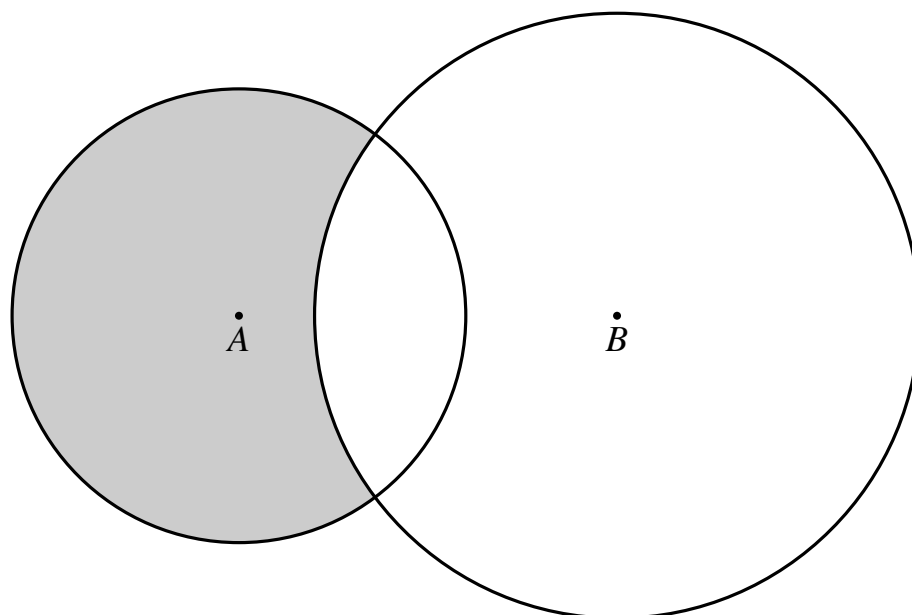
Shade the region that gets a signal from router A but **not** from router B .

Use the scale: 6 m is 3 cm and 8 m is 4 cm on the plan.

Draw a circle of radius 3 cm centred at A .

Draw a circle of radius 4 cm centred at B .

The region is inside the circle around A but outside the circle around B . Shade it.



Answer: Inside the 3 cm circle about A and outside the 4 cm circle about B

Tip: Use the scale for each router separately: 6 m is 3 cm and 8 m is 4 cm.

Marks: 1 mark for circles of radius 3 cm about A and 4 cm about B. 1 mark for the correct region.

8 (3 marks)

The diagram shows a plan of a rectangular garden $ABCD$.
The scale is 1 cm represents 2 m.

A shed is to be put in the garden.

The shed must be

closer to C than to D

and

less than 9 m from B .

Shade the region where the shed can be put.

Closer to C than to D : construct the perpendicular bisector of CD .

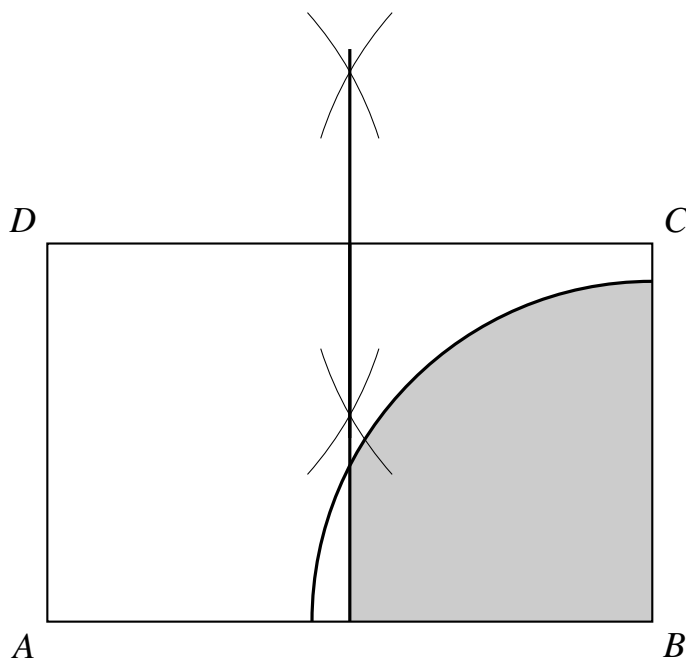
The shed must be on the C side (the right) of this line.

Use the scale: 9 m is $9 \div 2 = 4.5$ cm on the plan.

Less than 9 m from B : draw an arc of radius 4.5 cm centred at B .

The shed must be inside this arc.

Shade the region that fits both conditions.



Answer: Region right of the perpendicular bisector of CD and inside the 4.5 cm arc about B

Tip: “Closer to C than to D ” is about two **points**, so use the perpendicular bisector of CD , not an angle bisector.

Marks: 1 mark for the perpendicular bisector of CD . 1 mark for an arc of radius 4.5 cm centred at B . 1 mark for the correct region.

9 (3 marks)

Use ruler and compasses to answer this question.

Point T is inside the rectangle.

T is

the same distance from A as from B

and

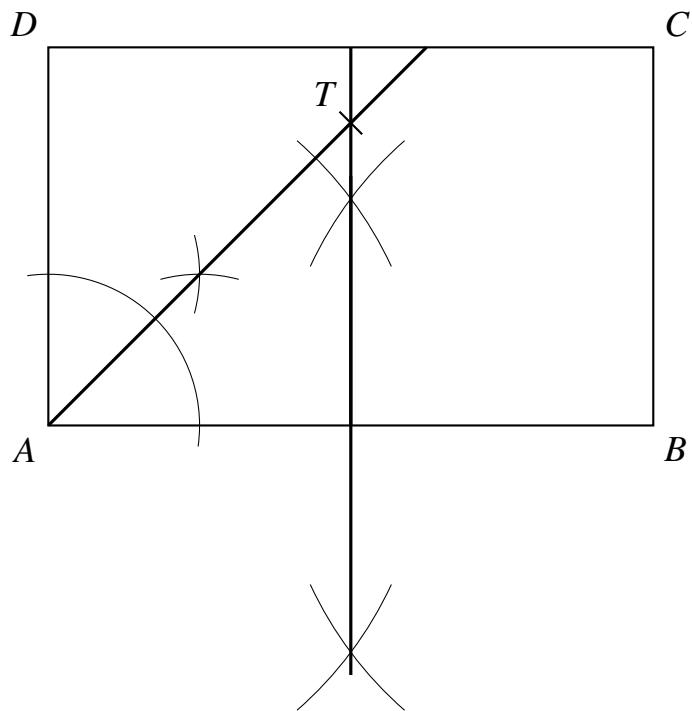
the same distance from side AB as from side AD .

Mark the position of T with a cross ($\times$).

Same distance from the points A and B : construct the perpendicular bisector of AB .

Same distance from the sides AB and AD : construct the bisector of angle DAB .

T is where the two lines cross.



Answer: T where the perpendicular bisector of AB meets the bisector of angle A (4 cm right of A and 4 cm up)

Tip: Two **points** (A and B) need a perpendicular bisector. Two **sides** (AB and AD) need an angle bisector.

Marks: 1 mark for the perpendicular bisector of AB . 1 mark for the bisector of angle A . 1 mark for T marked where they cross.

10 (4 marks)

The scale diagram shows two buoys, A and B , and a dive boat D .

Use a ruler and compasses in this question.

A diver is looking for a lost anchor.

The anchor is

less than 2 km from the dive boat D

and

closer to buoy A than to buoy B .

Label the region, R , where the anchor could be.

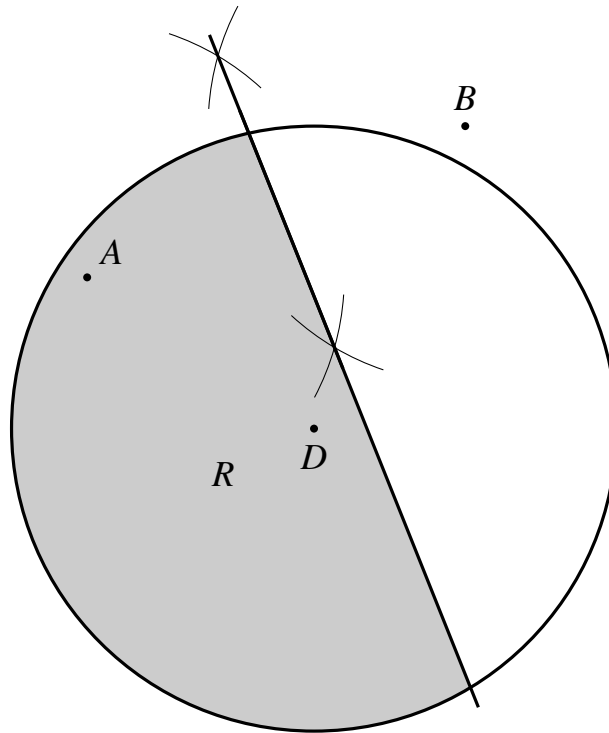
Show all your construction lines.

Use the scale: 2 km = 2000 m, and $2000 \div 500 = 4$ cm on the diagram.

Less than 2 km from D : inside a circle of radius 4 cm centred at D .

Closer to A than to B : construct the perpendicular bisector of AB .

R is the region inside the circle and on A 's side of the line.



Scale: 1 cm represents 500 m

Answer: Region inside the 4 cm circle about D and on A's side of the perpendicular bisector of AB, labelled R

Tip: Change 2 km to metres first: $2000 \div 500 = 4$ cm. "Closer to A than to B" needs the perpendicular bisector of AB, not circles around A and B.

Marks: 1 mark for a circle (or arc) of radius 4 cm centred at D. 1 mark for the perpendicular bisector of AB. 1 mark for construction arcs. 1 mark for the correct region labelled R.