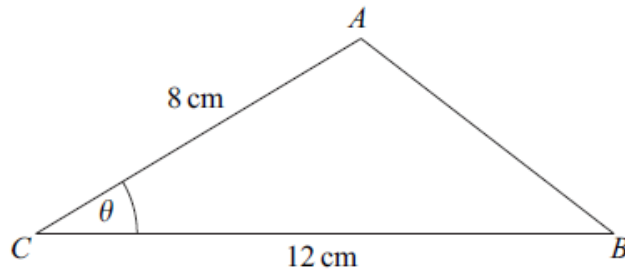


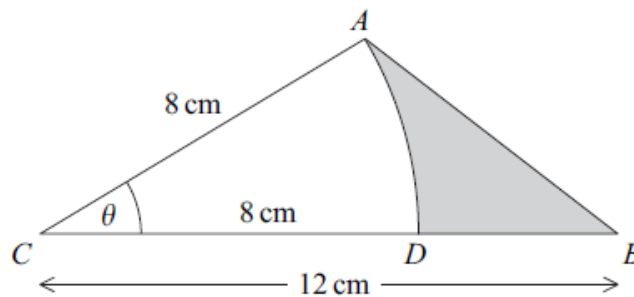
## Trigonometry Questions

- 4 The triangle  $ABC$ , shown in the diagram, is such that  $AC = 8$  cm,  $CB = 12$  cm and angle  $ACB = \theta$  radians.



The area of triangle  $ABC = 20$  cm<sup>2</sup>.

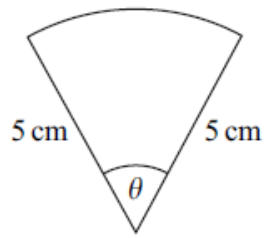
- (a) Show that  $\theta = 0.430$  correct to three significant figures. (3 marks)
- (b) Use the cosine rule to calculate the length of  $AB$ , giving your answer to two significant figures. (3 marks)
- (c) The point  $D$  lies on  $CB$  such that  $AD$  is an arc of a circle centre  $C$  and radius 8 cm. The region bounded by the arc  $AD$  and the straight lines  $DB$  and  $AB$  is shaded in the diagram.



Calculate, to two significant figures:

- (i) the length of the arc  $AD$ ; (2 marks)
- (ii) the area of the shaded region. (3 marks)
-

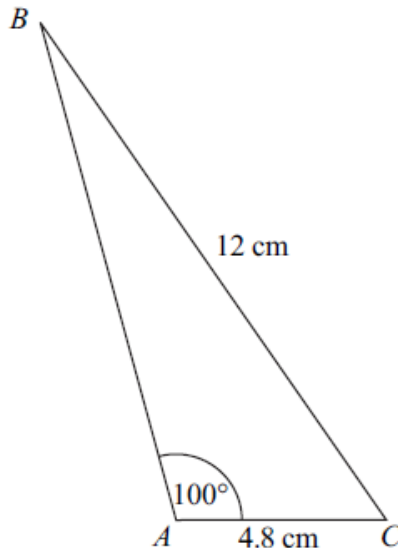
- 1 The diagram shows a sector of a circle of radius 5 cm and angle  $\theta$  radians.



The area of the sector is  $8.1 \text{ cm}^2$ .

- (a) Show that  $\theta = 0.648$ . (2 marks)
- (b) Find the perimeter of the sector. (3 marks)
- 

- 2 The diagram shows a triangle  $ABC$ .

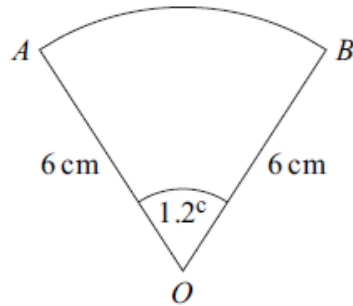


The lengths of  $AC$  and  $BC$  are 4.8 cm and 12 cm respectively.

The size of the angle  $BAC$  is  $100^\circ$ .

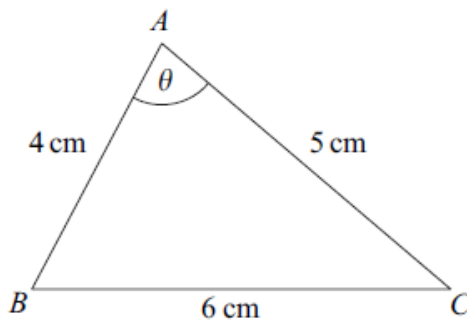
- (a) Show that angle  $ABC = 23.2^\circ$ , correct to the nearest  $0.1^\circ$ . (3 marks)
- (b) Calculate the area of triangle  $ABC$ , giving your answer in  $\text{cm}^2$  to three significant figures. (3 marks)
-

- 1 The diagram shows a sector  $OAB$  of a circle with centre  $O$ .



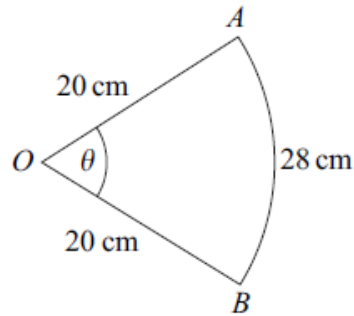
The radius of the circle is 6 cm and the angle  $AOB$  is 1.2 radians.

- (a) Find the area of the sector  $OAB$ . (2 marks)
- (b) Find the perimeter of the sector  $OAB$ . (3 marks)
- 
- 4 The triangle  $ABC$ , shown in the diagram, is such that  $BC = 6$  cm,  $AC = 5$  cm and  $AB = 4$  cm. The angle  $BAC$  is  $\theta$ .



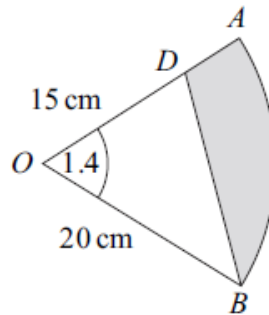
- (a) Use the cosine rule to show that  $\cos \theta = \frac{1}{8}$ . (3 marks)
- (b) Hence use a trigonometrical identity to show that  $\sin \theta = \frac{3\sqrt{7}}{8}$ . (3 marks)
- (c) Hence find the area of the triangle  $ABC$ . (2 marks)
-

- 3 The diagram shows a sector  $OAB$  of a circle with centre  $O$  and radius 20 cm. The angle between the radii  $OA$  and  $OB$  is  $\theta$  radians.



The length of the arc  $AB$  is 28 cm.

- (a) Show that  $\theta = 1.4$ . (2 marks)
- (b) Find the area of the sector  $OAB$ . (2 marks)
- (c) The point  $D$  lies on  $OA$ . The region bounded by the line  $BD$ , the line  $DA$  and the arc  $AB$  is shaded.



The length of  $OD$  is 15 cm.

- (i) Find the area of the shaded region, giving your answer to three significant figures. (3 marks)
- (ii) Use the cosine rule to calculate the length of  $BD$ , giving your answer to three significant figures. (3 marks)

## Trigonometry Answers

4(a)	Area of triangle = $\frac{1}{2}(12)(8)\sin\theta$	M1	3	Use of $\frac{1}{2}ab\sin C$ or full equivalent
	$\sin\theta = \frac{20}{48}$ [=0.41(666...)]	A1		OE (giving 0.412 to 0.42)
	$\Rightarrow \theta = 0.4297(7\dots) = 0.430$ to 3sf	A1		AG(need to see >3sf value)
(b)	$\{AB^2 =\}8^2 + 12^2 - 2 \times 8 \times 12 \times \cos\theta$	M1	3	Accept 33 to 34 inclusive if three values not separate If not 2sf condone 5.78 to 5.79 inclusive. Condone $\pm$
	$= 64 + 144 - 174.5\dots$	m1		
	$\Rightarrow AB = 5.78\dots = 5.8$ cm to 2sf	A1		
(c)(i)	Arc $AD = 8\theta$ ;	M1;	2	If not 2sf condone 3.438 to 3.44 inclusive
	$= 3.44\dots = 3.4$ cm to 2sf	A1		
(ii)	Area of sector = $\frac{1}{2}r^2\theta$	M1	3	Stated or used [or 13.7(6.) seen] Difference of areas
	Shaded area = Area of triangle – sector area	M1		
	Shaded area = $20 - 0.5 \times 8^2 \times \theta$	A1		Condone 6.24 to 6.2472
	$= 6.2$ cm <sup>2</sup> to 2sf			
<b>Total</b>			<b>11</b>	

1(a)	Area of sector = $\frac{1}{2}r^2\theta = \frac{1}{2} \times 5^2 \times \theta$	M1	2	$\frac{1}{2}r^2\theta$ seen or used AG Condone $\theta = 0.648$ used to show that area = 8.1
	$12.5\theta = 8.1 \Rightarrow \theta = 0.648$	A1		
(b)	Arc = $5\theta$ ;	M1	3	$5\theta$ PI by a correct perimeter CSO Condone missing/wrong units; condone 3sf i.e. 13.2 if no obvious error NMS 3/3
	$\dots = 3.24$ cm	A1		
	$\Rightarrow$ Perimeter = $10 + \text{arc} = 13.24$ cm	A1✓		
<b>Total</b>			<b>5</b>	

2(a)	$\frac{\sin B}{4.8} = \frac{\sin 100}{12}$	M1	3	Use of the sine rule
	$\sin B = \frac{4.8\sin 100}{12}$ [= 0.39(392...)]	m1		Rearrangement
	(angle $ABC$ ) = $23.19(8\dots)$ {= $23.2^\circ$ .}	A1		AG Need >1dp eg 23.19 or 23.20
(b)	Angle $C = 80^\circ - 23.2^\circ = 56.8^\circ$	M1	3	Valid method to find a relevant angle eg $C$ (PI eg by correct $\sin C$ ) or $23.2^\circ + 10^\circ$
	Area of triangle = $0.5 \times 12 \times 4.8 \times \sin C$	M1		OE eg $0.5 \times 4.8 \times 12 \times \cos(B+10)$
	$\dots = 24.09\dots = 24.1$ cm <sup>2</sup> . (to 3sf)	A1		Condone missing/wrong units
<b>Total</b>			<b>6</b>	

1(a)	{Area of sector =} $\frac{1}{2}r^2\theta$ $= 0.5 \times 36 \times 1.2 = 21.6 \text{ cm}^2$	M1 A1	2	Condone missing/wrong units throughout the paper
(b)	Arc = $r\theta$ $= 6 \times 1.2 = 7.2$ Perimeter = $12 + 7.2 = 19.2 \text{ cm}$	M1 A1 A1ft	3	
<b>Total</b>			<b>5</b>	

4(a)	$6^2 = 4^2 + 5^2 - 2(4)(5) \cos \theta$ $\cos \theta = \frac{4^2 + 5^2 - 6^2}{2(4)(5)}$ $\cos \theta = \frac{5}{40} = \frac{1}{8}$	M1 m1 A1	3	Use of the cosine rule Rearrangement CSO AG (be convinced)
(b)	$\cos^2 \theta + \sin^2 \theta = 1$ $\sin^2 \theta = \frac{63}{64}$ $\sin \theta = \frac{\sqrt{63}}{8} = \frac{\sqrt{9 \times 7}}{8} = \frac{3\sqrt{7}}{8}$	M1 A1 A1	3	Stated or used (PI) Or better AG (be convinced)
(c)	Area of triangle = $0.5 \times 4 \times 5 \times \sin \theta$ . ..... = $\frac{30\sqrt{7}}{8} \text{ cm}^2$ .	M1 A1	2	OE (Condone 9.92)
<b>Total</b>			<b>8</b>	

3(a)	Arc = $r\theta$ $28 = 20\theta \Rightarrow \theta = 1.4$	M1 A1	2	For $r\theta$ or $20\theta$ or PI by $20 \times 1.4$ AG
(b)	Area of sector = $\frac{1}{2}r^2\theta$ $= \frac{1}{2}20^2(1.4) = 280 \text{ (cm}^2\text{)}$	M1 A1	2	$\frac{1}{2}r^2\theta$ OE seen Condone absent $\text{cm}^2$ .
(c)(i)	Area triangle = $\frac{1}{2} \times 15 \times 20 \times \sin 1.4$ (= 147.8....) Shaded area = Area of sector – area of triangle $= 280 - 147.8 = 132 \text{ (cm}^2\text{)} \text{ (3sf)}$	M1 M1 A1ft	3	Use of $\frac{1}{2}ab \sin C$ OE Ft on [ans (b) – 147.8...] to 3sf provided [...] > 0
(ii)	{ $BD^2 =$ } $15^2 + 20^2 - 2 \times 15 \times 20 \cos 1.4$ $= 225 + 400 - 101.98...$ $\Rightarrow BD = \sqrt{523.019...} = 22.86..$ $= 22.9 \text{ (cm)} \text{ to 3 sf}$	M1 m1 A1	3	RHS of cosine rule used Correct order of evaluation Condone absent cm
<b>Total</b>			<b>10</b>	