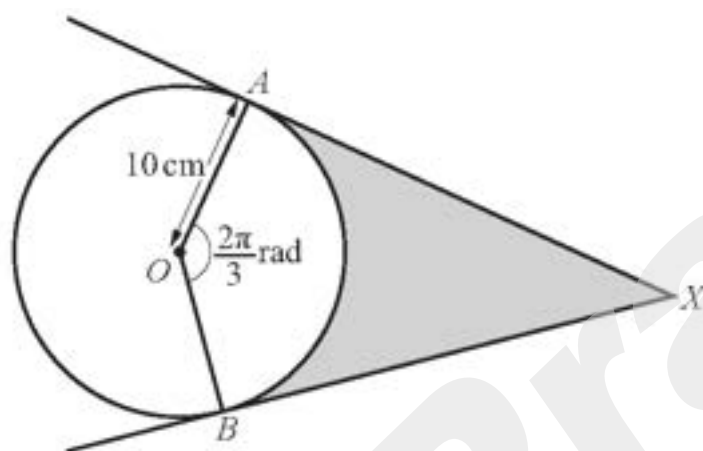


**Circular measure**

(Past Year Topical Questions 2012-2017)

May/June 2012 (12)

8.



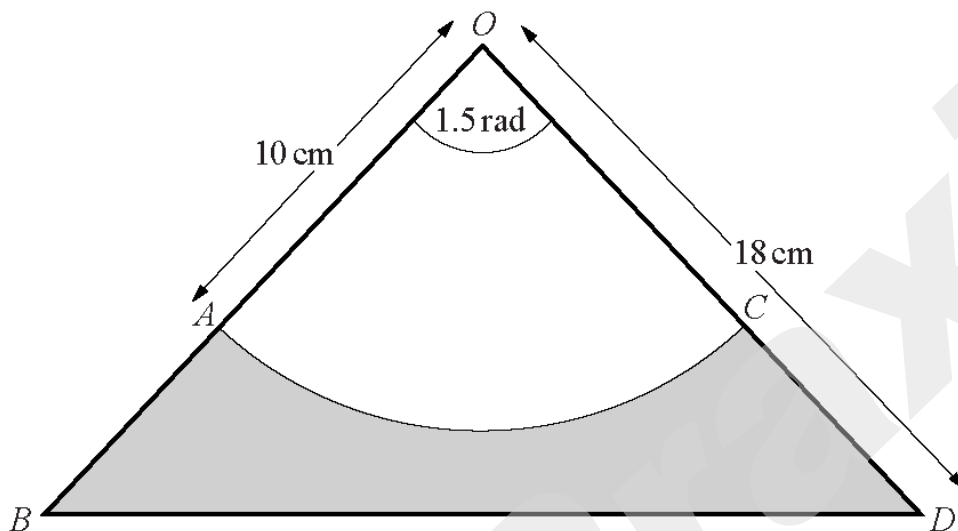
The figure shows a circle, centre  $O$ , with radius  $10$  cm. The lines  $XA$  and  $XB$  are tangents to the circle at  $A$  and  $B$  respectively, and angle  $AOB$  is  $\frac{2\pi}{3}$  radians.

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

(ii) Find the area of the shaded region. [4]

Oct/Nov 2012 (12)

8.



The diagram shows an isosceles triangle  $OBD$  in which  $OB = OD = 18$  cm and angle  $BOD = 1.5$  radians. An arc of the circle, centre  $O$  and radius  $10$  cm, meets  $OB$  at  $A$  and  $OD$  at  $C$ .

(i) Find the area of the shaded region.

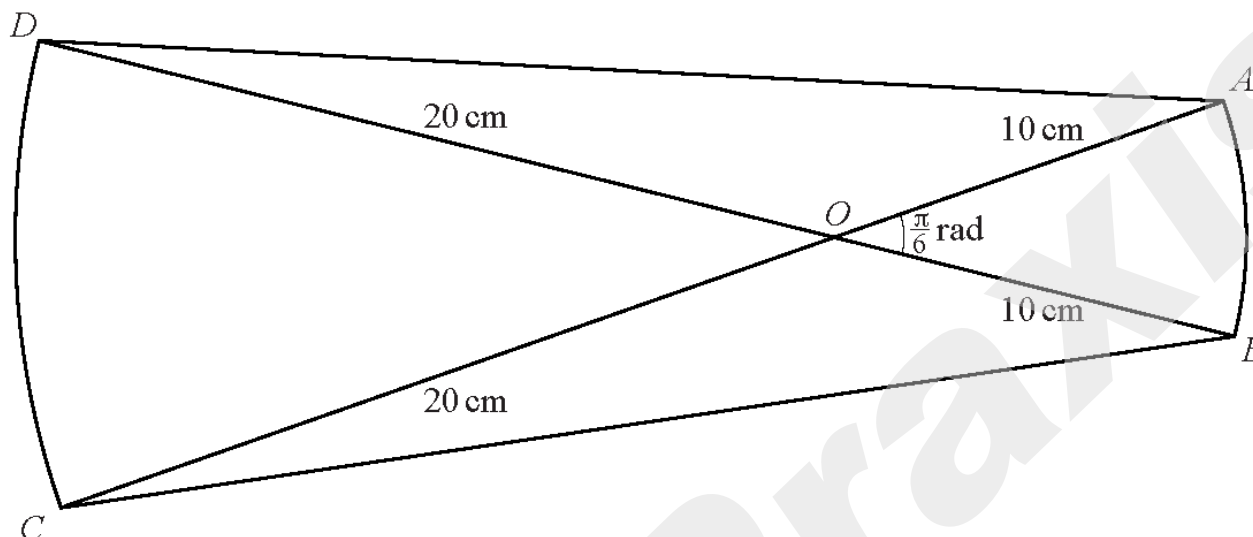
[3]

(ii) Find the perimeter of the shaded region.

[4]

Oct/Nov 2012 (13)

9.

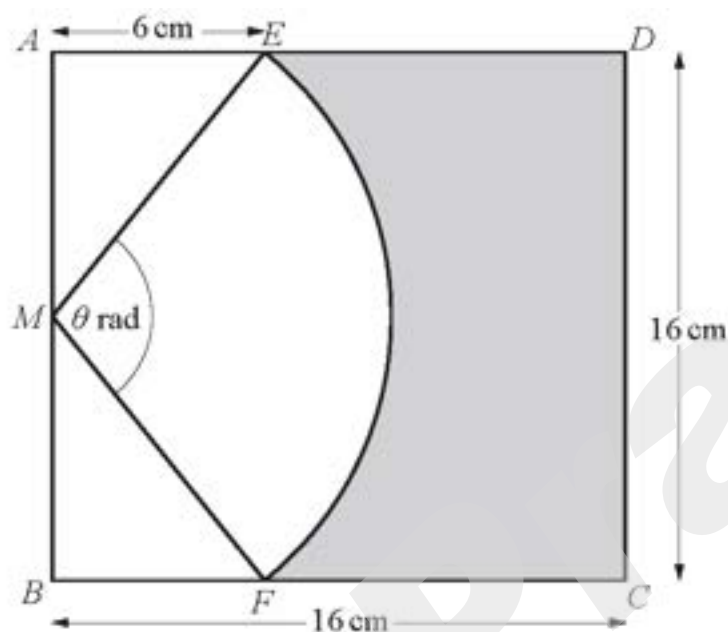


The diagram shows four straight lines,  $AD$ ,  $BC$ ,  $AC$  and  $BD$ . Lines  $AC$  and  $BD$  intersect at  $O$  such that angle  $AOB$  is  $\frac{\pi}{6}$  radians.  $AB$  is an arc of the circle, centre  $O$  and radius 10 cm, and  $CD$  is an arc of the circle, centre  $O$  and radius 20 cm.

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

May/June 2013 (11)

8.



The diagram shows a square  $ABCD$  of side  $16\text{ cm}$ .  $M$  is the mid-point of  $AB$ . The points  $E$  and  $F$  are on  $AD$  and  $BC$  respectively such that  $AE = BF = 6\text{ cm}$ .  $EF$  is an arc of the circle centre  $M$ , such that angle  $EMF$  is  $\theta$  radians.

(i) Show that  $\theta = 1.855$  radians, correct to 3 decimal places. [2]

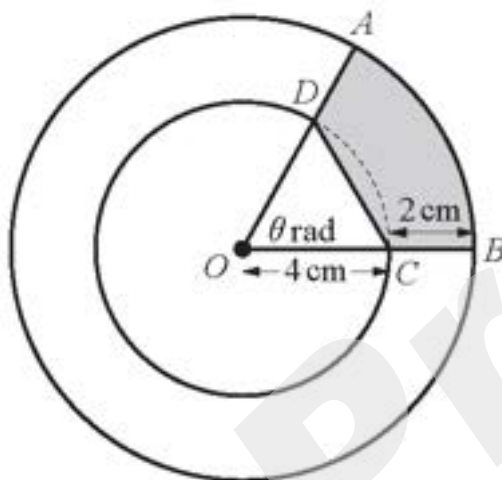
(ii) Calculate the perimeter of the shaded region. [4]

(iii) Calculate the area of the shaded region. [3]

Oct/Nov 2013 (13)

8.

The diagram shows two concentric circles, centre  $O$ , radii 4 cm and 6 cm. The points  $A$  and  $B$  lie on the larger circle and the points  $C$  and  $D$  lie on the smaller circle such that  $ODA$  and  $OCB$  are straight lines.



- (i) Given that the area of triangle  $OCD$  is  $7.5 \text{ cm}^2$ , show that  $\theta = 1.215$  radians, to 3 decimal places. [2]

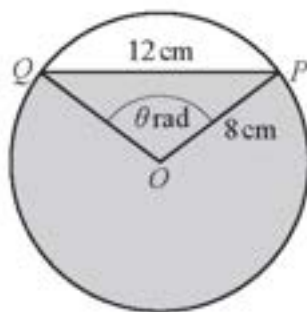
- (ii) Find the perimeter of the shaded region. [4]

- (iii) Find the area of the shaded region. [3]

May/June 2014 (12)

7.

The diagram shows a circle, centre  $O$ , radius 8 cm. Points  $P$  and  $Q$  lie on the circle such that the chord  $PQ = 12$  cm and angle  $POQ = \theta$  radians.



(i) Show that  $\theta = 1.696$ , correct to 3 decimal places.

[2]

(ii) Find the perimeter of the shaded region.

[3]

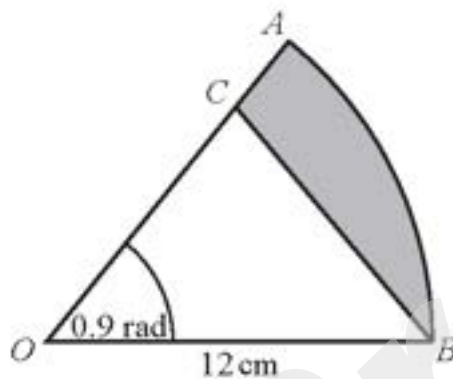
(iii) Find the area of the shaded region.

[3]

Oct/Nov 2014 (13)

6.

The diagram shows a sector,  $AOB$ , of a circle centre  $O$ , radius 12 cm. Angle  $AOB = 0.9$  radians. The point  $C$  lies on  $OA$  such that  $OC = CB$ .



(i) Show that  $OC = 9.65$  cm correct to 3 significant figures.

[2]

(ii) Find the perimeter of the shaded region.

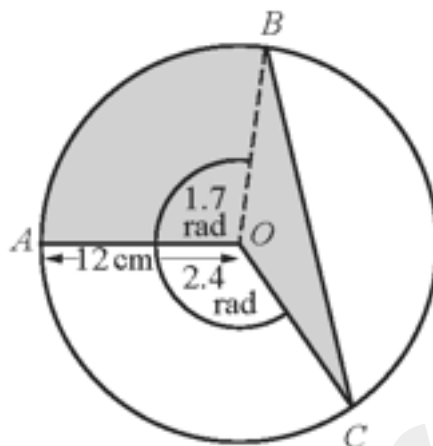
[3]

(iii) Find the area of the shaded region.

[3]

May/June 2015 (12)

4.



The diagram shows a circle, centre  $O$ , radius  $12\text{ cm}$ . The points  $A$ ,  $B$  and  $C$  lie on the circumference of this circle such that angle  $AOB$  is  $1.7$  radians and angle  $AOC$  is  $2.4$  radians.

(i) Find the area of the shaded region.

[4]

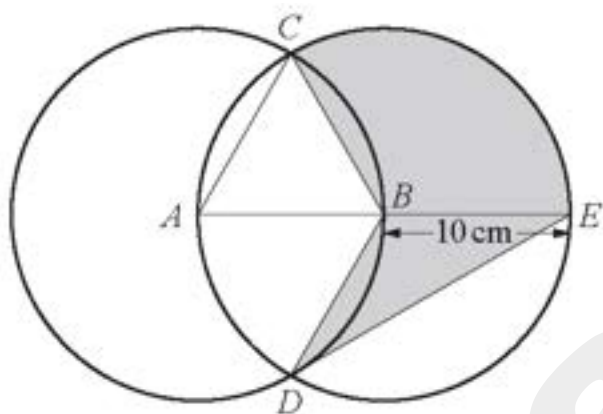
(ii) Find the perimeter of the shaded region.

[5]



Oct/Nov 2015 (11)

10.



The diagram shows two circles, centres  $A$  and  $B$ , each of radius 10 cm. The point  $B$  lies on the circumference of the circle with centre  $A$ . The two circles intersect at the points  $C$  and  $D$ . The point  $E$  lies on the circumference of the circle centre  $B$  such that  $ABE$  is a diameter.

(i) Explain why triangle  $ABC$  is equilateral. [1]

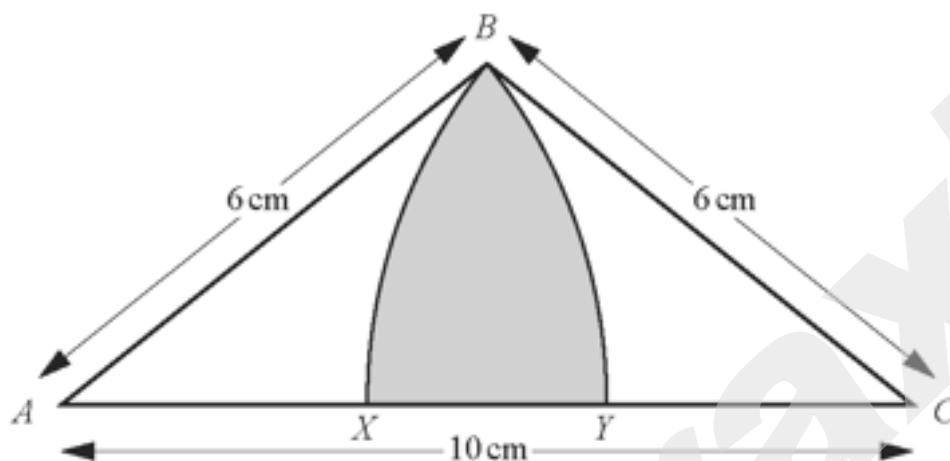
(ii) Write down, in terms of  $\pi$ , angle  $CBE$ . [1]

(iii) Find the perimeter of the shaded region. [5]

(iv) Find the area of the shaded region. [3]

Oct/Nov 2015 (13)

10.



The diagram shows an isosceles triangle  $ABC$  such that  $AC = 10$  cm and  $AB = BC = 6$  cm.  $BX$  is an arc of a circle, centre  $C$ , and  $BY$  is an arc of a circle, centre  $A$ .

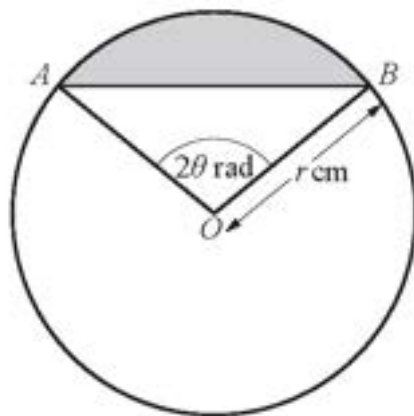
(i) Show that angle  $ABC = 1.970$  radians, correct to 3 decimal places. [2]

(ii) Find the perimeter of the shaded region. [4]

(iii) Find the area of the shaded region. [3]

May/June 2016 (11)

11.



The diagram shows a circle, centre  $O$ , radius  $r$  cm. The points  $A$  and  $B$  lie on the circle such that angle  $AOB = 2\theta$  radians.

(i) Find, in terms of  $r$  and  $\theta$ , an expression for the length of the chord  $AB$ . [1]

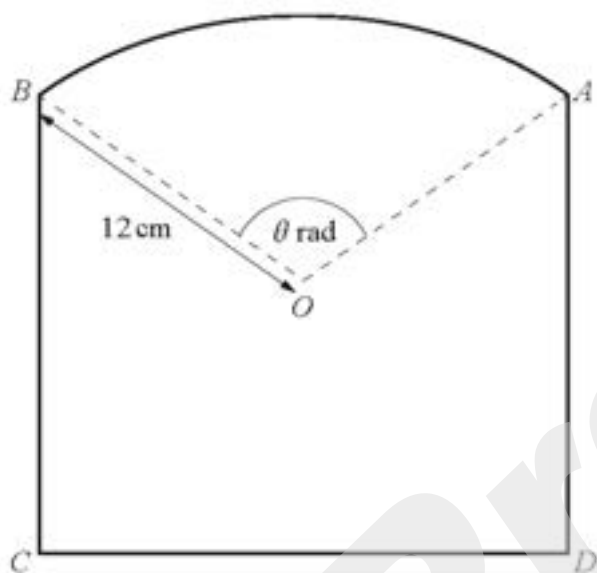
(ii) Given that the perimeter of the shaded region is 20 cm, show that  $r = \frac{10}{\theta + \sin \theta}$ . [2]

- (iii) Given that  $r$  and  $\theta$  can vary, find the value of  $\frac{dr}{d\theta}$  when  $\theta = \frac{\pi}{6}$ . [4]

- (iv) Given that  $r$  is increasing at the rate of  $15 \text{ cm s}^{-1}$ , find the corresponding rate of change of  $\theta$  when  $\theta = \frac{\pi}{6}$ . [3]

Oct/Nov 2016 (11)

8.



The diagram shows a sector  $AOB$  of the circle, centre  $O$ , radius 12 cm, together with points  $C$  and  $D$  such that  $ABCD$  is a rectangle. The angle  $AOB$  is  $\theta$  radians and the perimeter of the sector  $AOB$  is 47 cm.

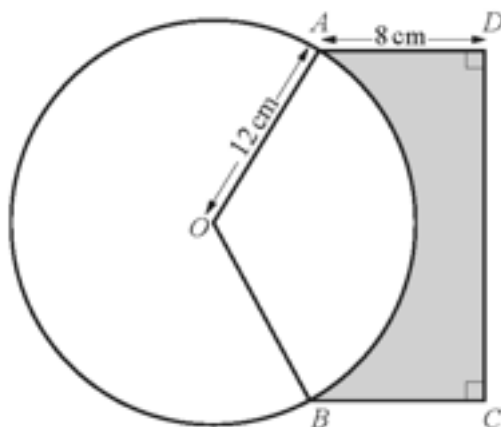
(i) Show that  $\theta = 1.92$  radians correct to 2 decimal places. [2]

(ii) Find the length of  $CD$ . [2]

(iii) Given that the total area of the shape is  $425 \text{ cm}^2$ , find the length of  $AD$ . [5]

May/June 2017 (11)

6.



The diagram shows a circle, centre  $O$ , radius  $12\text{ cm}$ . The points  $A$  and  $B$  lie on the circumference of the circle and form a rectangle with the points  $C$  and  $D$ . The length of  $AD$  is  $8\text{ cm}$  and the area of the minor sector  $AOB$  is  $150\text{ cm}^2$ .

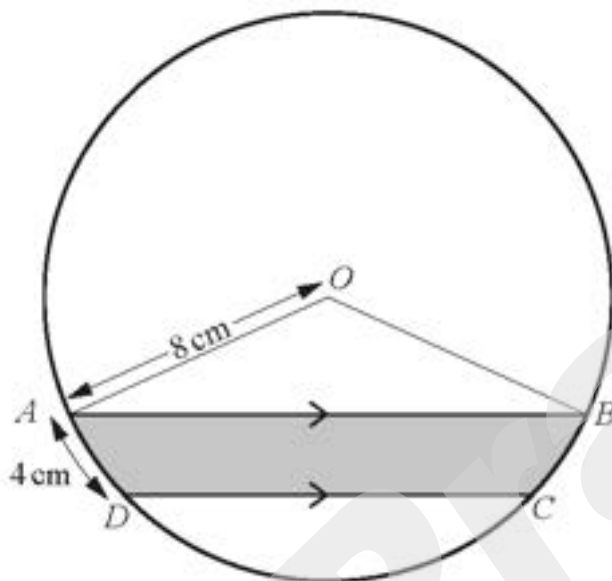
(i) Show that angle  $AOB$  is  $2.08$  radians, correct to 2 decimal places. [2]

(ii) Find the area of the shaded region  $ADCB$ . [6]

(iii) Find the perimeter of the shaded region  $ADCB$ . [3]

May/June 2017 (12)

10.



The diagram shows a circle, centre  $O$ , radius  $8\text{ cm}$ . The points  $A, B, C$  and  $D$  lie on the circumference of the circle such that  $AB$  is parallel to  $DC$ . The length of the arc  $AD$  is  $4\text{ cm}$  and the length of the chord  $AB$  is  $15\text{ cm}$ .

(i) Find, in radians, angle  $AOD$ . [1]

(ii) Hence show that angle  $DOC = 1.43$  radians, correct to 2 decimal places. [3]

(iii) Find the perimeter of the shaded region.

[3]

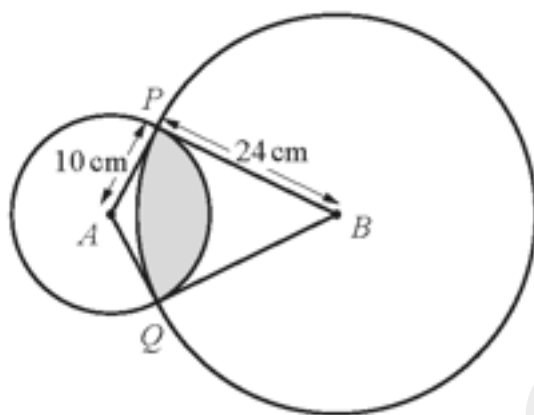
(iv) Find the area of the shaded region.

[4]



Oct/Nov 2017 (11)

9.



The diagram shows a circle, centre  $A$ , radius 10 cm, intersecting a circle, centre  $B$ , radius 24 cm. The two circles intersect at the points  $P$  and  $Q$ . The radii  $AP$  and  $AQ$  are tangents to the circle with centre  $B$ . The radii  $BP$  and  $BQ$  are tangents to the circle with centre  $A$ .

(i) Show that angle  $PAQ$  is 2.35 radians, correct to 3 significant figures. [2]

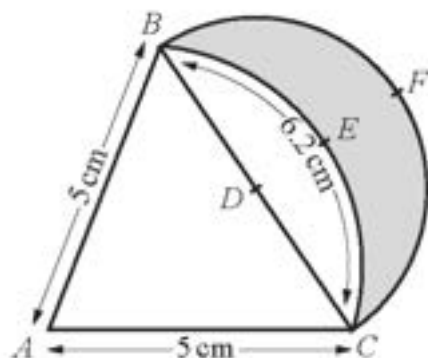
(ii) Find angle  $PBQ$  in radians. [1]

(iii) Find the perimeter of the shaded region. [3]

(iv) Find the area of the shaded region. [4]

Oct/Nov 2017 (12)

10.



The diagram shows an isosceles triangle  $ABC$ , where  $AB = AC = 5$  cm. The arc  $BEC$  is part of the circle centre  $A$  and has length  $6.2$  cm. The point  $D$  is the midpoint of the line  $BC$ . The arc  $BFC$  is a semi-circle centre  $D$ .

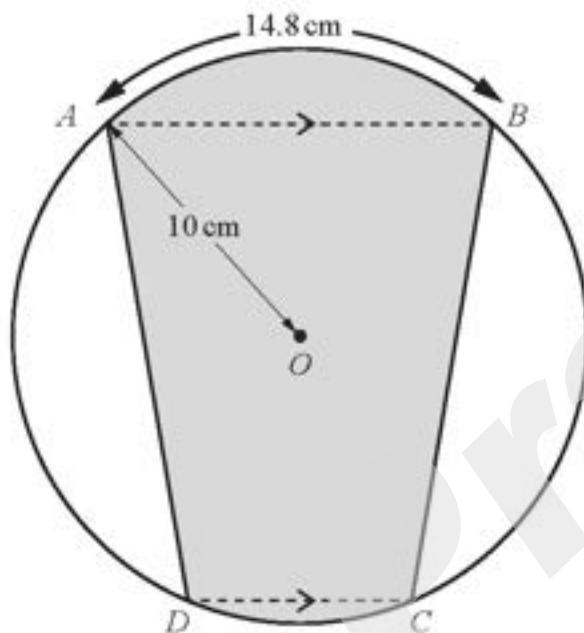
(i) Show that angle  $BAC$  is  $1.24$  radians. [1]

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

(iii) Find the area of the shaded region. [4]

Oct/Nov 2017 (13)

11.



The diagram shows a circle, centre  $O$ , radius  $10\text{ cm}$ . The points  $A$ ,  $B$ ,  $C$  and  $D$  lie on the circumference of the circle such that  $AB$  is parallel to  $DC$ . The length of the minor arc  $AB$  is  $14.8\text{ cm}$ . The area of the minor sector  $ODC$  is  $21.8\text{ cm}^2$ .

(i) Write down, in radians, angle  $AOB$ . [1]

(ii) Find, in radians, angle  $DOC$ . [2]

(iii) Find the perimeter of the shaded region.

[4]

(iv) Find the area of the shaded region.

[3]