

Constructions and Loci - Higher

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Higher 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 (2 marks)

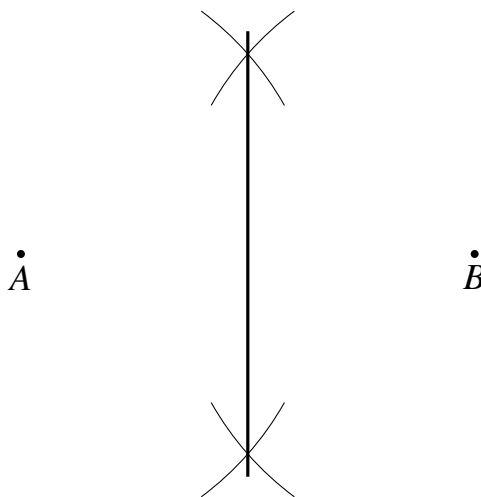
Use ruler and compasses to construct the perpendicular bisector of AB .
You must show all your construction lines.

Open your compasses to more than half of AB .

Draw arcs above and below AB , centred at A .

Keep the same radius. Draw arcs centred at B that cross the first arcs.

Join the two crossing points with a straight line.



Answer: The perpendicular bisector of AB , with construction arcs

Tip: Don't find the midpoint by measuring. The marks are for the compass arcs, so leave them showing.

Marks: 1 mark for arcs that cross above and below AB . 1 mark for the line.

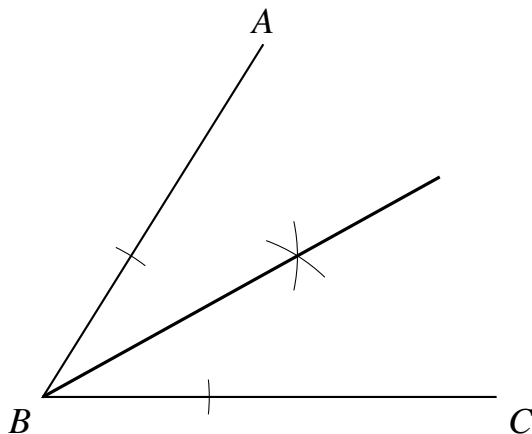
2 (2 marks)

Use ruler and compasses to construct the bisector of angle ABC .
You must show all your construction lines.

Put the compass point on B . Draw an arc that cuts BA and BC .

From these two points, draw equal arcs that cross inside the angle.

Join B to the crossing point.



Answer: The bisector of angle ABC , with construction arcs

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

3 (2 marks)

PQ is a line segment.

Use ruler and compasses to construct the line through Q that is perpendicular to PQ .
You must show all your construction lines.

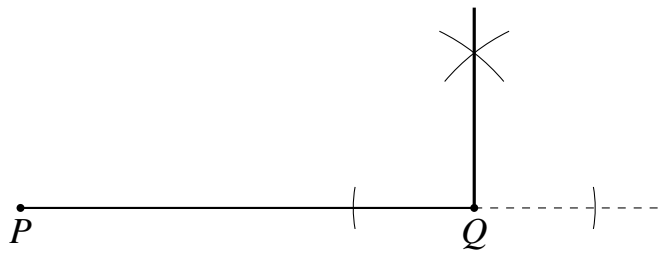
Q is at the end of the segment, so first extend the line PQ beyond Q .

Put the compass point on Q . Draw arcs that cut the line on each side of Q .

Open the compasses wider.

From each of these two points, draw arcs of the same radius that cross above Q .

Join Q to the crossing point.



Answer: A line perpendicular to PQ through Q , with construction arcs

Tip: You need space on both sides of Q for your first two arcs, so extend PQ past Q with a ruler before you start.

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

4 (2 marks)

The diagram shows a house, H , and a straight river bank, RS .

A path is going to be made from H to the river bank.

The path will be as short as possible.

Use ruler and compasses to construct the path.

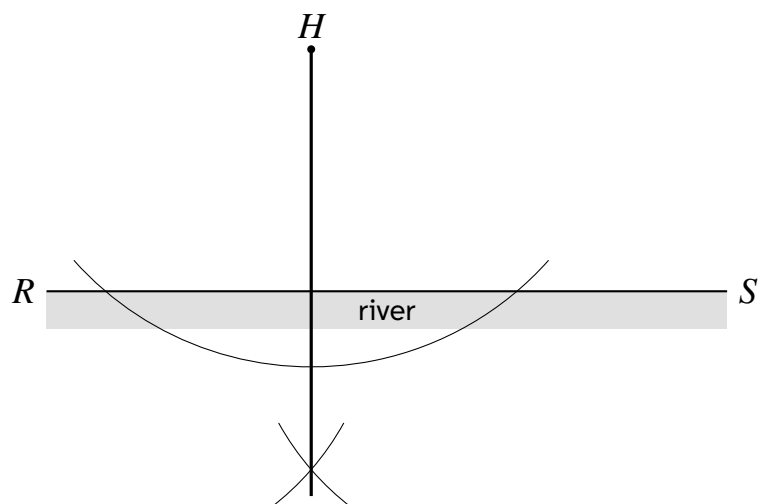
You must show all your construction lines.

The shortest path from a point to a line is perpendicular to the line.

Put the compass point on H . Draw an arc that cuts RS at two points.

From each of these two points, draw arcs of the same radius that cross below RS .

Draw a straight line from H towards the crossing point. The path is the part from H to RS .



Answer: The perpendicular from H to RS , with construction arcs

Tip: “As short as possible” means the path meets the river bank at right angles.

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

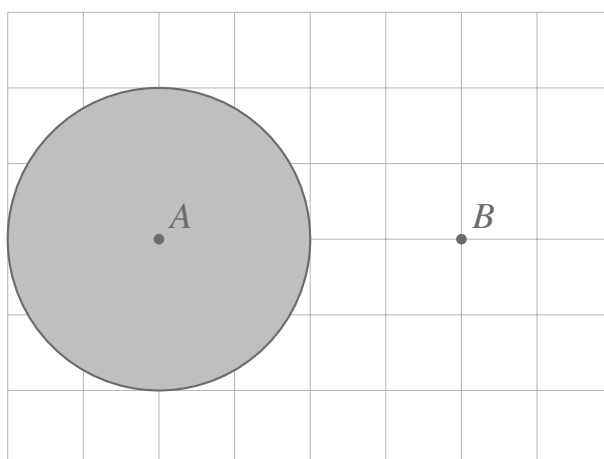
5 (1 mark)

Two points, A and B , are 4 cm apart on a centimetre grid.

Ellis wants to show all the points that are closer to A than to B .

He shades the circle shown on the grid.

Explain why Ellis is wrong.



Ellis has shaded only the points within 2 cm of A .

“Closer to A than to B ” is not about a fixed distance.

The boundary is the perpendicular bisector of AB (the vertical line halfway between them).

P could be anywhere on A 's side of that line, e.g. 3 cm left of A .

Answer: He drew a circle round A . He should have shaded everything on A 's side of the perpendicular bisector of AB .

Tip: "Closer to A than to B " always needs the perpendicular bisector of AB , not a circle.

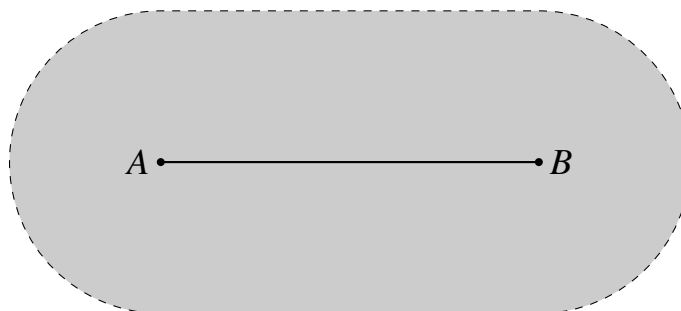
6 (3 marks)

Show, by shading, the region of points that are less than 2 cm from the line segment AB .

Draw two lines parallel to AB , one 2 cm above it and one 2 cm below it.

At each end, draw a semicircle of radius 2 cm, centred at A and at B .

Shade the region inside this shape.



Answer: The shaded "stadium" shape shown

Tip: Around the ends A and B the boundary is curved. Use your compasses for these semicircles, not freehand.

Marks: 1 mark for the parallel lines. 1 mark for the semicircles. 1 mark for the correct region shaded.

7 (3 marks)

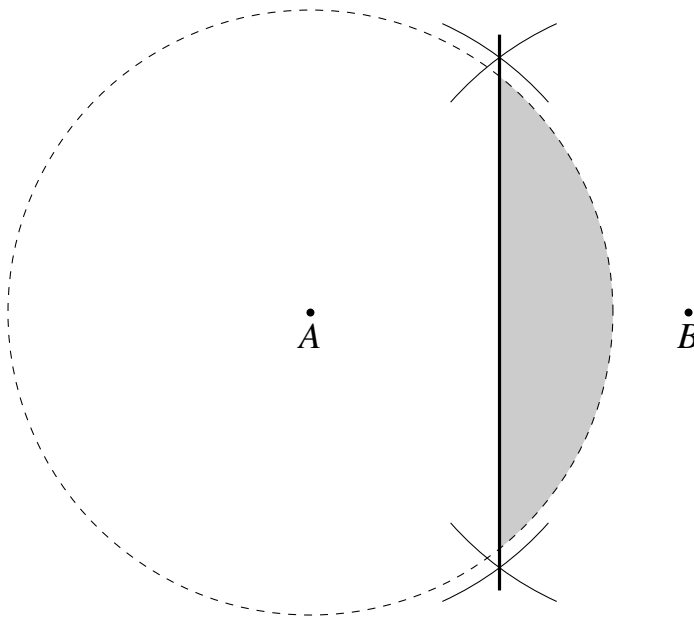
Shade the region of points that are less than 4 cm from A and closer to B than to A . Show all your construction lines.

“Less than 4 cm from A ”: draw a circle of radius 4 cm centred at A . The points are inside it.

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

The points are on B 's side of this line.

Shade the part of the circle on B 's side of the bisector.



Answer: The shaded region shown

Tip: Only shade where **both** conditions are true. That is a closed region inside the circle, not everything to the right of the line.

Marks: 1 mark for the circle. 1 mark for the perpendicular bisector. 1 mark for the correct region.

8 (3 marks)

The diagram shows a scale drawing of a garden $ABCD$.

Anwen is going to plant a tree in the garden.

The tree must be

at least 4 m from the fence AB

closer to the fence BC than to the fence DC .

Show, by shading on the diagram, the region where Anwen can plant the tree.

You must show all your construction lines.

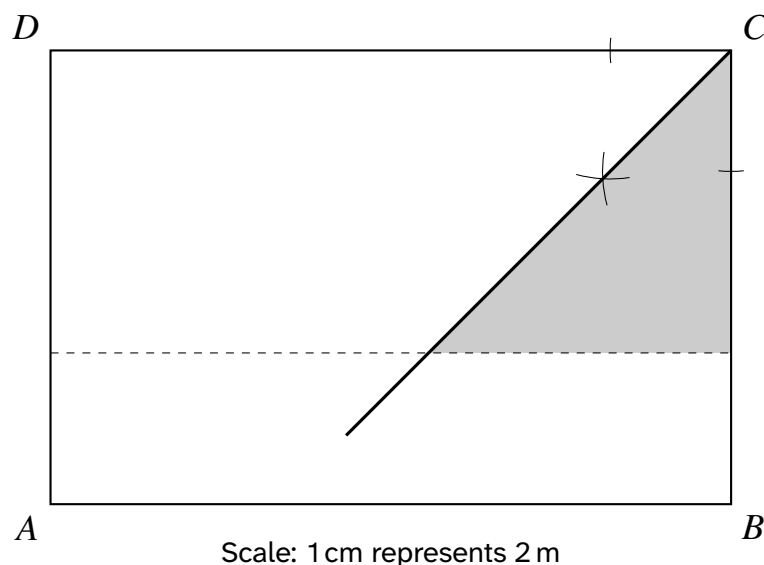
The scale is 1 cm for 2 m, so 4 m is 2 cm.

“At least 4 m from AB ”: draw a line parallel to AB , 2 cm above it. The tree is on or above this line.

“Closer to BC than to DC ”: construct the bisector of angle BCD .

The tree is on the BC side of this bisector.

Shade inside the garden, above the parallel line and on the BC side of the bisector.



Answer: The shaded region shown

Tip: Change 4 m to cm using the scale first. “Closer to one fence than another” means an angle bisector.

Marks: 1 mark for the line 2 cm from AB . 1 mark for the bisector of angle BCD . 1 mark for the correct region.

9 (4 marks)

Shade the region inside triangle ABC that is closer to AB than to AC and closer to B than to A .

Show all your construction lines.

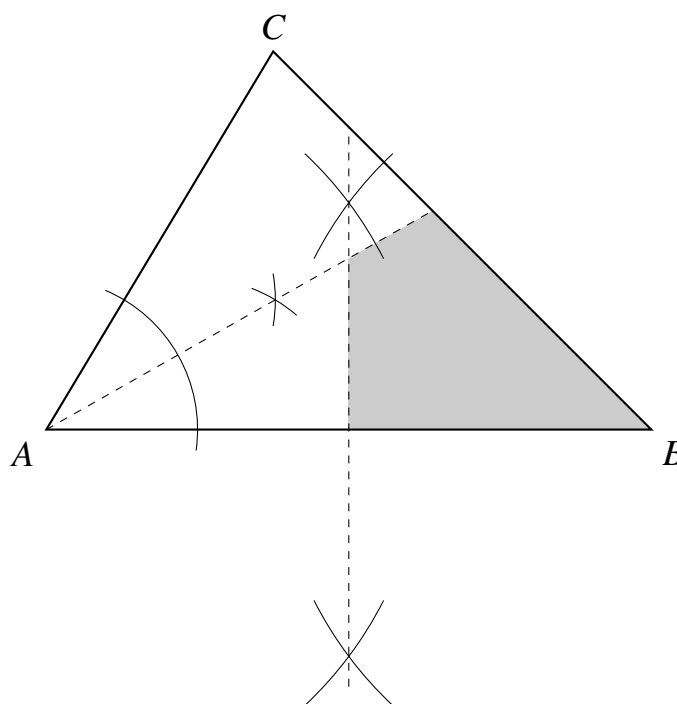
“Closer to AB than to AC ” (two lines): bisect angle A .

Points below this bisector are closer to AB .

“Closer to B than to A ” (two points): construct the perpendicular bisector of AB .

Points to the right of it are closer to B .

Shade the region inside the triangle that is below the angle bisector and to the right of the perpendicular bisector.



Answer: The shaded region shown

Tip: Two **lines** give an angle bisector. Two **points** give a perpendicular bisector.

Marks: 1 mark for the angle bisector. 1 mark for the perpendicular bisector. 1 mark for showing construction arcs. 1 mark for the correct region.