Mark scheme

Question			Answer/Indicative content	Marks	Guidance	
1	a		Angle in a semi-circle [= 90]	1		Accept: Angle subtended by diameter [= 90] Angle at centre is twice angle at circumference
	b		EBD or EBO or FBD or FBO and angle between radius and tangent [= 90]	2	**B1** for EBD or EBO or FBD or FBO or for correct reason	Accept DBE etc but not B Accept diameter for radius
	c		43	1		
	d		29	1		
			Total	**5**		
2	a		45	2	**M1** for 360 ÷ 8 or for $180 - \frac{180 \times (8-2)}{8}$ oe	
	b		135	1	Correct or **FT** 180 – *their* 45	**FT** dep on (a) < 180
			Total	**3**		
3	a		84	3	**B1** for angle SRQ = 180 – 54 or SRQ = 126 **B1** for angle RSQ = 42 **B1** for angle ROQ =	Could be marked on the diagram, For alternative methods refer to 'Qn12a, 2024 June, Alternative J560/04, Mark Scheme Appendix'

					2 × *their* 42 to maximum of **B2**	within downloadable resource materials.
	b		Method 1 using **angle EFH :** *angle* DEF = *angle* EFH *because* alternate [angle] *angle* EDF = *angle* EFH *because* alternate segment [thm.] *therefore angle* DEF = *angle* EDF or "they have two angles equal" **oe**	B1 B1 B1dep	Method 2 using **angle DFG** : *angle* EDF = *angle* DFG *because* alternate [angle] *angle* DEF = *angle* DFG *because* alternate segment [theorem] **dep** on **B2** awarded If **0** scored **SC1** for two sets of angles linked with incorrect/missing reasons e.g. DEF = EFH and EDF = EFH or EDF = DFG and DEF = DFG	If extra statements mark the best two BOD 'alternating' but not 'Z-angles' BOD 'alt. seg.' Note : Angles may be written the other way round e.g. EDF is the same as FDE and they can say *angle* DFG = *angle* EDF and in marking you must use either method 1 or method 2 not both
			Total	**6**		
4			16 **nfww**	4	**B2** for 22.5 **M1** for 360 ÷ *their* 22.5 seen OR **B1** for 7a and a or 8a **M1** for 7a + a = 180 **oe** **M1** for 360 ÷ *their* 22.5 seen Alternative method 1: **M2** for 7 × 360 = 180(n – 2) or better or **M1** for $\frac{180(n-2)}{n} = 7 \times \frac{360}{n}$ and **M1** for 180n = 2520 + 360 **oe**	a = exterior angle and allow any consistent single letter **B1 M1** implied by 8a = 180 or $\frac{180}{7+1}$ **oe** Alternative for number of sides: e.g. **M1** for $\frac{180(n-2)}{n}$ = 180 – *their* 22.5

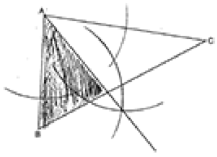
					Alternative method 2: Use of trials by choosing a value for n. **M1** for each correct trial up to a maximum of **M3** for using <u>two</u> of these [exterior angle] = $\frac{360}{n}$ (formula A) [interior angle] = $\frac{180(n-2)}{n}$ (formula B) interior + exterior = 180 and for checking that interior = 7 × exterior if **0** scored **SC1** for one of formula A or B seen or used	If they get 16 from any number of trials they score **4** marks. Trials can be seen from a calculation or a list. See Appendix* for likely results *Refer to 'Qn6, 2024 June, Alternative J560/04, Mark Scheme Appendix' within downloadable resource materials.
			Total	**4**		
5			Acceptable bisector of angle C with two pairs of supporting arcs Region above their bisector shaded 	M2 B1	**M1** for acceptable bisector of angle C with no or incorrect arcs **Dep** on ruled line from angle C reaching AB	Tolerance ± 2° Accept dashed or solid line for bisector If additional incorrect bisectors are drawn then this is choice and M0 unless the shading indicates they have chosen the correct bisector Accept any clear indication for shading
			Total	**3**		
6			Bar for 10-20 drawn with height 7 small squares	2	**M1** for 14 ÷ 10 **soi** by 1.4	Condone good freehand
			Total	**2**		
7	a		Angle in a semi-circle [= 90]	1	<u>**Examiner's Comments**</u>	Accept: Angle subtended by diameter [= 90] Angle at centre is twice angle at circumference

					Very few candidates used the correct terminology in their reason. Common incorrect reasons were, it is a right-angle, it is a right-angled triangle, or it is on the diameter.
	b		EBD or EBO or FBD or FBO and angle between radius and tangent [= 90]	2	**B1** for EBD or EBO or FBD or FBO or for correct reason Accept DBE etc but not B Accept diameter for radius **<u>Examiner's Comments</u>** Some candidates could identify another 90-degree angle although angle ABC was a common error. Most did not give a complete explanation using the correct terminology in their reason. Reasons sometimes included the word tangent or radius, but not both. Some candidates incorrectly stated that angle ABC was 90-degrees, stating that it was an angle in a semicircle.
	c		35	1	**<u>Examiner's Comments</u>** A few candidates answered this part correctly. The most common answers were 25, 45, 60 and 90. A common misconception is that the lines AD and BC are parallel.
	d		25	1	**<u>Examiner's Comments</u>** A few candidates answered this part correctly. A common misconception is that angle CAD is equal to angle EBA.
			Total	**5**	
8	a		60	2	

					M1 for 360 ÷ 6 or for $180 - \frac{180\times(6-2)}{6}$ oe **Examiner's Comments** Those candidates that recognised the exterior sum of a polygon was 360° were usually successful in this part. For many candidates there were a number of misconceptions, however. These included interior angle sum of a polygon = 360, interior angle + exterior angle = 360. Some candidates attempted to find the interior angle first using $\frac{180(6-2)}{6}$ and then subtracting from 180°, this was a less successful approach.	
	b		120	1	Correct or FT 180 – *their* 60 **Examiner's Comments** More candidates were successful in this part. Examiners allowed a follow through from the previous answer. A number did 360 minus their answer and some gave an interior angle sum of the polygon rather than the size of one individual angle. **Misconception** A number of candidates are not secure in recalling interior and exterior angle facts, e.g. common errors included exterior + interior = 360, interior angle sum = 360. Some did not recognise a hexagon has six sides.	FT dep on (a) < 180
			Total	**3**		
9			9.40 or 9.397 to 9.398	4	**B1** for [ABC =] 85 **soi** AND	Accept 9.4 with working May be seen on diagram or within **M2/M1** expressions

					M2 for [AC =] $\frac{8 \times \sin(85 \text{ or } \textit{their} \text{ ABC})}{\sin 58}$ or **M1** for $\frac{\text{AC}}{\sin(85 \text{ or } \textit{their} \text{ ABC})} = \frac{8}{\sin 58}$ oe	
			Total	**4**		
10	a		BF = DE or BF = 4*t* and [opposite sides of a] rectangle [are equal] AB = BF [= 4*t*] and radii [of a sector/circle]	1 1	For **2 marks**, 4*t* must be seen in at least one statement as BF or on the diagram as BF	
	b		ABF = 65 and BC = 2*t* $\frac{\textit{their } 65}{360} \times 2\pi \times \textit{their } 4t$ $\frac{25}{360} \times 2\pi \times 2t$ 4*t* + 2*t* + 4*t* + 2*t* $\frac{25}{360} \times 2\pi \times 2t + \frac{65}{360} \times 2\pi \times 4t$ $+4t + 2t + 4t + 2t$ $\frac{31}{18}\pi t + 12t$	B1 M1 M1 M1 A1		Stated or seen on diagram All **M** marks may be seen within a summarising expression Condone 8*t* + 4*t*, 6*t* + 6*t* etc but not 12*t*
			Total	**7**		
11			ABF 60 equilateral/all angles equal FBC 120 straight line/line adds to 180 ECD 60 equilateral/all angles equal BCF 30 FCE 90° and straight line/line adds to 180° BFC 30 angles in a triangle add to 180° [so triangle BCF is isosceles with BC = BF]	1 1 1 1 1	If **0** or **1** scored, instead award **SC2** for all of these angles correct If **0** scored, instead award **SC1** for two of the first four angles correct	Ignore other angles Accept in any order Condone spelling Angles could be seen on diagram in correct position(s) For full marks, must be convinced they are working forwards and not backwards

			Total	**5**		
12			BMD and [diameter bisects chord] so CD [diameter] is perpendicular to AB [chord] [MD is] common SAS	1 1 1		Also accept DMB Accept e.g. ‘shared’
			Total	**3**		
13	a		95	4	**M1** for $5x - 160 = 2(x + 25)$ **oe** **M1** for $5x - 160 = 2x + 50$ **FT** *their* 4 term linear equation with brackets **M1** for $x = 70$ **FT** *their* 4 term linear equation	**FT** linear equation with more than 4 terms but not fewer, must have at least two terms in x
	b		85 and Opposite angles of a cyclic quadrilateral are supplementary	2	**FT** 180 – *their* **(a)** **B1** for 85 **FT** or for correct reason	Accept [Opp angles of] cyclic quad [add up to 180] [Angles in] opposite segments [are supplementary] Accept complete longer reasons Angles at a point add to 360 and angle at centre is twice angle at circumference **oe** Any incorrect statement does not score for reason
			Total	**6**		
14			Bar for 30–45 drawn with height 3 small squares	2	**M1** for 9 ÷ 15 soi by 0.6 **<u>Examiner’s Comments</u>** Those candidates who identified a frequency density of 3.2 in part (a) usually drew this bar correctly. A bar of height nine little squares was very common from candidates who had scored 0	Condone good freehand

					marks in part (a). It was rare to see any working. When present, 15 ÷ 9 was nearly as frequent as 9 ÷ 15.
			Total	**2**	
15			acceptable bisector of angle A with two pairs of supporting arcs Region to the left of their bisector shaded 	M2 B1	**M1** for acceptable bisector of angle A with no or incorrect arcs — Tolerance ± 2° Use overlay Accept dashed or solid line for bisector If additional incorrect bisectors are drawn then this is choice and M0 unless the shading indicates they have chosen the correct bisector **Dep** on ruled line from angle A reaching BC — Accept any clear indication for shading **<u>Examiner's Comments</u>** Many recognised that the required region involved constructing the bisector of angle BAC and shading to the left of the bisector; most who attempted this gave an accurate construction and earned full marks. Errors included drawing the perpendicular bisector of BC (or another length) as well as drawing a line from point A to the midpoint of BC.
			Total	**3**	
16			32 nfww	4	**B2** for 11.25 **M1** for 360 ÷ *their* 11.25 seen OR **B1** for 15*a* and *a* or 16*a* **M1** for 15*a* + *a* = 180 oe **M1** for 360 ÷ *their* 11.25 seen Alternative method 1: **M2** for 15 × 360 = 180(*n* – 2) or better or **M1** for $\frac{180(n-2)}{n} = 15 \times \frac{360}{n}$ *a* = exterior angle and allow any consistent single letter **B1 M1** implied by 16*a* = 180 or $\frac{180}{15+1}$ oe Alternative for number of sides: e.g. **M1** for $\frac{180(n-2)}{n}$ = 180 – *their*11.25

and
M1 for $180n = 5400 + 360$ oe

Alternative method 2:
Use of trials by choosing a value for n.
M1 for each correct trial up to a maximum of **M3** for using two of these

[exterior angle] = $\frac{360}{n}$ (formula A)

[interior angle] = $\frac{180(n-2)}{n}$ (formula B)

interior + exterior = 180
and
for checking that interior = 15 × exterior

if **0** scored **SC1** for one of formula A or B seen or used

If they get 32 from any number of trials they score **4** marks. Trials can be seen from a calculation or a list.

see appendix for likely results

sides	interior	exterior			
5.00	108.00	72.00	35.00	169.71	10.29
6.00	120.00	60.00			
7.00	128.57	51.43			
8.00	135.00	45.00			
9.00	140.00	40.00			
10.00	144.00	36.00			
11.00	147.27	32.73			
12.00	150.00	30.00			
13.00	152.31	27.69			
14.00	154.29	25.71			
15.00	156.00	24.00			
16.00	157.50	22.50			
17.00	158.82	21.18			
18.00	160.00	20.00			
19.00	161.05	18.95			

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<tr><td>20.00</td><td>162.00</td><td>18.00</td></tr>
<tr><td>21.00</td><td>162.86</td><td>17.14</td></tr>
<tr><td>22.00</td><td>163.64</td><td>16.36</td></tr>
<tr><td>23.00</td><td>164.35</td><td>15.65</td></tr>
<tr><td>24.00</td><td>165.00</td><td>15.00</td></tr>
<tr><td>25.00</td><td>165.60</td><td>14.40</td></tr>
<tr><td>26.00</td><td>166.15</td><td>13.85</td></tr>
<tr><td>27.00</td><td>166.67</td><td>13.33</td></tr>
<tr><td>28.00</td><td>167.14</td><td>12.86</td></tr>
<tr><td>29.00</td><td>167.59</td><td>12.41</td></tr>
<tr><td>30.00</td><td>168.00</td><td>12.00</td></tr>
<tr><td>31.00</td><td>168.39</td><td>11.61</td></tr>
<tr><td>32.00</td><td>168.75</td><td>11.25</td></tr>
<tr><td>33.00</td><td>169.09</td><td>10.91</td></tr>
<tr><td>34.00</td><td>169.41</td><td>10.59</td></tr>
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<u>Examiner's Comments</u>
Many found this difficult. A large number attempted it as if the interior angle and the exterior angle sum to 360° and not 180°, therefore giving an answer of 16 rather than 32. Some correctly found the exterior angle of 11.25° and the interior angle of 168.75° but did not know how to use these to find the number of sides. Some thought the formula to find the interior angle of a regular polygon was 180(n – 2). Few seemed to know the formula 360 ÷ n.
</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>4</td><td></td></tr>
<tr><td>17</td><td>a</td><td></td><td>96</td><td>3</td><td>
<table>
<tr><td>B1 for angle SRQ = 180 – 62 or SRQ = 118
B1 for angle RSQ = 48
B1 for angle ROQ = 2 × their 48
to maximum of B2</td><td>could be marked on the diagram, see appendix for alternative methods</td></tr>
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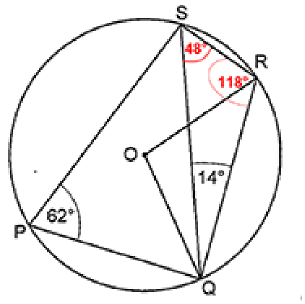
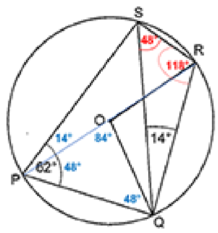
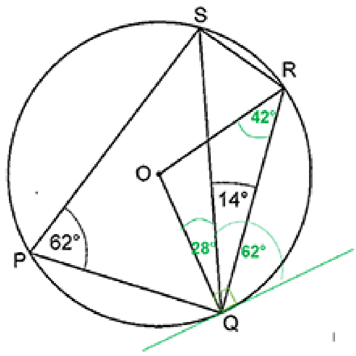
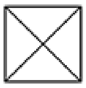
						 Hence angle ROQ = 96° from which ORQ=OQR=42°, SRO=76°, OQS=28°. Alternative method 1 Some candidates are joining OP, however ROP are not co-linear but point P can be moved so that ROP is a straight line and maintaining angle SPQ as 62°. Mark this; **B1** for angle SPO = 14° **B1** for angle OPQ and angle OQP = 48° **B1** for angle QOP = 84° or OQR and ORQ = 42° to maximum of **B2**  Alternative method 2 They can draw a tangent at Q. T is the end of the tangent. B1 for SQT = 62° (alternate segment theorem), B1 for (angle OQT = 90°) so angle OQS = 28°, B1 for making angle OQR = 42° = angle ORQ. to maximum of B2 Hence angle ROQ = 180° – 42° – 42° = 96° 

					Examiner's Comments On the diagram, we often saw the angle SRQ written as 118° and the angle RSQ as 48° correctly, but with some other angles incorrectly calculated. Only a few candidates were able to calculate the correct answer. Most did not answer or showed a few incorrect angles, highlighting that the angle properties of lines within a circle continues to be a topic that candidates struggle with.
	b		Method 1 using **angle EFH**: *angle* DEF = *angle* EFH *because* alternate [angle] *angle* EDF = *angle* EFH *because* alternate segment [thm.] *therefore angle* DEF = *angle* EDF or "they have two angles equal" oe	B1 B1 B1dep	Method 2 using **angle DFG**: *angle* EDF = *angle* DFG *because* alternate [angle] *angle* DEF = *angle* DFG *because* alternate segment [theorem] **dep** on **B2** awarded If **0** scored **SC1** for two sets of angles linked with incorrect/missing reasons e.g. DEF = EFH and EDF = EFH or EDF = DFG and DEF = DFG If extra statements mark the best two BOD 'alternating' but not 'Z-angles' BOD 'alt. seg.' Note : Angles may be written the other way round e.g. EDF is the same as FDE and they can say *angle* DFG = *angle* EDF and in marking you must use either method 1 or method 2 not both **Examiner's Comments** Candidates have often found proof questions to be a challenge and this one was no exception . A few did give the full and correct proof. Some were able to equate two angles with the correct property (such as angle DEF = angle EFH because they are alternate angles) even if they couldn't construct the full proof .
			Total	**6**	
18			119 with correct working	5	"Correct working" requires evidence of at least M2 or M1M1

					B3 for $x = 39$ or **M2** for $5x = 180 - 22 + 37$ oe or $4x - 37 = 119$ or better or **M1** for $4x - 37 + x + 22 = 180$ oe **A1** for $x = 39$ AND **M1** for $4 \times$ *their* $x - 37$ or *their* $x + 22$ If **0** or **1** scored, instead award **SC2** for answer 119 with no or insufficient working If **0** scored, instead award **SC1** for [x =] 39	Accept equivalents for M2 e.g. $(180 - 22 + 37) \div 5$ if no algebra seen Accept e.g. $4x - 37$ and $x + 22 = 180$ Using trial, allow correct substitution into $4x - 37 + x + 22$ to imply M1 if 180 also stated SC marks may be seen on diagram
			Total	**5**		
19			Angle AEB = angle DEC and [vertically] opposite Angle ABE = angle ECD and same segment Angle BAE = angle EDC and same segment [Triangle AEB is similar to triangle DEC] [corresponding] angles are equal oe or AAA oe OR After two pairs of angles with reasons gives 3rd pair of equal angles with a reason	M2 A1	For **M2** only two of the three statements and reasons are required **M1** for one pair of angles with a reason With no errors or incorrect statements seen If 0 scored, **SC1** for at least two correct pairs of angles identified with no / incorrect reasons	Allow any unambiguous labelling for angles e.g. ABE or ABD or B, but not E For reason accept e.g. opp ∠'s For same segment, accept same arc but not same chord Accept 3rd angle in triangle oe for reason with final angle if other two given correctly with correct reasons Accept they have the 'same/equal angles' oe, AA **and** similar. Accept symbol **~** for similar Condone angles

						identified on diagram for **SC1**
			Total	**3**		
20			 with side 6 cm	2	**B1** for a square drawn with side 6 cm or for a square of any length with two diagonals	Mark intention 2 mm tolerance radially on centre point by eye
			Total	**2**		
21			Accurate ruled perpendicular bisector of BC with two correct pairs of supporting arcs Accurate ruled bisector of angle ABC with two correct pairs of supporting arcs Correct position of boat clearly identified at point of intersection of two straight lines	2 2 1 dep	**B1** for accurate ruled perpendicular bisector of BC with no or incorrect arcs **B1** for accurate ruled bisector of angle ABC with no or incorrect arcs **Dep** on at least **B1** and **B1**	Tolerance ±2 mm and ±2°. Line length at least 2 cm Tolerance ±2°. Line length at least 2 cm
			Total	**5**		
22	a	i	[*a*] 69° and [angles in] alternate segment [are equal]	2	**B1** for 69 **Response Mark** Angles in the alternate segment are equal **1** Angles on a tangent which meet a triangle in a circle equal the **alternate** angle in the triangle **0**	Note : **0** for 57 (or any other value) and alternate segment Allow for reason : angle between chord and tangent equals angle in opposite segment
		ii	[*b*] 21° [angle between] radius and tangent is 90° **oe**	1 1	**FT** 90 – *their a* (providing the answer is positive)	Condone these terms : diameter,

						perpendicular, right-angle
					Response Mark Angle between tangent and radius is 90 **1** Radius meets tangent at 90 **1** Tangent is perpendicular to radius **1** Tangent and diameter form a perpendicular bisector **1** Tangent subtends a 90 angle at the radius **1** Angles on a tangent on a radius are 90 **1(BOD)** Line from centre to tangent **at the point where the tangent touches the circle** is 90° **1(BOD)** Radius to line SPT will form a right angle **0** Angle between tangent and circle is 90 **0** Angle between tangent and a straight line is 90 **0** Angles at a right angle add up to 90 **0** Right angle between centre and tangent **0** Angles on a tangent add up to 90 **0** Tangent meets the chord at 90 **0**	
	b	i	$2x$ [because] angle [subtended] at centre is twice angle at circumference **oe** $360 - 2x$ $180 - x$	1 1FT 1dep	**STRICT FT** e.g. 360 – *their* $2x$ **Dep** on $2x$ and $360 - 2x$	Condone "inscribed angle theorem" and "central angle theorem" For $180 - x$ condone $\frac{360-2x}{2}$ Do not accept working back from **(b)(ii)** unless whole part is complete and correct
					Response Mark Angles at centre is twice angle at circumference **1** Angles from the same chord are double at the centre than at the circumference **1** Angles on the perimeter are half the centre angle **1** Angle at the centre of a cyclic quadrilateral is twice the angle at the opposite point **0** Angles at centre is twice angle at the edge **0**	
		ii	Opposite angles [in a] cyclic quadrilateral [sum to] 180°	1	**Response Mark**	

					Opposite angles in a cyclic quadrilateral add up to 180/supplementary **1** Opposite angles in a cyclic quadrilateral = 180 **1(BOD)** Opposite angles in a quadrilateral add up to 180 **0** Angles in a [cyclic] quadrilateral add up to 360 **0** It is a cyclic quadrilateral **0** Cyclic quadrilateral theorem **0**
			Total	**8**	
23	a		115 Corresponding [angles]	2	**B1** for each Do not accept F [angles] Ignore irrelevant further comments
	b		55	3	**M1** for 180 – 115 **soi** **M1** for 60 marked in correct place[s] inside triangle or used in correct calculation to find angle For **M1**, accept 65 marked on diagram in correct place[s] **M1** for e.g. 180 – (180 – 115) – 60 **oe** Do not award if incorrect angle e.g. 65 is also marked in a place where 60 should be
			Total	**5**	
24	a		59 alternate segment [theorem]	1 1	condone ‘rule’ for ‘theorem’
	b		46 with correct working	5	**B1** for GOH = 44 **B1** for OHJ = 44 **B2** for [OHG =] 68 or **M1** for 180 – 44 [÷2] If **0** or **1** scored award **SC2** for answer 46 with no working or insufficient working Note: If answer is 46 “correct working” requires at least **B2** or **B1B1** angles may be on diagram Alt. 1: **B1** for GOH = 44 **B1** for OGJ = 22 **B2** for [OGH =] 68 Alt.2: **B1** for

					and the working is incorrect only award the **B** marks	tangent at H **B1** for OHJ = 44 **M2** for 90 − 44
			Total	**7**		
25			12 with correct working	6	**M2** for a correct method to find the interior angle of a hexagon e.g. 180 – $\frac{360}{6}$ or $\frac{(6-2)\times 180}{6}$ or **M1** for partial method e.g. $\frac{360}{6}$ or (6 – 2) × 180 AND **M1** for 360 – 90 – *their* 120 AND **M2** for $\frac{360}{180 - their\ 150}$ or **M1** for 180 − *their* 150 If **0**, **1** or **2** scored, instead award **SC3** for answer 12 with no working or insufficient working	“correct working” requires at least **M1M1** or **M2** **M2** implied by 120 **M1** implied by 60 or 720 **M3** implied by 150 **M1** for (n – 2)180 = *their* 150n oe and **M1** for a correct rearrangement e.g. 30n = 360 <u>Alternative method</u> as the third angle is the sum of the exterior angle of the square and the exterior angle of the hexagon **M3** for 90 + $\frac{360}{6}$ [= 150] or **M1** for $\frac{360}{6}$ **M2** for $\frac{360}{360 - their\ 60 - 90 - 180}$ oe or **M1** for 360 – *their* 60 – 90 – 180 oe
			Total	**6**		
26	a		Ruled bisector of angle DAB to reach CD with construction arcs	2	**B1** for correct ruled bisector at least 2	Tolerance ±2°

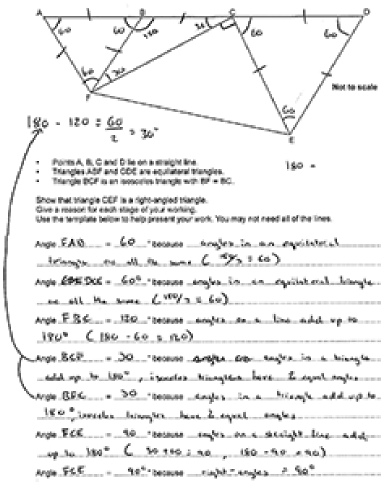
					cm long by eye with no construction arcs or correct construction arcs with no/wrong bisector drawn	Construction arcs on AB and on AD and two intersecting arcs from these
	b		Arc, centre C, radius 4 cm, intersecting *their* line once or intersecting BC and CD or two points marked on *their* line that are 4 cm from C Locus of line within arc from C rad indicated	2 1dep	**B1** for any arc, centre C intersecting *their* line once or intersecting BC or CD or short arc (at least 1 cm), centre C, radius 4 cm Dep on at least **B1** in **(a)** and **B1** in **(b)**	Tolerance 3.8 – 4.2 cm Max **B1** for freehand
			Total	**5**		
27	a		<u>Using interior angles</u> ((15 – 2) × 180) ÷ 15 or 2340 ÷ 15 seen [Int angle of triangle =] 60 in working 360 – (156 + 60) **oe** [= 144]	1 1 1	<u>Using exterior angles</u> 360 ÷ 15 seen [Ext angle of triangle =] 120 in working 24 + 120 [= 144] <u>Alternative method</u> **1** for 360 ÷ 15 seen **1** for [Int angle of triangle =] 60 in working **1** for 180 – (60 – 24) [= 144] If **0** scored, **SC1** for 24, 36, 60, 120 or 156 shown in correct place on diagram	Mark the working. Mark angles on diagram only if **0** scored Working backwards from 144 to 156 [to 15 sides] scores **0**
	b		10	2		

					M1 for $[n =]\frac{360}{180-144}$ or $\frac{180(n-2)}{n} = 144$	
			Total	**5**		
28			45 with correct working	5	**B3** for angle BCD = 105 with correct working Or **M1** for angle BAD = 75 or for angle BDE = 180 – 75 or 105 **M1** for angle BCD = 180 – *their* angle BAD AND **M2** for *their* angle BCD ÷ 7 × 3 **oe** Or **M1** for *their* angle BCD ÷ 7 **oe** If **0** scored **SC2** for answer 45 Or **SC1** for angle BCD = 105	For full marks 'correct working' requires evidence of at least **M1** AND **M1** i.e. at least a correct angle and some ratio work Ignore geometric reasons if given For **B3** "correct working" requires at least **M1** or alternate convincing approach Angles may be indicated on diagram for part marks May be seen on diagram
			Total	**5**		
29			Complete correct argument e.g. Angle ABC = 20° [BO =] e.g. $\frac{5}{\sin 10}$ 28.793…… or 28.794	B1 M2 A1dep	**M1** for e.g. $\sin 10 = \frac{5}{[BO]}$ Dep on at least **M1**	Accept any correct method not using 28.79 Could be on diagram and also accept ABO = 10°, BO'T' = 80° i.e. BO as subject for **M2** and condone sine

					rule with sin 90° for **M2**
			Total	**4**	
30			6.67 or 6.670 to 6.671	4	**B1** for [BAC =] 45 soi AND **M2** for [BC=] $\frac{8 \times \sin(45 \text{ or } their \text{ BAC})}{\sin 58}$ or **M1** for $\frac{BC}{\sin(45 \text{ or } their \text{ BAC})} = \frac{8}{\sin 58}$ oe Accept 6.7 with working May be seen on diagram or within **M2**/**M1** expressions **<u>Examiner's Comments</u>** Lower performing candidates did not make worthwhile progress, as knowledge of circle theorems and the sine rule needed to be combined to answer the question. Angle CAB is 45° from the alternate segment theorem, although the reason was not required for the award of the mark. However, it was common to misuse the theorem and give the angle as 77°. A few candidates assumed this was an isosceles triangle and therefore worked out the angle as 64°. The sine rule work was performed very well by those attempting to finish the question. Many of those candidates who had an incorrect value for angle CAB were still able to use it correctly in the sine rule and so gained two marks out of four.
			Total	**4**	
31	a		BD = EF or BD = 2*t* and [opposite sides of a] rectangle [are equal] BC = BD [= 2*t*] and radii [of a sector/circle]	1 1	For two marks, 2*t* must be seen in at least one statement as BD or on the diagram as BD

					Examiner's Comments Candidates needed to make clear use of BD as the connection between FE and BC alongside supporting reasons. For example, 'BD = FE because they are opposite sides of a rectangle and so BD = 2*t* and then BC = BD because they are both radii of the same sector/circle'.
	b		ABF = 55 and AB = 5*t* $\frac{their 55}{360} \times 2\pi \times$ *their* 5*t* $\frac{35}{360} \times 2\pi \times 2t$ $5t + 2t + 5t + 2t$ $\frac{35}{360} \times 2\pi \times 2t + \frac{55}{360} \times 2\pi \times 5t + 5t + 2t + 5t + 2t$ $\frac{23}{12}\pi t + 14t$	B1 M1 M1 M1 A1	Stated or seen on diagram All **M** marks may be seen within a summarising expression Condone 10*t* + 4*t*, 7*t* + 7*t* etc but not 14*t* **Examiner's Comments** Part (a) served as a prompt for part (b) and most candidates making an attempt deduced that AB = 5*t*, which enabled them to gain a mark if showing the sum of the four straight sides leading to 14*t*. Candidates could also gain a mark for having both AB = 5*t* and angle ABF = 55°. The remaining three marks were for the arc lengths of the two sectors and completing the summation of the perimeter to the given answer without error. Some candidates found the areas of the sectors, but then abandoned their work. Generally, those who made an attempt knew what they were doing and completed the task accurately.
			Total	**7**	
32				1 1	

			ABF 60 equilateral/all angles equal FBC 120 straight line/line adds to 180 BCF 30 isosceles/ BCF=BFC and angles in triangle add to 180 ECD 60 equilateral/all angles equal FCE 90 straight line and 180–30–60	1 1 1	If **0** or **1** scored, instead award **SC2** for all of these angles correct in template or on diagram If **0** scored, instead award **SC1** for two of the first four angles correct in template or on diagram	Ignore other angles Accept in any order Condone spelling For full marks, must be convinced they are working forwards and not backwards
					<u>Examiner's Comments</u> Marks were given as one mark for each complete, correct, relevant statement. There are five specific angles that need to be found in order to show what the question requires. Other angles (such as FAB and CEF) are not necessary to answer the question and so received no credit. The statements were accepted in any order. Correct notation was required, such as angle 'ABF' rather than angle 'B'. This question used the command words 'show that', so for the final mark it was a requirement to present the arithmetic 180 – 30 – 60 (or similar) that justifies angle FCE as being a right angle. Candidates have struggled in the past to present their working and reasons clearly. The provided template appeared to help candidates achieve marks. **Assessment for learning** Content statement 8.01b of the specification requires standard labelling of angles, such as 'angle ABC'. If there is just one triangle (for example, as is often the case in trigonometry) then 'angle B' is unambiguous, but on diagrams	

33	a				like the one presented here, three-letter notation is needed. Exemplar 2  There is no credit for the first statement as FAB is not needed to answer the question set. Instead, the candidate should have referenced angle ABF. In the second statement, angle DCE is relevant, 60˚ is correct and the equilateral triangle reason is correct, and so a mark is given. Likewise, the third and fourth statements are relevant, correct and explained, gaining another mark each. The fifth statement does not receive a mark because angle BFC is not relevant to the question. Finally, angle FCE is justified to be a right angle (or 90˚) with a reason and supporting calculation. In total four of the five marks have been given. The mark for angle ABF has not been given as the reason has not been given despite 60° being marked on the diagram. Had their reasons been insufficient or omitted, or incorrect angle notation used, candidates could still receive SC2 or SC1 marks for correct angles marked on the diagram.
			Total	**5**	
33	a		115	4	**M1** for $4x - 150 = 2(x + 20)$ **oe** **M1** for $4x - 150 = 2x + 40$ FT *their* 4 term linear — FT linear eqn with more than 4 terms

					equation with brackets **M1** for $x = 95$ FT *their* 4 term linear equation | but not fewer, must have at least two terms in x **Examiner's Comments** A few candidates were able to set up a correct equation, solve it to find the value of x and then use this to find the size of angle BCD. Many set up an incorrect equation, for example $x + 20 = 4x - 150$ or $x + 20 + 4x - 150 = 360$. A follow-through mark was available for solving an incorrect equation of equivalent difficulty to the correct equation. This mark was given to a small number of candidates.
	b		65 and Opposite angles of a cyclic quadrilateral are supplementary	2	**FT** 180 – *their* (a) **B1** for 65 FT | Accept or for correct reason | [Opp angles of] cyclic quad [add up to 180] [Angles in] opposite segments [are supplementary] Accept complete longer reasons Angles at a point add to 360 and angle at centre is twice angle at circumference **oe** Any incorrect statement does not score for reason **Examiner's Comments** There were some good responses that gave a correct angle and used the correct geometrical language involving a cyclic quadrilateral. A few candidates were given a partial mark for the

					correct angle with an incorrect reason or not using the correct language to describe the geometrical property.
			Total	**6**	
34			QMT and [diameter bisects chord] so VT [diameter] is perpendicular to PQ [chord] [MT is] common SAS	1 1 1	Also accept TMQ accept e.g. 'shared' **Examiner's Comments** This was meant to be a partly completed proof. Only a few candidates realised they needed to refer to angle to angle QMT in the first part as most candidates put 90° instead and most did not know the reason why these two angles were equal. However, many used the correct term for side MT with 'common' or 'shared' being the most popular words. Also, many candidates realised it was SAS that was the reason for congruence. As there was a right angle some did give RHS instead.
			Total	**3**	
35	a	i	[*a*] 67° and [angles in] alternate segment [are equal]	2	**B1** for 67 — Note : **0** for 59 (or any other value) and alternate segment Allow for reason : angle between chord and tangent equals angle in opposite segment **Response Mark** **For additional information refer to 2023 June (J56004) Mark scheme Appendix within downloadable additional mark guidance.** **Examiner's Comments** Some candidates gave the correct answer 67°, but many of those did not give the correct

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td>reason. The two most common incorrect angles were 59° and 54. For the reason, the two most important terms are ‘alternate’ and ‘segment’ (there were many reasons involving ‘alternate angles’). There were many attempts to explain it using other words, but this is very difficult.

Assessment for learning

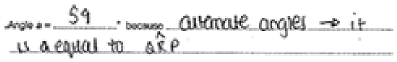
It is well worth spending time learning the correct terms for the circle and learning the circle properties. The concepts of circle theorems is something that most candidates seem to find difficult. Candidates often quote random angle facts and hope that they are the appropriate ones.

Exemplar 1


Angle a = 67 ° because alternate segment theorem so angle PQR is equal to angle RPT.

Correct geometric property stated with implication for this question.

Exemplar 2


Angle a = 59 ° because alternate angles → it is a equal to $A\hat{R}P$

Students were not told that ST and QR are parallel, so this has been incorrectly assumed.</td></tr>
<tr><td></td><td></td><td>ii</td><td>[b] 23°

[angle between] radius and tangent is 90° oe</td><td>1
1</td><td>FT 90 – their a (providing the answer is positive)

Condone these terms : diameter, perpendicular, right-angle

Response Mark

For additional information refer to 2023 June</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td>(J56004) Mark scheme Appendix within downloadable additional mark guidance.

<u>Examiner’s Comments</u>

This was answered better than Question 17 (a)(i), with many candidates following through from their incorrect answer to part (a)(i) correctly. The reason often involved ‘angles on a straight line add up to 180’ or ‘angles on a tangent add up to 90’. Some did not use the term ‘radius’ so we would see ‘from centre to tangent…’ or ‘line from centre to tangent…’, however this reason was more well-known than the reason in part (a)(i).</td></tr>
<tr><td></td><td>b</td><td>i</td><td>2x [because] angle [subtended] at centre is twice angle at circumference oe

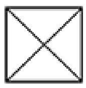
360 – 2x

180 – x</td><td>1
1FT
1dep</td><td><table><tr><td></td><td>Condone “inscribed angle theorem” and “central angle theorem”</td></tr><tr><td>STRICT FT e.g. 360 – their 2x</td><td>For 180 – x condone $\frac{360-2x}{2}$</td></tr><tr><td>Dep. on 2x and 360 – 2x</td><td>Do not accept working back from (b)(ii) unless whole part is complete and correct</td></tr></table>
Response Mark

For additional information refer to 2023 June (J56004) Mark scheme Appendix within downloadable additional mark guidance.

<u>Examiner’s Comments</u>

In the first part many candidates did write 2x, but some of these did not give the reason correctly. There were many candidates who did not use the correct term for ‘centre’, the most common ones being ‘middle’ or ‘origin’. Some did not use the term ‘circumference’ and instead used ‘edge’ or ‘perimeter’. A few wrote 360 – 2x, not reading the word ‘obtuse’ in the demand. The second angle was given correctly more often than the first one. The third angle was dependent on the other two because it was part of a ‘proof’. Very</td></tr>
</table>

					few candidates wrote the third angle correctly; a common wrong answer was 180 – 2*x*.
		ii	Opposite angles [in a] cyclic quadrilateral [sum to] 180˚	1	**Response** **Mark** For additional information refer to **2023 June (J56004) Mark scheme Appendix** within downloadable additional mark guidance. **Examiner's Comments** Few candidates answered this question correctly, although some did mention a quadrilateral in a circle or even a cyclic quadrilateral and some wrote that the angles of a quadrilateral added up to 360, which is not what this proves.
			Total	**8**	
36			 with side 5 cm	2	**B1** for a square drawn with side 5 cm or for a square of any length with two diagonals — Mark intention 2mm tolerance radially on centre point by eye **Examiner's Comments** Most candidates drew a square of the correct size, but it was quite common for the diagonals to be omitted. When drawn, diagonals were usually accurate, passing well within the tolerance of the centre point. Some candidates seemingly did not know what a plan view was and there were some diagrams of the triangle front elevation, nets and attempts at 3D drawings of the pyramid. A few candidates did not understand the meaning of the dashed lines on the diagram and drew dashed lines for their square's top and left sides and the top left diagonal.
			Total	**2**	
37			Accurate ruled perpendicular bisector of AB with two correct pairs of supporting arcs	2 2 1 dep	Use overlay as a guide

			Accurate ruled bisector of angle ABC with two correct pairs of supporting arcs Correct position of boat clearly identified at point of intersection of two straight lines		Put ruler on screen to check 2 cm if needed **B1** for accurate ruled bisector perpendicular bisector of AB with no or incorrect arcs Tolerance ±2 mm and ±2°. Line length at least 2 cm Bisector crosses between circles of overlay but does not cut them and perpendicular by eye **B1** for accurate ruled bisector of angle ABC with no or incorrect arcs Tolerance ±2°. Line length at least 2 cm Bisector between or on red lines of overlay arcs Dep on at least **B1** and **B1** **<u>Examiner's Comments</u>** Constructions is a topic area that candidates of all abilities can often score well on. On this occasion, about a third of the candidates scored full marks and about another third scored 0, which can make quite a difference to the overall outcome for a candidate. Even though the actual constructions were within a context, many candidates were able to determine what was required and provide the necessary constructions with supporting arcs. There also appeared to be fewer instances of 'false' construction arcs being added to a line that had been drawn by eye. The perpendicular bisector of AB was constructed particularly well. The 'same distance from AB and BC' was less well understood as requiring an angle bisection. Those bisecting angle ABC usually did so correctly, but a significant number of candidates instead constructed the perpendicular bisector of BC. **Assessment for learning** Construction arcs are an essential part of the

					working. Some candidates appeared to either erase them or drew them very faintly. Candidates should be using a dark pencil for their constructions and only erase what they do not wish to be marked.
			Total	**5**	
38	a		125 Corresponding [angles]	2	**B1** for each Do not accept F [angles] Ignore irrelevant further comments **<u>Examiner's Comments</u>** Most candidates were able to score at least 1 mark in this part, usually for *a* = 125°. Many did give the correct reason of 'corresponding angles'. Common errors were to explain how they found the answer for angle a and not refer to the geometrical reason, or to give an incorrect geometrical reason such as alternate angles or co-interior angles.
	b		50	3	**M1** for 180 – 125 **soi** For M1, accept 55 marked on diagram in correct place[s] **M1** for 75 marked in correct place[s] inside triangle or used in correct calculation to find angle M1 for e.g. 180 – (180 – 125) –75 oe Do not award if incorrect angle e.g. 55 is also marked in a place where 75 should be **<u>Examiner's Comments</u>** Many were successful here and gave the answer 50°. Of those that didn't, they were often able to correctly identify the angle 55° or 75° in the correct position within the relevant triangle, usually marked on the diagram and credit was given for this. The most common error was to assume that the triangle is isosceles leading to an answer of 70° from 180° – 55° – 55°, or less

					often 30° from 180° – 75° – 75°. There were a few candidates that made arithmetic errors within an otherwise correct method. **Misconception** In problems involving angle calculations, always use the given information to find the missing angles. Do not assume properties of angles or shapes that are not given in the question, such as the triangle here being isosceles.	
			Total	**5**		
39			Angle AED = angle BEC and [vertically] opposite Angle DAE = angle EBC and same segment Angle ADE = angle ECB and same segment [Triangle AED is similar to triangle BEC] [corresponding] angles are equal oe or AAA oe OR After two pairs of angles with reasons gives 3rd pair of equal angles with a reason	M2 A1	For **M2** only two of the three statements and reasons are required **M1** for one pair of angles with a reason With no errors or incorrect statements seen If 0 scored, **SC1** for at least two correct pairs of angles	Allow any unambiguous labelling for angles e.g. DAE or DAC or A, but not E For reason accept e.g. opp ∠'s For same segment, accept same arc but not same chord Accept 3rd angle in triangle oe for reason with final angle if other two given correctly with correct reasons Accept they have the 'same/equal angles' oe, AA **and** similar. Accept symbol ~ for similar Condone angles identified on diagram for **SC1**

					identified with no / incorrect reasons **<u>Examiner's Comments</u>** This question proved challenging for all candidates and was omitted by a number of candidates. A few realised that finding equal pairs of angles was the strategy. More able candidates attempted to work systematically, line by line, giving a pair of angles with a reason. Angle AED = angle BEC with the reason, [vertically] opposite, earned partial credit for some candidates, but the majority were unable to give correct geometric reasons for the other equal pairs of angles. A number gave incorrect angle pairs, such as angle A = angle C, perhaps thinking they were alternate angles. Some also referred to lengths and gave reasons of congruency, such as SAS.
			Total	**3**	
40	a		53 alternate segment [theorem]	1 1	condone 'rule' for 'theorem' **<u>Examiner's Comments</u>** The correct answer of 53 was seen quite regularly, the alternative answer often seen was 49. Many candidates did not know the reason and a common response was 'alternating angles'.
	b		38 with correct working	5	**B1** for OGH = 52 **B1** for JHG = 26 **B2** for [OGJ =] 64 or **M1** for 180 − 52 [÷2] If **0** or **1** scored award **SC2** for answer 38 with no working or insufficient working "correct working" requires at least **B2** or **B1B1** angles may be on diagram Alt. 1: **B1** for JHG = 26

					Note: If answer is 38 and the working is incorrect only award the **B** marks.	**B1** for OJH = 26 **B2** for [OJG =] 64 Alt.2: **B1** for tangent at G **B1** for OGH = 52 **M2** for 90 − 52
					<u>Examiner's Comments</u> Many candidates gave the answer of 38 which came from 90 − 52 but this was only correct if they drew the tangent at G. Many assumed the angles where line JH intersects the line OG were right angles and also assumed angle OGJ was 52°. The other incorrect assumption was that triangle GHJ was isosceles and angle JGH was 104 from which they worked out $\frac{180-104}{2}$ Many correctly stated that angle OGH was 52° and some noticed that triangle OJG was isosceles and that angle OGJ was therefore 64°. The most difficult angle to see was that angle GHJ was half of 52. **Misconception** Angles that look like right angles were assumed to be right angles. Triangles that look isosceles may not be isosceles.	
			Total	**7**		
41			10 with correct working	6	**M2** for a correct method to find the interior angle of a pentagon e.g. $180 - \frac{360}{5}$ or $\frac{(5-2)\times 180}{5}$ or **M1** for partial method e.g. $\frac{360}{5}$ or (5 − 2) × 180 AND **M1** for 360 − 2 × *their* 108 AND	"correct working" requires at least **M1M1** or **M2** **M2** implied by 108 **M1** implied by 72 or 540 **M3** implied by 144 **M1** for (n − 2)180 = *their*144n oe and **M1** for a correct rearrangement e.g. 36n = 360

M2 for $\frac{360}{180 - \textit{their}144}$

or **M1** for 180−*their* 144

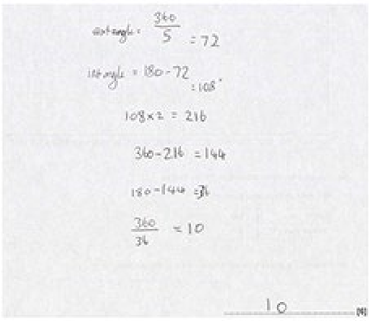
If **0**, **1** or **2** scored, instead award **SC3** for answer 10 with no working or insufficient working

Alternative method as the third angle is the sum of the two exteriors of the pentagons
M3 for $2 \times \frac{360}{5}$ [= 144] or **M1** for $\frac{360}{5}$ and
M2 for $\frac{360}{360 - \textit{their}144 - 180}$ oe or
M1 for 360 − *their* 144 − 180 oe

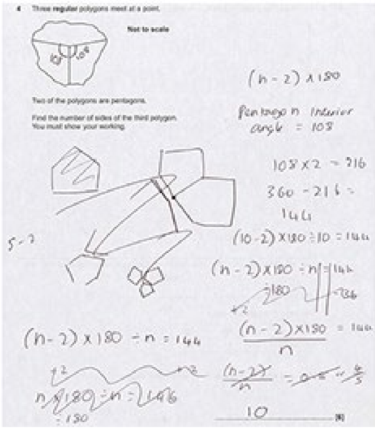
Examiner's Comments

The first error was that some candidates thought that a pentagon had either 6 or 8 sides. There are two distinct methods to find the internal angle of a polygon. The first method involves using the formula for the angle sum, $\frac{(n-2) \times 180}{n}$ However this is very cumbersome to use when you have the angle and you need to find the number of sides. The other method involves finding the external angle first and in one step it is $\frac{180-104}{2}$ Most candidates, using either method, found the internal angle of their pentagon correctly and most of these found the third angle round the point. However some candidates did not know how to find the number of sides from the internal angle of the third polygon. In this question the working was not always easy to follow.

Exemplar 1



The method is logical and easy to follow. The first two steps are labelled "ext. angle" and "int. angle". They find the number of sides by reversing the first two steps. This demonstrates that, in this question, this method proved to be easier than the other method as demonstrated in Exemplar 2.

					Exemplar 2  This response uses the formula to find the internal angle from the angle sum and it is more difficult to follow. Top right is the angle sum formula and to the left is 5 − 2 which shows substitution of n = 5. Just below top right is the internal angle of a regular pentagon and below that the third angle round the point. They find it difficult to use this formula to find the number of sides and, in the middle right, they appear to guess n = 10 and they check it. However this is sufficient working to gain full marks and we can just follow it.
			Total	**6**	
42	a		Ruled bisector of angle ABC to reach CD with construction arcs	2	**B1** for correct ruled bisector at least 2cm long by eye with no construction arcs or correct construction arcs with no/wrong bisector drawn Tolerance ±2° Construction arcs on AB and on BC and two intersecting arcs from these **Examiner's Comments** Many candidates did not interpret "the same distance from side AB and side BC" as requiring the bisection of angle B.
	b		Arc, centre C, radius 5 cm, intersecting *their* line twice or intersecting BC and CD or two points marked on *their* line that are 5 cm from C Locus of line within arc from C rad indicated	2 1dep	**B1** for any arc, centre C, intersecting *their* line at least once or intersecting BC or CD or short arc (at least 1 Tolerance 4.8 – 5.2 cm Max **B1** for freehand, all within template

					cm), centre C, radius 5 cm **Dep** on at least **B1** in (a) and **B1** in (b) **<u>Examiner's Comments</u>** In this part, the bench was to be placed on the path, represented by the angle bisector. Most candidates who produced the correct constructions in (a) and (b) then shaded a region rather than indicating part of the line.	
			Total	**5**		
43	a		<u>Using interior angles:</u> ((10 – 2) × 180) ÷ 10 or 1440 ÷ 10 seen [Int angle of triangle =] 60 in working 360 – (144 + 60) oe [= 156]	1 1 1	<u>Using exterior angles:</u> 360 ÷ 10 seen [Ext angle of triangle =] 120 in working 36 + 120 [= 156] <u>Alternative method:</u> **1** for 360 ÷ 10 seen **1** for [Int angle of triangle =] 60 in working **1** for 180 – (60 – 36) [= 156] If **0** scored **SC1** for 24, 36, 60, 120 or 144 shown in correct place on diagram **<u>Examiner's Comments</u>** **AfL** Candidates were required to show that an angle marked on a diagram was 156˚. In a "show" question, it is important that the candidate convinces the examiner that they can demonstrate each step and are not working backwards from the given answer. Obtaining 144	Mark the working. Mark angles on diagram only if 0 scored. Working backwards from 156 to 144 [to 10 sides] scores 0

					from 360 – 156 – 60, and then using 144 to obtain 156, is not acceptable. Instead, 144 should be seen to be derived, for example from $\frac{(10-2)\times 180}{10}$. The "show" can then be completed by 144 + 60 = 204 and 360 – 204 = 156, or equivalents.	
	b		15	2	**M1** for [*n* =] $[n=]\frac{360}{180-156}$ or $\frac{180(n-2)}{n}=156$ = 156	
			Total	**5**		
44			44 with correct working	5	**B3** for angle BCD = 110 with correct working or **M1** for angle BAD = 70 or for angle BDE = 180 – 70 or 110 **M1** for angle BCD = 180 – *their* angle BAD AND **M2** for *their* angle BCD ÷ 5 × 2 **oe** or **M1** for *their* angle BCD ÷ 5 **oe** If 0 scored **SC2** for answer 44 or **SC1** for angle BCD = 110	For full marks "correct working" requires evidence of at least M1 AND M1 ie at least a correct angle and some ratio work Ignore geometric reasons if given For B3 "correct working" requires at least M1 or alternate convincing approach Angles may be indicated on diagram for part marks May be seen on diagram
			Total	**5**		
45			complete correct argument e.g. angle ABC = 40° [BO =] e.g. $\frac{6}{\sin 20}$ 17.542… or 17.543	B1 M2 A1dep	**M1** for e.g sin 20 = $\frac{6}{[BO]}$ **dep**. on at least **M1**	accept any correct method not using 17.54 could be on diagram and also accept ABO = 20°, BO'T' = 70° i.e BO as subject for **M2** and condone sine

					rule with sin 90° for **M2**
			Total	**4**	