

Loci

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

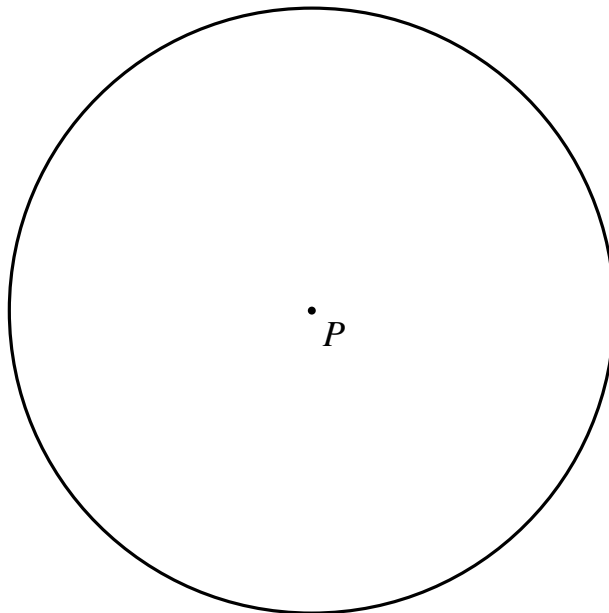
Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (1 mark)

Draw the locus of all points that are 4 cm from the point P .

All the points 4 cm from P make a circle.

Put the compasses on P , open them to 4 cm, and draw the circle.

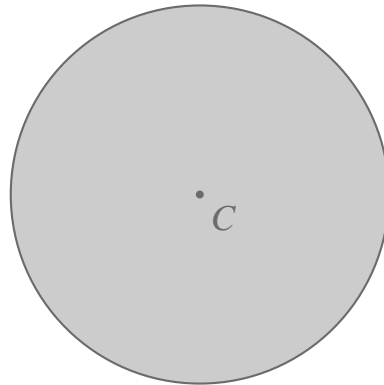


Answer: Circle, radius 4 cm

Tip: Draw the whole circle with compasses. A few points marked 4 cm from P are not enough.

2 (1 mark)

Ellis draws this diagram.



Ellis says,

“The shaded region is the locus of points exactly 2.5 cm from C.”

Ellis is wrong.

Explain why.

The points exactly 2.5 cm from C lie **on** the circle, centre C , radius 2.5 cm.

The points inside the circle are **less than** 2.5 cm from C .

So the locus is just the circle, not the shaded region inside it.

Answer: The locus is only the circle itself; the shaded points inside are less than 2.5 cm from C

Tip: “Exactly” gives a line or curve (the circle). “Less than” or “more than” gives a region.

3 (2 marks)

Draw the region of points that are less than 2 cm from the line segment XY .

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

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

Around X and Y , the edge is a semicircle of radius 2 cm.

Join them up to make a “stadium” shape. The region is inside it.



Answer: Stadium shape, 2 cm from XY

Marks: 1 mark for the two straight parallel lines. 1 mark for the semicircular ends.

4 (2 marks)

Use ruler and compasses to construct the locus of points that are the same distance from A as from B .

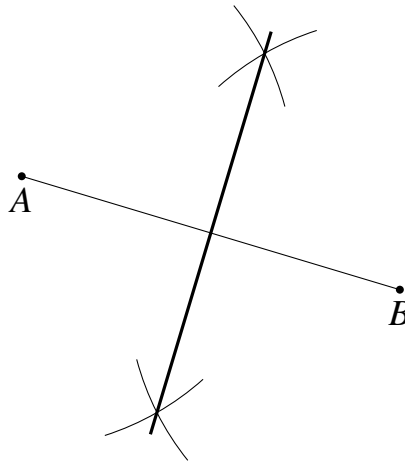
You must show all your construction lines.

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 with arcs

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

5 (2 marks)

Use ruler and compasses to construct the locus of points that are the same distance from AB as from AC .

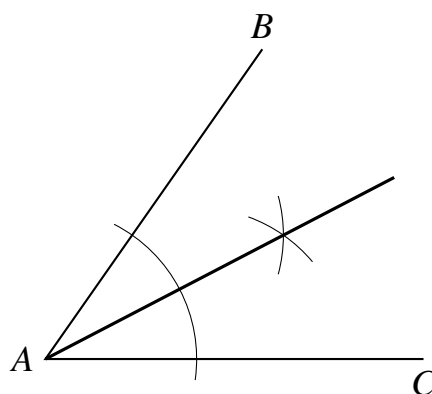
You must show all your construction lines.

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

Draw an arc from A crossing AB and AC .

From each crossing point, draw equal arcs that cross.

Draw a line from A through where they cross.



Answer: Angle bisector

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

6 (2 marks)

The map shows two phone masts, M and N .

The scale of the map is 1 cm represents 10 km.

Each mast sends a signal up to 30 km.

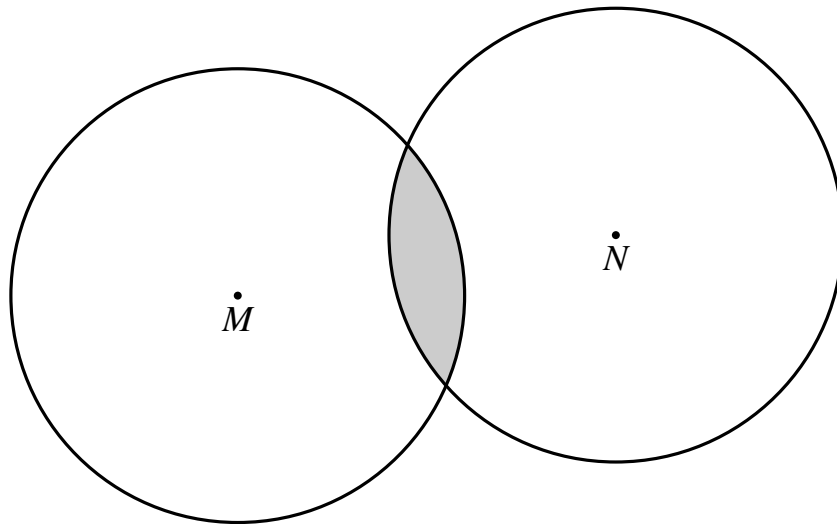
Show, by shading, the region that gets a signal from **both** masts.

Use the scale: 30 km is $30 \div 10 = 3$ cm on the map.

Draw a circle of radius 3 cm centred at M .

Draw a circle of radius 3 cm centred at N .

Both signals reach where the circles overlap. Shade this region.



Answer: The overlap of two circles of radius 3 cm

Marks: 1 mark for both circles (or arcs) of radius 3 cm. 1 mark for shading the overlap.

7 (3 marks)

Shade the region of points inside the rectangle that are
more than 4 cm from D
and
closer to AB than to CD .

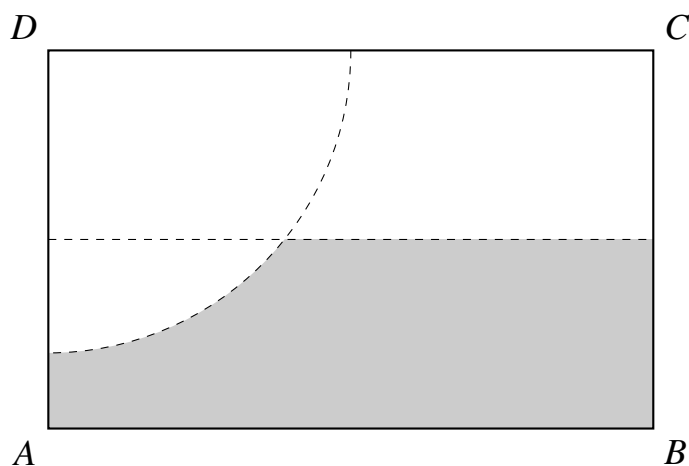
AB and CD are parallel, 5 cm apart.

Points the same distance from both are on the line halfway between them (2.5 cm up).

Closer to AB means below this line.

More than 4 cm from D means outside the arc of radius 4 cm centred at D .

Shade the region that fits both conditions.



Answer: Region below the line halfway between AB and CD , outside the 4 cm arc about D

Marks: 1 mark for the line halfway between AB and CD . 1 mark for an arc of radius 4 cm centred at D . 1 mark for the correct region.

8 (3 marks)

Shade the region inside triangle ABC of the points that are more than 3 cm from B

and

nearer to side AB than to side AC .

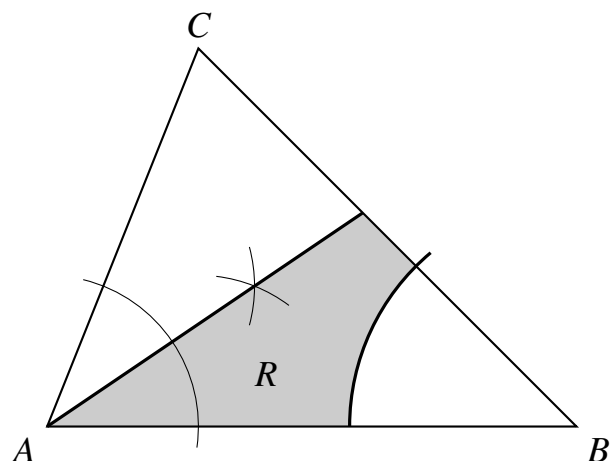
Label the region R .

More than 3 cm from B : outside an arc of radius 3 cm centred at B .

Nearer to side AB than to side AC : construct the bisector of angle BAC .

The region is on the AB side of this bisector (below it).

Shade the part of the triangle that fits both conditions and label it R .



Answer: Region inside the triangle, below the bisector of angle A and outside the 3 cm arc about B, labelled R

Tip: “Nearer to side AB than to side AC ” is about two **sides**, so you need the angle bisector at A , not a perpendicular bisector.

Marks: 1 mark for an arc of radius 3 cm centred at B . 1 mark for the bisector of angle A (with arcs). 1 mark for the correct region labelled R .

9 (4 marks)

The diagram shows a scale plan of a car park $ABCD$.

The scale is 1 cm represents 5 m.

An electric car charging point is going to be put in the car park.

The charging point has to be

closer to B than to D

more than 20 m from the side CD .

Show, by shading, the region where the charging point can go.

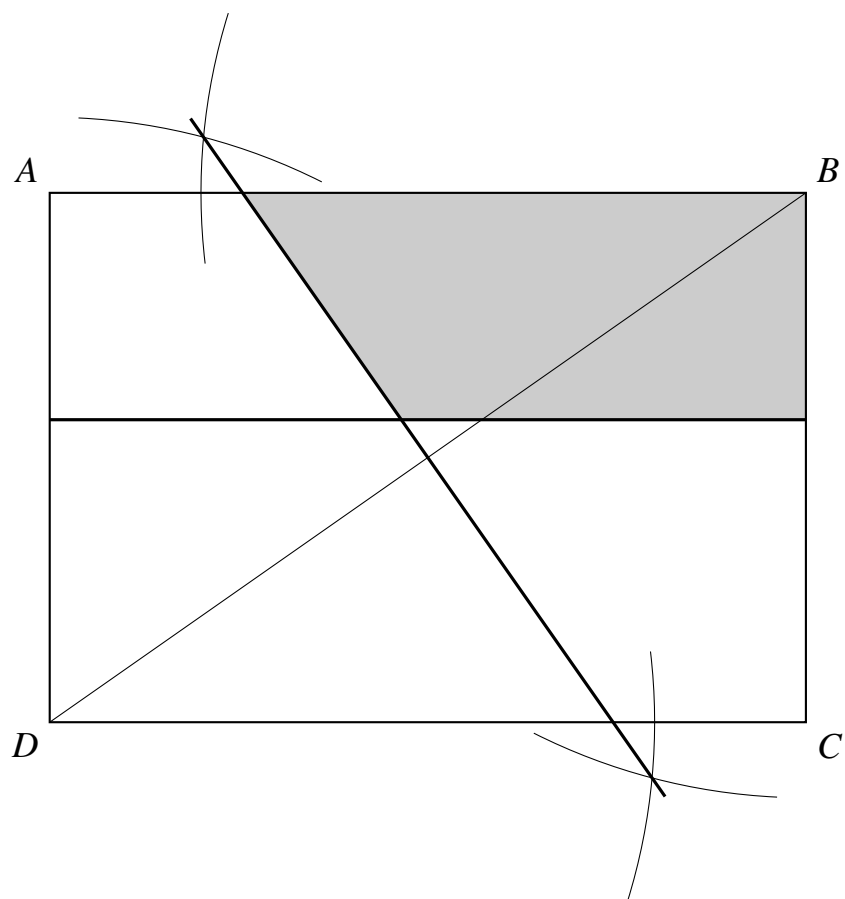
Closer to B than to D : construct the perpendicular bisector of BD .

The charging point is on B 's side of this line.

Use the scale: 20 m is $20 \div 5 = 4$ cm on the plan.

More than 20 m from CD : above a line parallel to CD , 4 cm from it.

Shade the region that fits both conditions.



Answer: Region above the line 4 cm from CD and on B's side of the perpendicular bisector of BD

Tip: Change the real distance to cm on the plan first: $20 \div 5 = 4$ cm. "Closer to *B* than to *D*" needs the perpendicular bisector of *BD*.

Marks: 1 mark for construction arcs for the perpendicular bisector of *BD*. 1 mark for the perpendicular bisector. 1 mark for a line 4 cm from *CD*. 1 mark for the correct region shaded.