4.15 Loci and Construction: 30-minute Pack

EDEXCEL 1MA1 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Write down the locus of points that are equidistant from two distinct points A and B.

(Total for Question 1 is 1 mark)

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2 On a scale drawing 1 cm represents 2 m. A tree is represented by a point T. Draw the locus of points that are exactly 4 m from T. Describe the locus and state its radius on the drawing.

(Total for Question 2 is 1 mark)

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3 Two towns S and T are 7 km apart. The region within 3 km of S and the region within 5 km of T are considered. Is there any point that lies in both regions? Give a reason.

(Total for Question 3 is 2 marks)

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4 A point A is at (0, 0) and point B is at (6, 0) on a grid. Work out and construct the perpendicular bisector of AB. Give the equation of the line of the perpendicular bisector and state one point on it.

(Total for Question 4 is 4 marks)

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5 Two towers T1 and T2 are 14 m apart. A point X must be placed so that it is 10 m from T1 and within 8 m of T2. On a scale plan 1 cm = 2 m.

(a) Radius for locus 10 m from T1 on the plan. **(1)**

.....

(b) Radius for locus within 8 m of T2 on the plan. **(1)**

.....

(c) Describe the feasible region for X on the plan. **(2)**

.....

.....

(Total for Question 5 is 4 marks)

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6 A rectangular garden PQRS has PQ = 10 m and QR = 6 m, with P, Q, R, S labelled in order going around the rectangle. Using a scale of 1 cm to 1 m, draw the rectangle. A tree is to be planted so that it is (i) within 7 m of corner P, and (ii) nearer to side QR than to side PS. Construct the necessary loci and shade the region of the garden where the tree could be planted.

(Total for Question 6 is 4 marks)

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7 Describe the locus of points that are equidistant from two lines that meet at a point.

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(Total for Question 7 is 1 mark)

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8 Draw a straight horizontal line segment XY, 9 cm long. Mark a point P above the line, not on it. Using a ruler and compasses only, construct the perpendicular line from P to the line XY. Show all your construction lines.

(Total for Question 8 is 2 marks)

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9 A garden sprinkler is placed at point S. It waters the ground up to a distance of 3.5 m from S. Using a scale of 1 cm to 1 m, draw the locus of the boundary of the area that gets watered.

(Total for Question 9 is 2 marks)

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10 A library L and a park P are points on a plan. You are to find the places that are 5 m from L and closer to P than to L. The scale is 1 cm = 1 m.

(a) Draw the locus 5 m from L on the plan (1 cm = 1 m). **(1)**

(b) Describe the region closer to P than to L. **(2)**

(c) Shade the part of the circle from part (a) that lies on the P side of the perpendicular bisector. **(2)**

(Total for Question 10 is 5 marks)

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Mark scheme · 4.15 Loci and Construction: 30-minute Pack

Question 1

the perpendicular bisector of AB cao **B1**

Answer: The perpendicular bisector of AB.

Question 2

circle centre T, radius 2 cm (since 4 m -> 2 cm on drawing) cao **B1**

Answer: A circle centre T, radius 2 cm.

Question 3

use intersection test: radii sum 3 + 5 = 8 which is > 7 and |5 - 3| = 2 which is < 7 so circles overlap **M1**

Yes, there are points in both regions (the two discs intersect) cao **A1**

Answer: Yes. Because 3 + 5 = 8 > 7 and |5 - 3| = 2 < 7, the two discs intersect so there are points in both regions.

Question 4

midpoint of AB found as (3, 0), or by a correct method such as halfway between x = 0 and x = 6 **M1**

states or uses that the perpendicular bisector is vertical because AB is horizontal (its perpendicular gradient is undefined), or constructs it with compasses as the line through (3, 0) at right angles to AB **M1**

equation x = 3 cao (accept 3 = x) **A1**

any point with x = 3, e.g. (3, 0) or (3, 2), cao **A1**

Answer: Equation x = 3. One point on it: (3, 0) (midpoint) or (3, 2); any point (3, k) is correct.

Question 5

(a) 5 cm (since 10 m at scale 1 cm = 2 m gives 10/2 = 5 cm) cao **B1**

(a) Answer: 5 cm

(b) 4 cm (since 8 m / 2 m per cm = 4 cm) cao **B1**

(b) Answer: 4 cm

(c) identify intersection of circle radius 5 cm around T1 with disc radius 4 cm around T2 **M1**

(c) state feasible region: points on the circle centred at T1 radius 5 cm that also lie within the circle centred at T2 radius 4 cm cao **A1**

(c) Answer: Points on the circle centre T1 radius 5 cm that lie inside (or on) the circle centre T2 radius 4 cm; i.e. the parts of the T1 circle inside the T2 disc.

Question 6

rectangle PQRS drawn accurately to scale, 10 cm by 6 cm, correctly labelled **C1**

circle (or arc) of radius 7 cm centred on P drawn accurately **C1**

the line equidistant from QR and PS constructed correctly (a straight line parallel to QR and PS, 5 cm from each, using the perpendicular bisector method on a segment of PQ) **C1**

correct region shaded, satisfying both conditions (inside the circle radius 7 cm centred on P, and on the QR side of the midline), cao **B1**

Answer: The shaded region is the part of the garden inside the circle of radius 7 m centred on P that also lies on the QR side of the line 5 m from P (parallel to QR and PS).

Question 7

the angle bisector of the two lines **B1**

Answer: the angle bisector of the two lines

Question 8

one arc centred at P crossing the line XY at two points **C1**

correct perpendicular line drawn through P, meeting XY at 90 degrees (within 2 degrees), using equal arcs from the two crossing points **A1**

Answer: A straight line through P that meets XY at a right angle (90 degrees).

Question 9

point S clearly marked **B1**

circle of radius 3.5 cm (representing 3.5 m) drawn accurately centred on S **C1**

Answer: A circle of radius 3.5 cm (representing 3.5 m) centred on S.

Question 10

(a) circle centre L radius 5 cm shown **M1**

(a) Answer: Circle centre L radius 5 cm (on the plan).

(b) identify perpendicular bisector of PL divides plane into two regions **M1**

(b) state region: the side of the perpendicular bisector containing P is points closer to P than to L cao **A1**

(b) Answer: Points on the side of the perpendicular bisector of PL that contains P are closer to P than to L.

(c) correct region shaded: part of circle (or arc) on P side of perpendicular bisector **M1**

(c) clear indication of region (shaded area or labelled) cao **A1**

(c) Answer: The arc or sector of the circle of radius 5 m around L that lies on the P side of the perpendicular bisector is shaded.

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