

# OCR Core Maths 3

## Past paper questions Radian Measures

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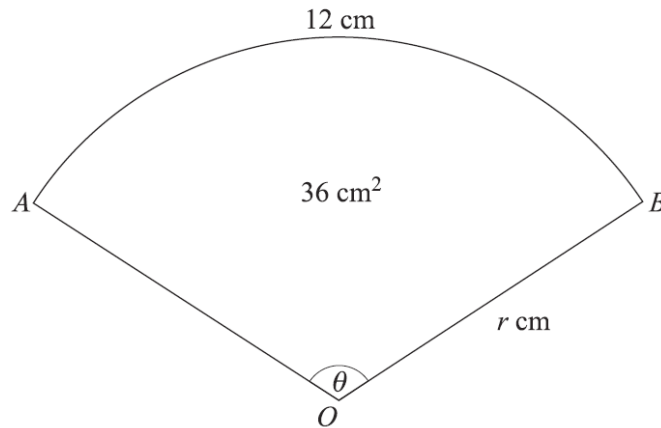
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## Radians

- There are (by definition)  $2\pi$  radians in a circle. So  $360^\circ = 2\pi$ . To convert from degrees to radians we use the conversion factor of  $\frac{\pi}{180}$ . For example to convert  $45^\circ$  to radians we calculate  $45 \times \frac{\pi}{180} = \frac{\pi}{4}$  rad. From radians to degrees we use its reciprocal  $\frac{180}{\pi}$ .
- *When using radians* the formulae for arc length and area of a sector of a circle become simpler. They are  $s = r\theta$  and  $A = \frac{1}{2}r^2\theta$ .

1.

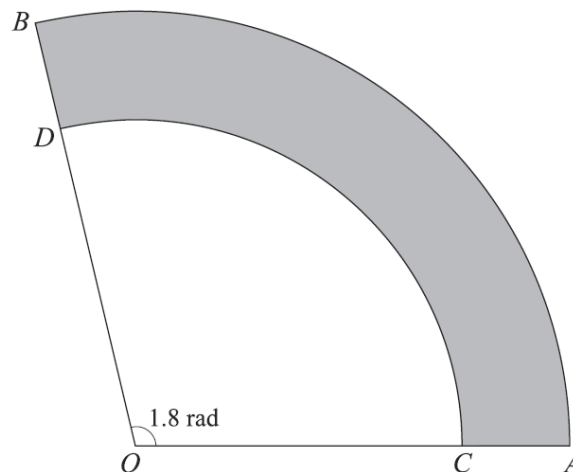


A sector  $OAB$  of a circle of radius  $r$  cm has angle  $\theta$  radians. The length of the arc of the sector is 12 cm and the area of the sector is  $36 \text{ cm}^2$  (see diagram).

- (i) Write down two equations involving  $r$  and  $\theta$ . [2]
- (ii) Hence show that  $r = 6$ , and state the value of  $\theta$ . [2]
- (iii) Find the area of the segment bounded by the arc  $AB$  and the chord  $AB$ . [3]

**Q2 June 2005**

2.

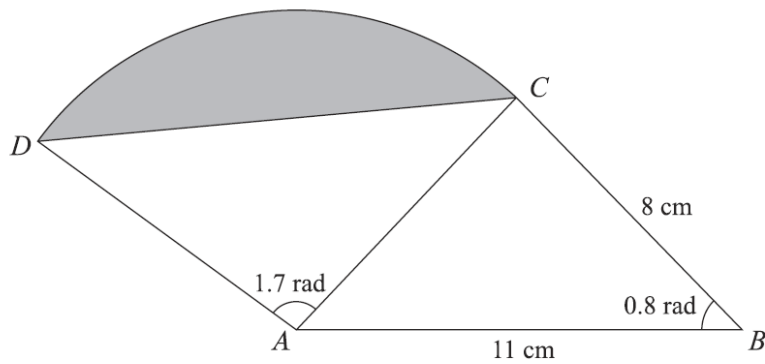


The diagram shows a sector  $OAB$  of a circle with centre  $O$ . The angle  $AOB$  is 1.8 radians. The points  $C$  and  $D$  lie on  $OA$  and  $OB$  respectively. It is given that  $OA = OB = 20$  cm and  $OC = OD = 15$  cm. The shaded region is bounded by the arcs  $AB$  and  $CD$  and by the lines  $CA$  and  $DB$ .

- (i) Find the perimeter of the shaded region. [3]
- (ii) Find the area of the shaded region. [3]

**Q4 Jan 2006**

3.

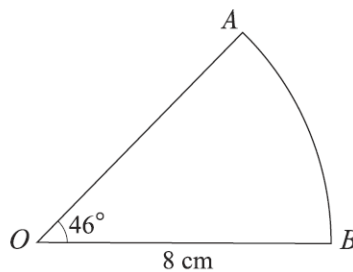


The diagram shows a triangle  $ABC$ , and a sector  $ACD$  of a circle with centre  $A$ . It is given that  $AB = 11$  cm,  $BC = 8$  cm, angle  $ABC = 0.8$  radians and angle  $DAC = 1.7$  radians. The shaded segment is bounded by the line  $DC$  and the arc  $DC$ .

- (i) Show that the length of  $AC$  is 7.90 cm, correct to 3 significant figures. [3]
- (ii) Find the area of the shaded segment. [3]
- (iii) Find the perimeter of the shaded segment. [4]

**Q7 June 2006**

4.

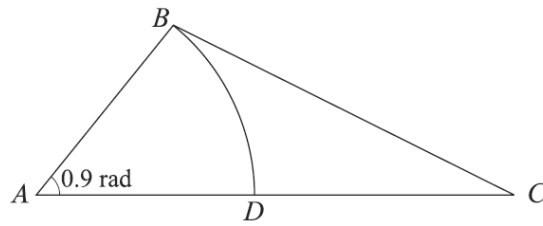


The diagram shows a sector  $OAB$  of a circle, centre  $O$  and radius 8 cm. The angle  $AOB$  is  $46^\circ$ .

- (i) Express  $46^\circ$  in radians, correct to 3 significant figures. [2]
- (ii) Find the length of the arc  $AB$ . [1]
- (iii) Find the area of the sector  $OAB$ . [2]

**Q2 Jan 2007**

5.

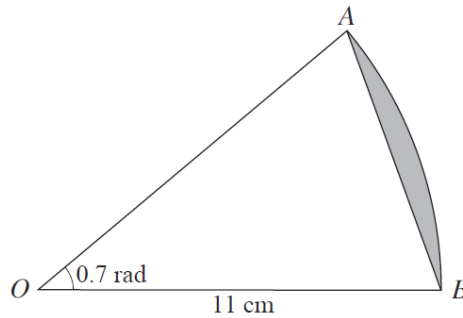


The diagram shows a triangle  $ABC$ , where angle  $BAC$  is  $0.9$  radians.  $BAD$  is a sector of the circle with centre  $A$  and radius  $AB$ .

- (i) The area of the sector  $BAD$  is  $16.2 \text{ cm}^2$ . Show that the length of  $AB$  is  $6 \text{ cm}$ . [2]
- (ii) The area of triangle  $ABC$  is twice the area of sector  $BAD$ . Find the length of  $AC$ . [3]
- (iii) Find the perimeter of the region  $BCD$ . [6]

**Q8 June 2007**

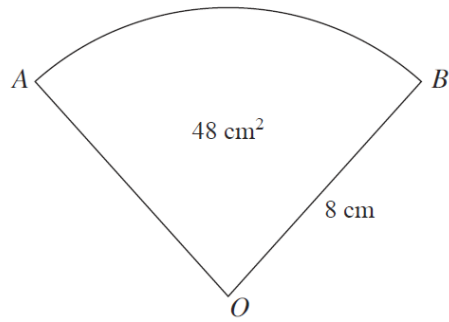
6.



The diagram shows a sector  $AOB$  of a circle with centre  $O$  and radius  $11 \text{ cm}$ . The angle  $AOB$  is  $0.7$  radians. Find the area of the segment shaded in the diagram. [4]

**Q1 Jan 2008**

7.

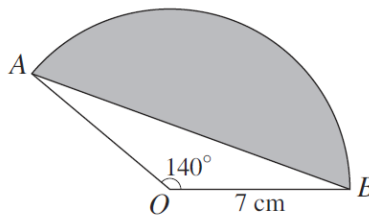


The diagram shows a sector  $AOB$  of a circle with centre  $O$  and radius 8 cm. The area of the sector is  $48 \text{ cm}^2$ .

- (i) Find angle  $AOB$ , giving your answer in radians. [2]
- (ii) Find the area of the segment bounded by the arc  $AB$  and the chord  $AB$ . [3]

**Q3 June 2008**

8.

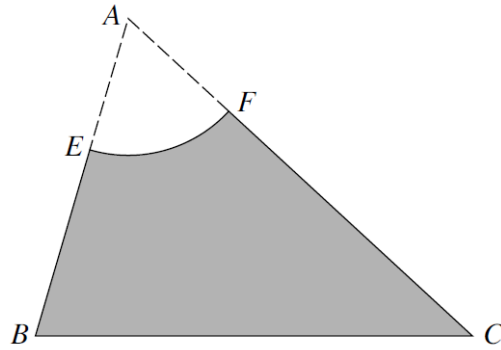


The diagram shows a sector  $OAB$  of a circle, centre  $O$  and radius 7 cm. The angle  $AOB$  is  $140^\circ$ .

- (i) Express  $140^\circ$  in radians, giving your answer in an exact form as simply as possible. [2]
- (ii) Find the perimeter of the segment shaded in the diagram, giving your answer correct to 3 significant figures. [4]

**Q2 Jan 2009**

9.



The diagram shows triangle  $ABC$ , with  $AB = 10$  cm,  $BC = 13$  cm and  $CA = 14$  cm.  $E$  and  $F$  are points on  $AB$  and  $AC$  respectively such that  $AE = AF = 4$  cm. The sector  $AEF$  of a circle with centre  $A$  is removed to leave the shaded region  $EBCF$ .

- (i) Show that angle  $CAB$  is 1.10 radians, correct to 3 significant figures. [2]
- (ii) Find the perimeter of the shaded region  $EBCF$ . [3]
- (iii) Find the area of the shaded region  $EBCF$ . [5]

**Q7 Jan 2010**

10.

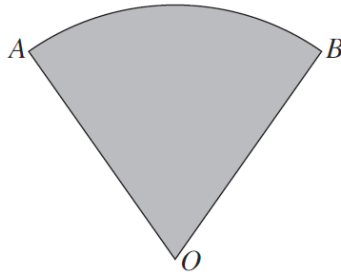


Fig. 1

Fig. 1 shows a sector  $AOB$  of a circle, centre  $O$  and radius  $OA$ . The angle  $AOB$  is 1.2 radians and the area of the sector is  $60 \text{ cm}^2$ .

- (i) Find the perimeter of the sector. [4]

A pattern on a T-shirt, the start of which is shown in Fig. 2, consists of a sequence of similar sectors. The first sector in the pattern is sector  $AOB$  from Fig. 1, and the area of each successive sector is  $\frac{3}{5}$  of the area of the previous one.

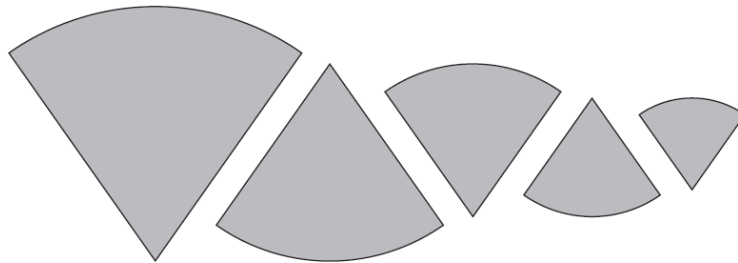


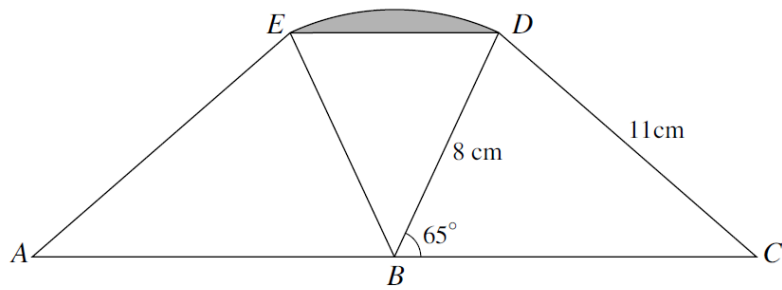
Fig. 2

- (ii) (a) Find the area of the fifth sector in the pattern. [2]  
(b) Find the total area of the first ten sectors in the pattern. [2]  
(c) Explain why the total area will never exceed a certain limit, no matter how many sectors are used, and state the value of this limit. [3]

Q8 June 2009



11.

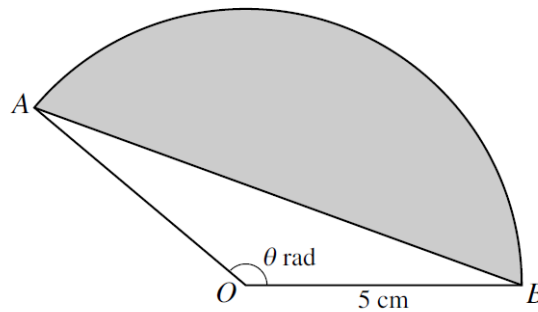


The diagram shows two congruent triangles,  $BCD$  and  $BAE$ , where  $ABC$  is a straight line. In triangle  $BCD$ ,  $BD = 8$  cm,  $CD = 11$  cm and angle  $CBD = 65^\circ$ . The points  $E$  and  $D$  are joined by an arc of a circle with centre  $B$  and radius 8 cm.

- (i) Find angle  $BCD$ . [2]
- (ii) (a) Show that angle  $EBD$  is 0.873 radians, correct to 3 significant figures. [2]
- (b) Hence find the area of the shaded segment bounded by the chord  $ED$  and the arc  $ED$ , giving your answer correct to 3 significant figures. [4]

**Q5 June 2010**

12.



The diagram shows a sector  $AOB$  of a circle with centre  $O$  and radius 5 cm. Angle  $AOB$  is  $\theta$  radians. The area of triangle  $AOB$  is  $8 \text{ cm}^2$ .

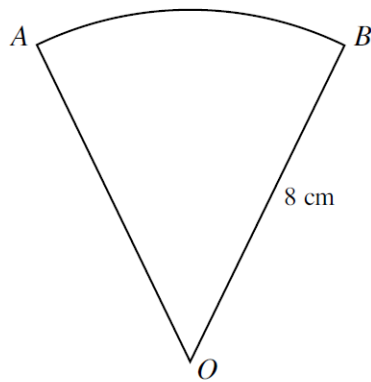
- (i) Given that the angle  $\theta$  is obtuse, find  $\theta$ . [3]

The shaded segment in the diagram is bounded by the chord  $AB$  and the arc  $AB$ .

- (ii) Find the area of the segment, giving your answer correct to 3 significant figures. [3]
- (iii) Find the perimeter of the segment, giving your answer correct to 3 significant figures. [4]

**Q8 Jan 2011**

13.



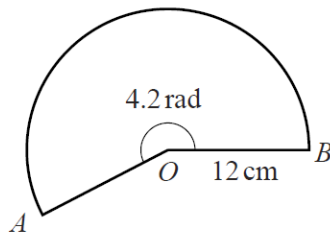
The diagram shows a sector  $AOB$  of a circle, centre  $O$  and radius 8 cm. The perimeter of the sector is 23.2 cm.

(i) Find angle  $AOB$  in radians. [3]

(ii) Find the area of the sector. [2]

**Q3 June 2011**

14.



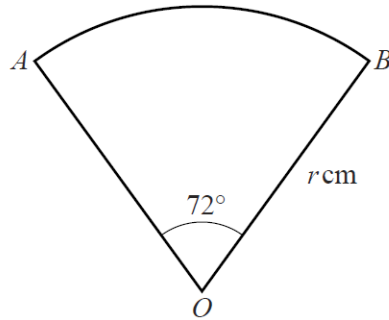
The diagram shows a sector  $AOB$  of a circle with centre  $O$  and radius 12 cm. The reflex angle  $AOB$  is 4.2 radians.

(i) Find the perimeter of the sector. [3]

(ii) Find the area of the sector. [2]

**Q1 Jan 2012**

15.



The diagram shows a sector  $AOB$  of a circle, centre  $O$  and radius  $r$  cm. Angle  $AOB$  is  $72^\circ$ .

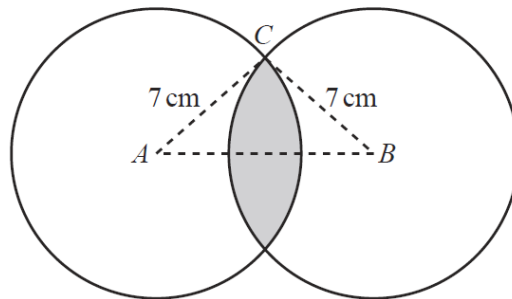
- (i) Express  $72^\circ$  exactly in radians, simplifying your answer. [1]

The area of the sector  $AOB$  is  $45\pi$  cm<sup>2</sup>.

- (ii) Find the value of  $r$ . [2]
- (iii) Find the area of the segment bounded by the arc  $AB$  and the chord  $AB$ , giving your answer correct to 3 significant figures. [3]

**Q3 June 2012**

16.

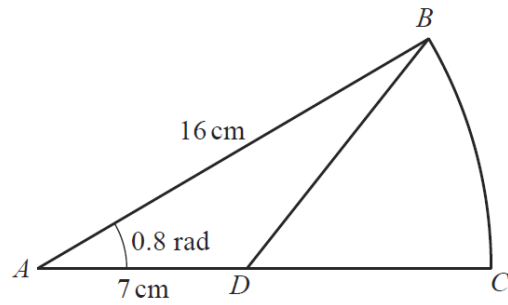


The diagram shows two circles of radius 7 cm with centres  $A$  and  $B$ . The distance  $AB$  is 12 cm and the point  $C$  lies on both circles. The region common to both circles is shaded.

- (i) Show that angle  $CAB$  is 0.5411 radians, correct to 4 significant figures. [2]
- (ii) Find the perimeter of the shaded region. [2]
- (iii) Find the area of the shaded region. [5]

**Q7 Jan 2013**

17.

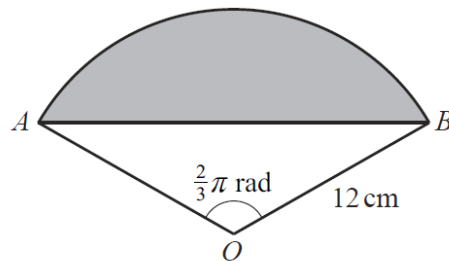


The diagram shows a sector  $BAC$  of a circle with centre  $A$  and radius 16 cm. The angle  $BAC$  is 0.8 radians. The length  $AD$  is 7 cm.

- (i) Find the area of the region  $BDC$ . [4]
- (ii) Find the perimeter of the region  $BDC$ . [4]

**Q5 June 2013**

18.

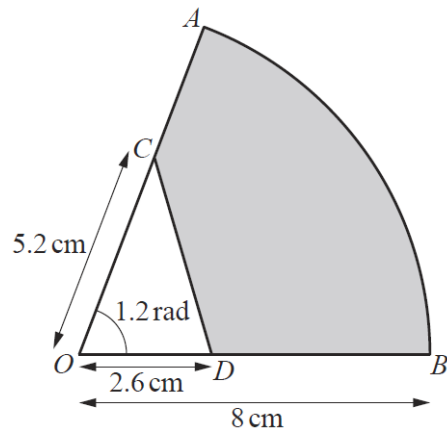


The diagram shows a sector  $OAB$  of a circle, centre  $O$  and radius 12 cm. The angle  $AOB$  is  $\frac{2}{3}\pi$  radians.

- (i) Find the exact length of the arc  $AB$ . [2]
- (ii) Find the exact area of the shaded segment enclosed by the arc  $AB$  and the chord  $AB$ . [5]

**Q3 June 2014**

19.



The diagram shows a sector  $AOB$  of a circle with centre  $O$  and radius  $8$  cm. The angle  $AOB$  is  $1.2$  radians. The points  $C$  and  $D$  lie on  $OA$  and  $OB$  respectively such that  $OC = 5.2$  cm and  $OD = 2.6$  cm.  $CD$  is a straight line.

(i) Find the area of the shaded region  $ACDB$ . [4]

(ii) Find the perimeter of the shaded region  $ACDB$ . [5]

**Q3 June 2015**