1. Otis keeps bees in two beehives.
They are marked P and Q in the scale drawing below.

Scale: 1 cm represents 50 metres

Q

Otis plants some fruit trees, which are

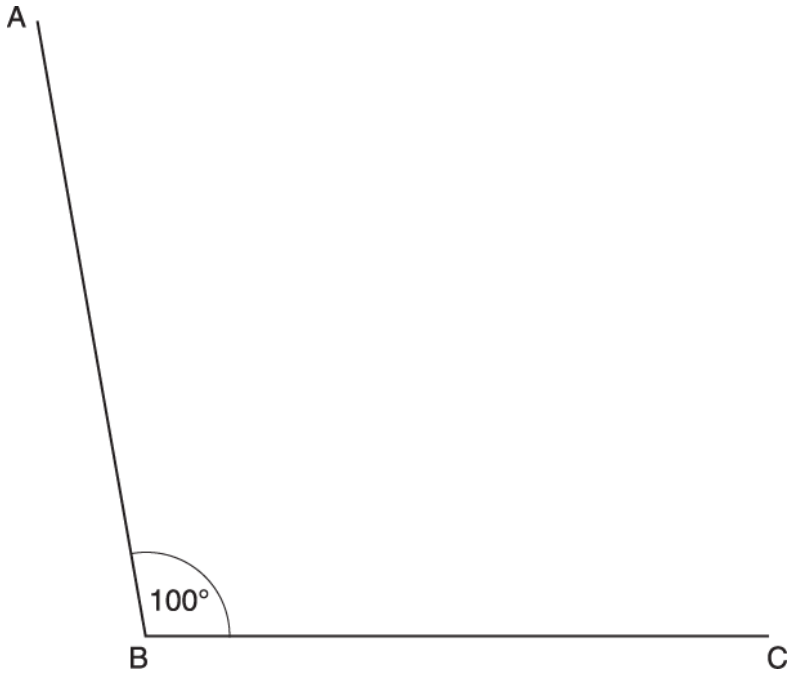
- the same distance from P and from Q
- 200 m or less from P.

Indicate on the scale drawing where Otis plants the trees.
You must show all your construction lines.

[4]

2. *In this question, use a ruler, a protractor and a pair of compasses.*
Do not rub out your construction lines.

Quadrilateral ABCD has two sides AB and BC each of length 8.2 cm.
Angle ABC = 100° and angle BCD = 105°.
Side AD has length 11.7 cm.

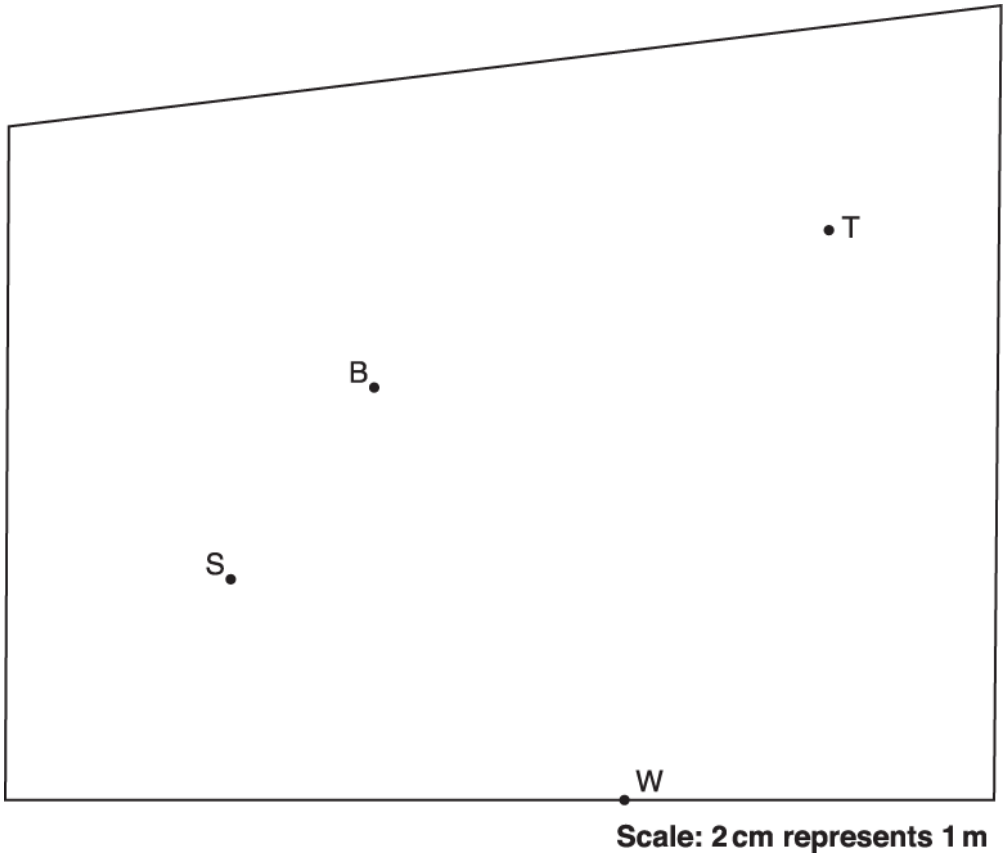


Construct the bisector of angle ABC.

[2]

3. *In this question, use a ruler and a pair of compasses.*
Do not rub out your construction lines.

This scale drawing shows Colin's garden.



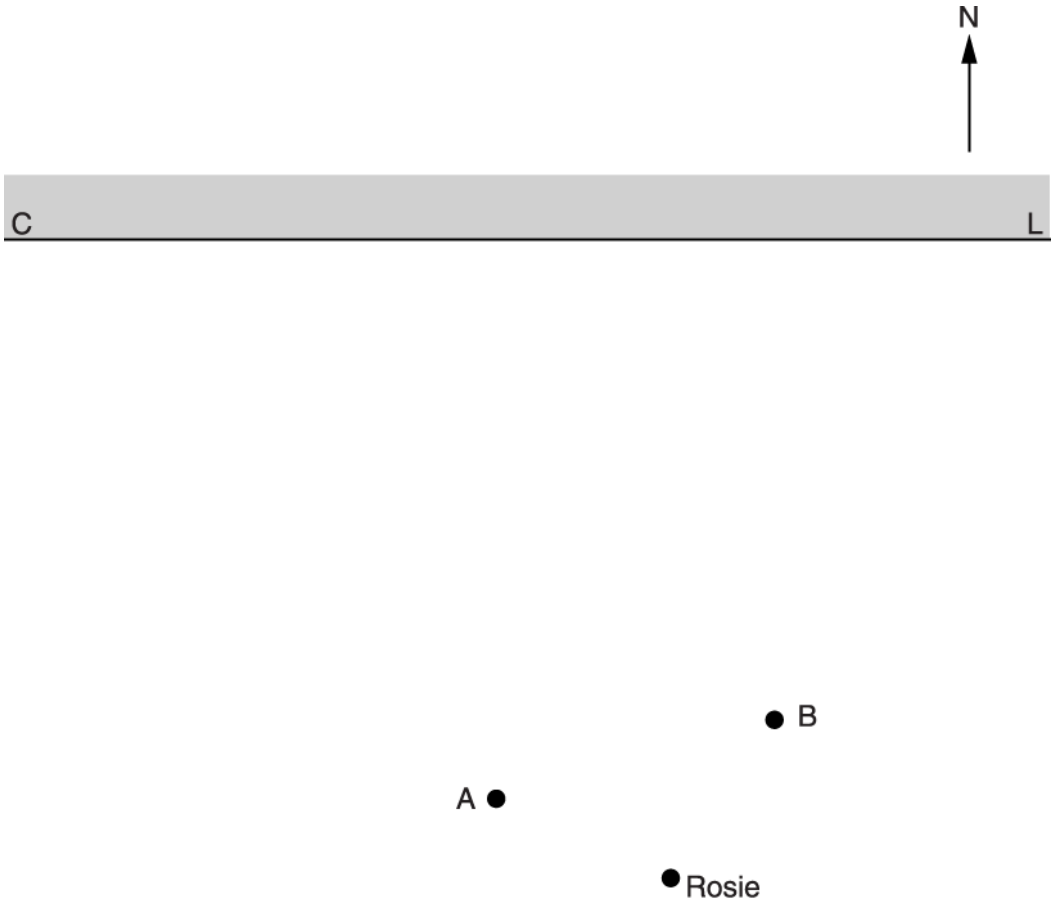
Colin wants to put a bird feeder in his garden.
He wants it to be

- up to 3 m from the tree T
- up to 2 m from the bush B
- nearer to the water tap W than to the seat S.

Construct the region where Colin can put the bird feeder.
Label the region R.

[5]

4. The diagram shows a coastline, CL.
A and B are two rocks in the sea.



Scale: 1 cm represents 500 m

Rosie is sailing her boat.
She sails on a course towards the coast so that she is an equal distance from the rocks, A and B.

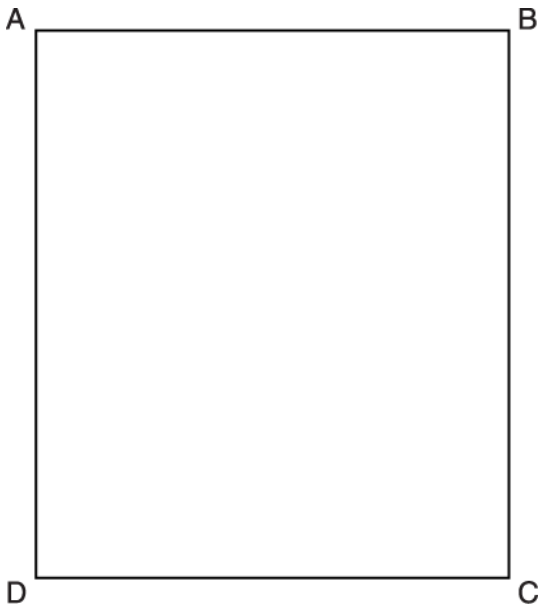
When she is less than 1 km from the coast she turns and sails due West.
She now sails so that she is between 500 m and 1 km from the coast.

Construct a route that Rosie could take.
You must leave in all your construction lines.

[4]

5. The scale drawing shows a garden ABCD.

Scale: 1 cm represents 2 m



Anna will plant a tree in the garden.

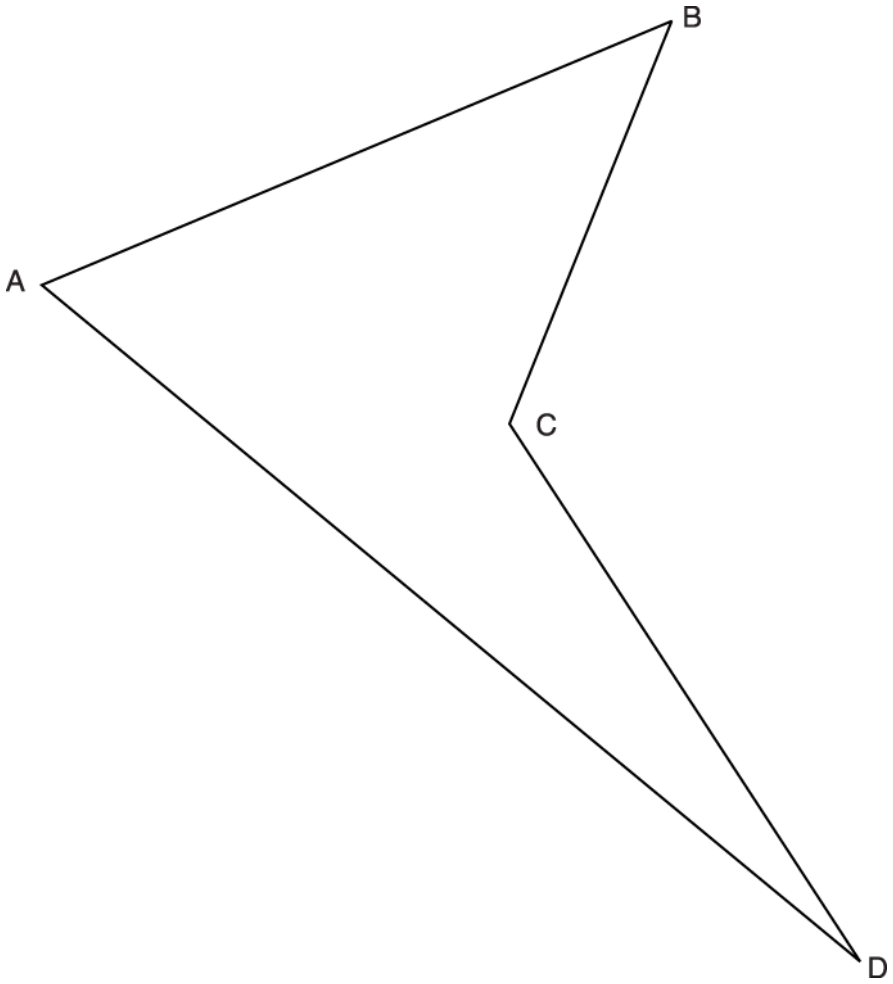
The tree must be

- closer to A than to D
- less than 9 m from C.

Construct and shade the region where Anna can plant the tree.
Leave in all your construction lines.

[4]

6. The diagram shows a park ABCD.



Scale: 1 cm represents 100 m

The council want to put a shed inside the park and it must be

- nearer to AB than AD
- less than 400 m from C.

Shade the region where they can put the shed.
You must show all your construction arcs.

[4]

7. The scale diagram shows the positions of town A and town B.

Scale: 1 cm represents 10 miles

B•

A•

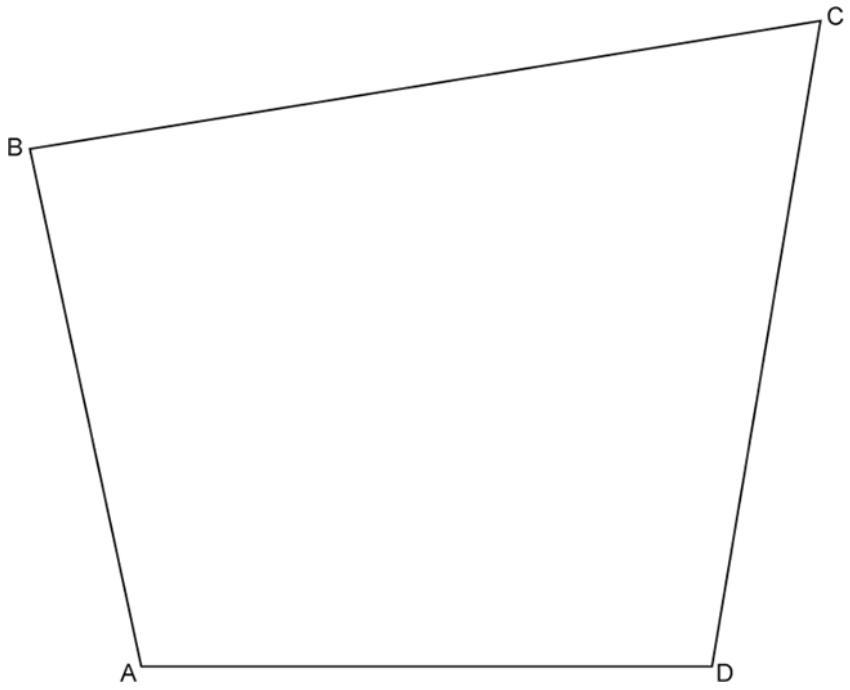
Lucy's house is nearer to town A than to town B.
Her house is exactly 50 miles from town B.

On the scale diagram show all the possible positions of Lucy's house.
You must show all your construction lines. **[5]**

8.

The scale drawing represents a park.

Scale: 1 cm represents 25 m



A new play area must be

- no more than 150 m from B
- closer to AD than to CD.

Construct and shade the region where the play area can be positioned.

Show all your construction lines.

[5]

9(a). Four points A, B, C and D are shown on the scale diagram below.

Scale: 1 cm represents 5 m

On the diagram, construct and mark the two points that are

- the same distance from A and B

and

- 15 m from C.

Show all your construction lines. **[5]**

(b). The points A, B, C and D represent the four corners of Monty's garden.
His garden is bounded by four straight fences A to B, B to C, C to D and D to A.

Monty wants to plant a tree in his garden at a place that satisfies the two conditions in part (a).

Explain why there is only one position where Monty can plant his tree.

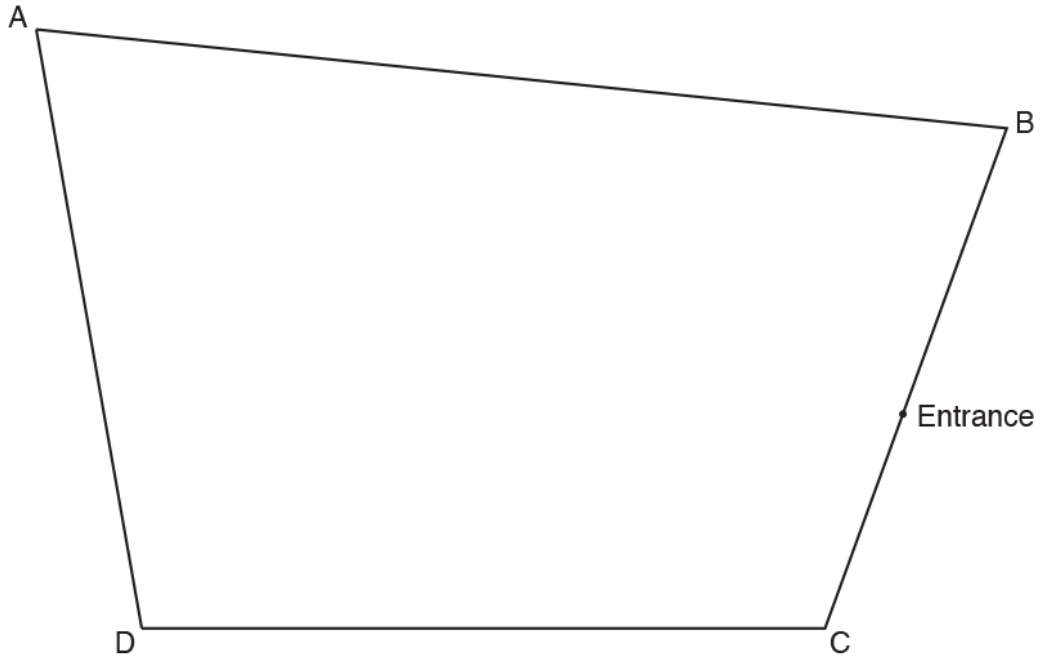
---

[1]

10(a) The diagram shows a scale drawing of a park, ABCD.

.

Scale: 1 cm represents 10 m



A straight water pipe runs across the park.
The pipe runs equidistant from DA and DC.

Construct, using compasses and ruler only, the position of the water pipe.
You must show all your construction lines. [2]

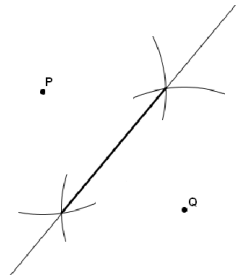
(b). A straight path connects the entrance to the exit.
This path is perpendicular to CB.

(i) Construct, using compasses and ruler only, the position of the path.
Leave in all your construction lines. [2]

(ii) Find the actual length of the path, in metres.

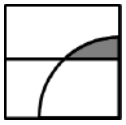
---------- m [2]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Part marks and guidance	
1				4	**B1** perpendicular bisector of PQ drawn ± 2° **B1** for arcs seen **B1** arc centre P, radius 4 ± 0.2 cm **B1** correct line segment marked **FT** their constructions	Arcs must be fit for purpose May be the same arcs as used for perpendicular bisector as shown
			Total	4		
2			Bisector of angle ABC drawn with correct compass arcs or perp bisector of AC drawn with correct compass arcs	2	tol 1°; must be ruled; condone bisector dashed one pair of arcs centres A and C crossing once then joined to B is sufficient; **B1** for acceptable bisector without correct compass arcs; **Examiner's Comments** Those who actually made an attempt were often fairly accurate with correct arcs. It was relatively rare for candidates to earn 1 mark.	Common since AB = BC, allow arcs on AB and BC drawn from B or from A and C use angle measurer set at 50°
			Total	2		
3			arc of circle centre T radius 6 cm drawn arc of circle centre B radius 4 cm drawn	1 1	arcs for B and T circles must be compass drawn; radius tol 2 mm, and extending for a sector of at least 30°	

Question			Answer/Indicative content	Marks	Part marks and guidance	
			Perpendicular bisector of WS drawn with correct arcs	2	must be at least 3 cm long **B1** if no / wrong arcs e.g. arcs touching at midpoint of WS; line must be within 1 mm of centre of WS and tol 1°; or allow **M1** for two correct pairs of arcs but no line or line inaccurate or too short (e.g. if arcs too close)	
			Correct region indicated clearly, dep on arcs centres B and T drawn and straight line attempt at perpendicular bisector	1	accept lack of label R if other indication is clear; assume their region is bounded by the requested loci – ignore construction arcs for the perpendicular bisector going through this region **Examiner's Comments** Whilst most candidates were able to score 1 or 2 marks for correct arcs centred at points T and / or B, few were able to successfully construct the perpendicular bisector of T and B. Even those who did manage to construct the bisector could not then often identify the correct region. Full marks were very rarely awarded for this question.	
			Total	5		

Question			Answer/Indicative content	Marks	Part marks and guidance	
4			ruled perpendicular bisector of AB with at least one pair of correct arcs and then an intended route due West, which is always between 1 cm and 2 cm from the coast, it must be a joined up line	4	**B1** for correct ruled line between A and B going through and beyond the midpoint of AB, condone extension of bisector towards coastline **B1** for at least one intersection of one pair of correct arcs **B1** for an intended route due west **B1** for a route always within 1 cm and 2 cm of coast **Examiner's Comments** Marks were awarded for this question frequently across the full range. Many candidates drew the line between A and B, but failed to use compasses to construct arcs.	on or between the two V lines route parallel to coastline (due West) by eye, could be anywhere on diagram must remain between the two parallel lines for its length which has to be at least 5 mm by eye
			Total	4		

Question			Answer/Indicative content	Marks	Part marks and guidance	
5			Perpendicular bisector of AD with correct arcs with two intersections Arc centre C radius 4.5 cm Correct area shaded	2 1 1	**B1** for bisector with insufficient or no arcs **FT** *their* bisector parallel to AB and *their* arc centre C **Examiner's Comments** Candidates found this locus question challenging. Some draw an arc of a circle with the centre at C and with the correct radius. Not many drew the perpendicular bisector to AD and of those that did virtually no one used arcs to carry out the construction. A small number were able to use their arc and perpendicular bisector to identify the area in which the tree could be planted.	For tolerance check distances on perimeter of rectangle Bisector 34 to 38 mm from A **and** B Arc 43 to 47 mm from C Accept solid or dashed lines and arcs Shaded part should be as below 
			Total	4		

Question			Answer/Indicative content	Marks	Part marks and guidance	
6			bisector of angle A (± 2°)	1	must be ruled, condone dotted	on or within the two lines on the overlay
			two pairs of correct supporting arcs	1	intersection arcs on AB and AD could be short lines or a single arc	
			arc of circle, centre C, radius 4 cm (±2 mm)	1	not freehand, condone dotted and arc must meet their bisector and the line BC, if no bisector where it should have been	meets bisector 'near A' and use the ruler to check tolerance
			their region indicated	1FT	**FT dep** on any ruled line through A and an arc, centre C, intersecting with their line and BC	whole region must be within park
					Examiner's Comments	
					This question was poorly done, many did not draw a circle centred on C, several of those who did failed to draw the arc long enough, fewer understood that the constraint "nearer to AB than AD" meant they had to bisect the angle at A, several candidates did not attempt this question although some drew a random shed inside the shape.	for 4 marks the bisector through A has to intersect BC
			Total	4		

Question			Answer/Indicative content	Marks	Part marks and guidance		
7			Complete correct arc centred at B identified with full construction shown including either perpendicular bisector of AB (including arcs and intersecting the arc centred at B) or arc(s) of 5cm radius centred at A and intersecting the arc from B at 2 points	5	**B4** 5cm arc centred at B with full construction shown including either perpendicular bisector of AB (including arcs and intersecting the arc centred at B) or arc(s) of 5cm (±0.2 cm) radius centred at A and intersecting the arc from B at 2 points OR **B2** for complete arc 5cm (±0.2 cm) centred at B or **B1** for arc**s** 5cm (±0.2 cm) radius centred at B or continuous arc 5cm (±0.2 cm) radius centred at B, but not covering the whole of the required region, minimum	**B4** is fully correct without the correct locus identified Complete arc for the region required	

Question			Answer/Indicative content	Marks	Part marks and guidance		
					span 30° AND **B1** for arc[s] centred at A radius 5cm (±0.2 cm) or a perpendicular bisector of AB OR **B1** for minimum of 3 points in the correct position without arc from B **Examiner's Comments** A large number of candidates managed to score two marks for an arc of radius 5 cm covering the required region from point B. A lesser number achieved four marks for a completely correct construction, but without correctly identify where the house could be; common errors were identifying an inner region, or a series of correct points rather than the continuous arc. A minority just gave a series of crosses measured 5 cm from B with no arcs; a few candidates just drew arcs and circles seemingly at random.		
			Total	5			

Question			Answer/Indicative content	Marks	Part marks and guidance		
8			Arc centre B radius 6 cm meeting AB and CB or AB and bisector of ADC	2	**B1** for any arc centre B meeting AB and BC or short arc (at least 1cm) radius 6 cm centre B	Accept dashed or dotted for all marks Freehand, all within template, max **B1** Allow beyond AB and BC for 1 or 2 marks Tolerance 5.8 to 6.2 cm	
			Ruled bisector of angle ADC to reach BC with construction arcs or Bisector with construction arcs from BC to *their* arc centre B	2	**B1** for correct ruled bisector at least 2cm long by eye with no construction arcs or correct construction arcs with no bisector drawn	Tolerance ± 2°	
			Correct region shaded	1	**Dep** on **B1** and **B1**	Construction arcs on AD and on DC and two intersecting arcs from these	
					If 0 scored **SC1** for 6 [cm] [= 150] [m] seen		
					Examiner's Comment In this part, many candidates drew an arc of radius 6 cm in tolerance centred on B. Those who did not sometimes scored a mark for showing that 150 m would be represented by a length of 6 cm. Very few candidates realised that for the second condition it was		

Question			Answer/Indicative content	Marks	Part marks and guidance	
					necessary to bisect angle ADC. Of those who did, some did this correctly, but common errors were to join B to D, or bisect AB, or draw a random line. Weaker candidates drew and shaded a box, sometimes 6 cm from B, but with no other construction. In too many cases, random arcs covered the figure and sharp pencils were rarely in evidence.	
			Total	5		

Question			Answer/Indicative content	Marks	Part marks and guidance	
9	a		Accurate perpendicular bisector from at least AB passing within 3cm of C with two pairs of correct arcs Arc centre C, at least from BC to CD with radius 3 cm Two correct points marked intersecting the line and the arc	2 2 1	**B1** for accurate perpendicular bisector **B1** for any arc centre C **Dep** on **B1** (bisector) and **B2** (arc) scored above Tolerance ±2mm <u>Examiner's Comments</u> Part (a) proved to be challenging, with many not attempting this part or just marking random points or lines. The most common way to gain marks was by drawing the arc from C, this was usually the correct radius, but was not always of a sufficient length. Constructing the bisector proved to be more problematic, many drew arcs which were far too small to cross, in a number of cases the arcs were only 3 cm in radius. Those who drew the bisector rarely extended it far enough to find both points of intersection with the arc from C.	

Question			Answer/Indicative content	Marks	Part marks and guidance	
	b		One of the points is not in his garden or only one is in his garden	1	accept any correct reason e.g. one point is behind the *CD* fence Examiner's Comments In part (b), the majority offered horticultural rather than mathematical explanations, referring to the tree needing space to grow. Those who did attempt a mathematical explanation frequently assumed that there was only one place that met both conditions, only a minority realised that the second place that met both conditions was outside the boundary of the garden.	
			Total	6		

Question			Answer/Indicative content	Marks	Part marks and guidance		
10	a		Correct ruled line reaching AB and two pairs of correct arcs	2	**B1** for correct ruled line reaching AB without all arcs or correct ruled line with arcs but short	Tolerance $\pm 2^{o}$	
	b	i	Correct ruled line reaching AD through E and two pairs of correct arcs	2	**B1** for correct ruled line reaching AD without all arcs or correct ruled line with arcs but short or perpendicular ruled line from BC to another side	Tolerance $\pm 2^{o}$	

Question			Answer/Indicative content	Marks	Part marks and guidance		
		ii	118 to 122	2	**Strict FT** for all marks. Follow through *their* straight line in **(b)(i)** from entrance to another side **B1** for *their* 11.8 to 12.2 [cm]	Use ruler and measure to 2 mm accuracy	
					<u>Examiner's Comments</u> This question also saw very few correct responses. Most did not know what was required for a construction and could not decode the given information. Some drew randomly placed arcs and lines. Often lines were unrelated to arcs (and the description in the question). Only the few candidates who drew a path in part (b)(i) had anything to measure in part (ii).		
			Total	6			