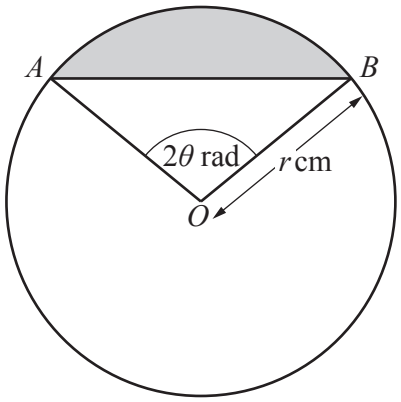
1

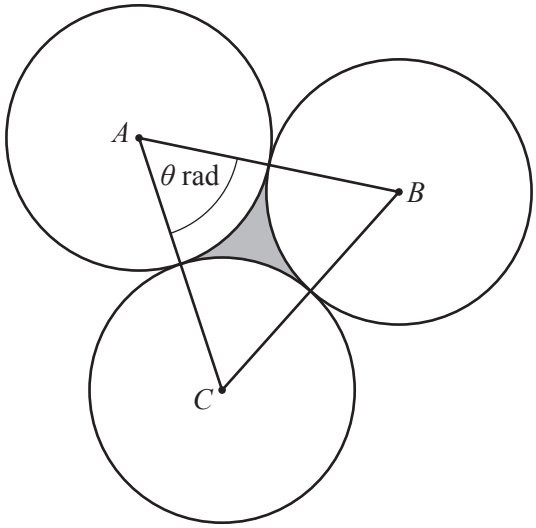


The diagram shows a circle, centre O, radius r cm. The points A and B lie on the circle such that angle $AOB = 2\theta$ radians.

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

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

2

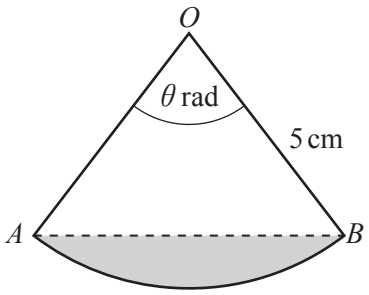


The diagram shows 3 circles with centres A, B and C, each of radius 5 cm. Each circle touches the other two circles. Angle BAC is θ radians.

(i) Write down the value of θ. [1]

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

3



The diagram shows a sector of a circle with centre O and radius 5 cm. The length of the arc AB is 7 cm. Angle AOB is θ radians.

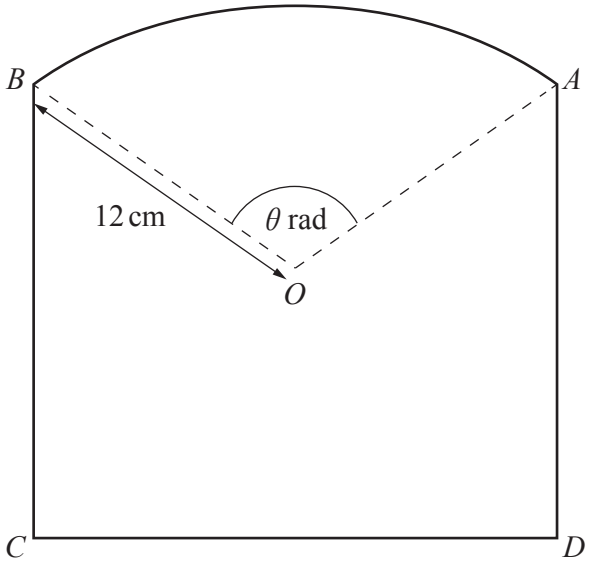
(i) Explain why θ must be greater than 1 radian. [1]

(ii) Find the value of θ. [2]

(iii) Calculate the area of the sector AOB. [2]

(iv) Calculate the area of the shaded segment. [2]

4



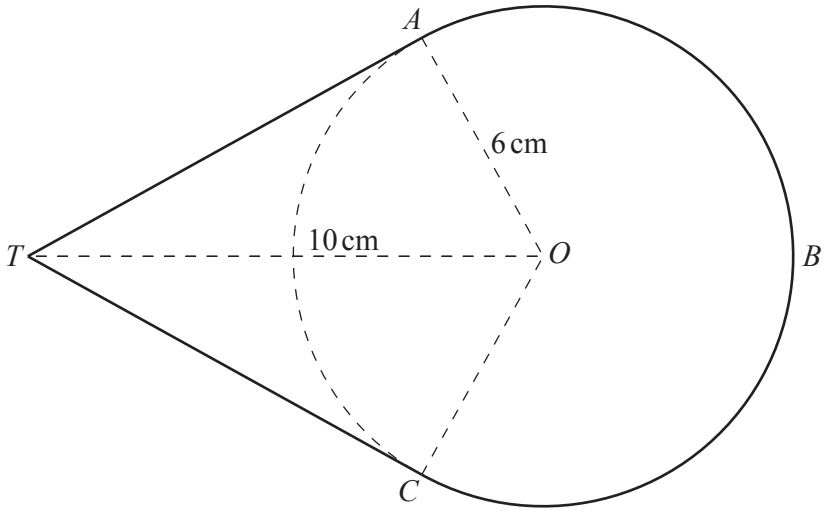
The diagram shows a sector AOB of the circle, centre O, radius 12 cm, together with points C and D such that $ABCD$ is a rectangle. The angle AOB is θ radians and the perimeter of the sector AOB is 47 cm.

(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]

5



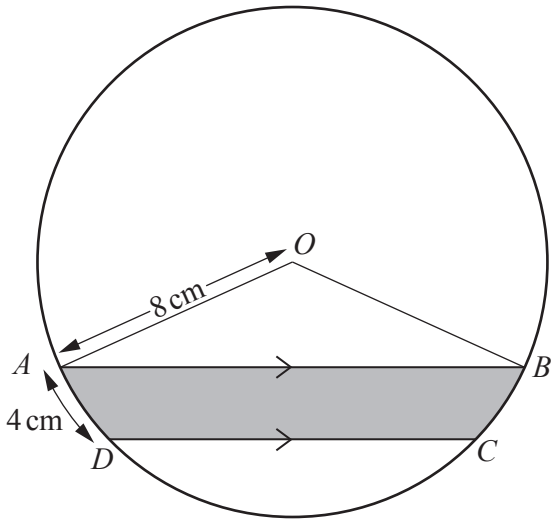
The points A, B and C lie on a circle centre O, radius 6 cm. The tangents to the circle at A and C meet at the point T. The length of OT is 10 cm. Find

(i) the angle TOA in radians, [2]

(ii) the area of the region *TABCT,* [6]

(iii) the perimeter of the region *TABCT.* [2]

6



The diagram shows a circle, centre O, radius 8 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 cm and the length of the chord AB is 15 cm.

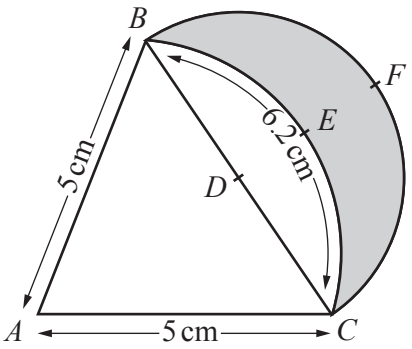
(i) Find, in radians, angle AOD. [1]

(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]

7



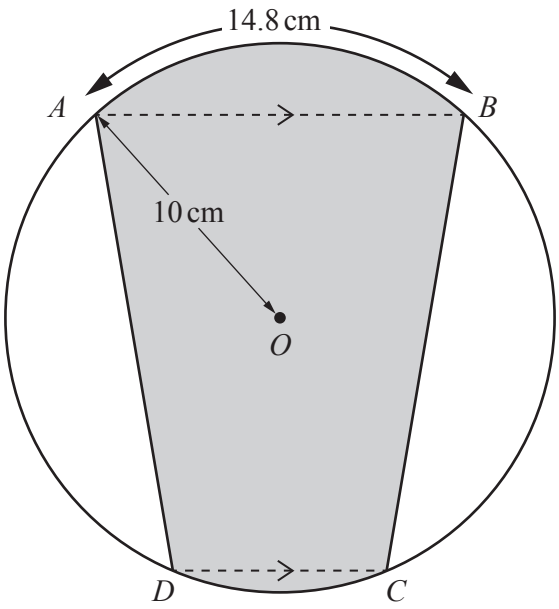
The diagram shows an isosceles triangle ABC, where $AB = AC = 5$ cm. The arc BEC is part of the circle centre A and has length 6.2 cm. The point D is the midpoint of the line BC. The arc BFC is a semi-circle centre D.

(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]

8



The diagram shows a circle, centre O, radius 10 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 cm. The area of the minor sector ODC is 21.8 cm^2.

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

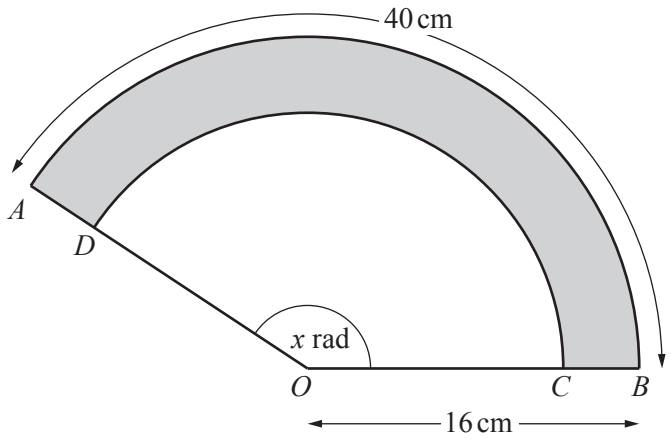
(ii) Find, in radians, angle DOC. [2]

4037/13/O/N/17

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

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

9



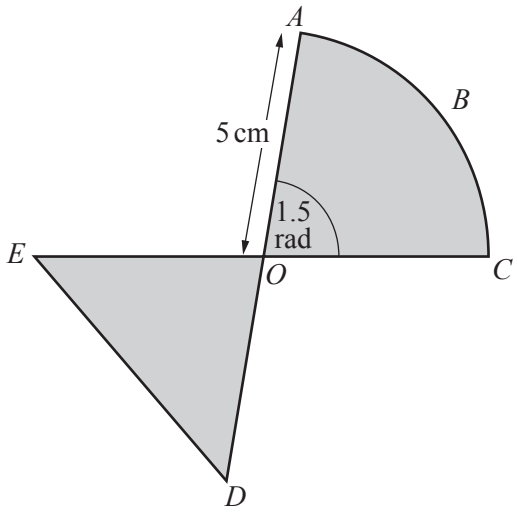
In the diagram AOB and DOC are sectors of a circle centre O. The angle AOB is x radians. The length of the arc AB is 40 cm and the radius OB is 16 cm.

(i) Find the value of x. [2]

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

(iii) Given that the area of the shaded region $ABCD$ is 140 cm^2, find the length of OC. [3]

10



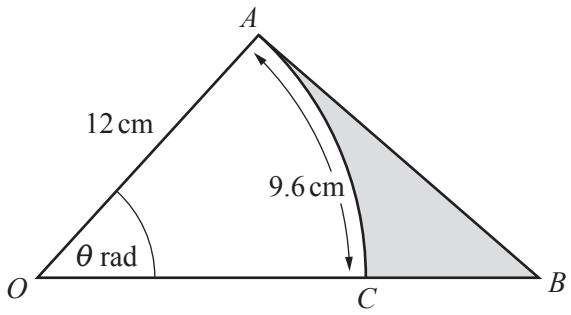
In the diagram, ABC is an arc of the circle centre O, radius 5 cm, and angle AOC is 1.5 radians. AD and CE are diameters of the circle and DE is a straight line.

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

(ii) Find the total area of the shaded regions. [3]

4037/22/M/J/18

11



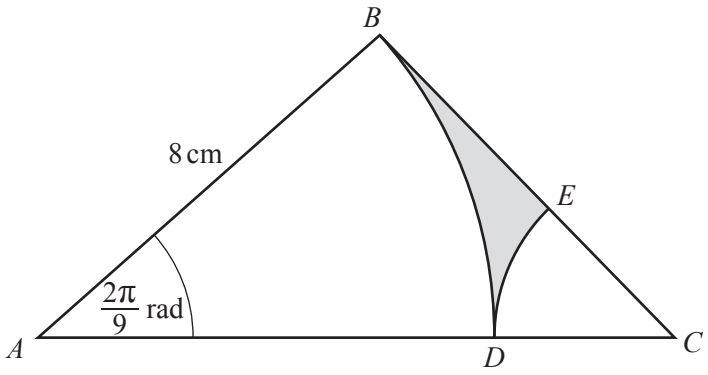
The diagram shows the right-angled triangle OAB. The point C lies on the line OB. Angle $OAB = \frac{\pi}{2}$ radians and angle $AOB = \theta$ radians. AC is an arc of the circle, centre O, radius 12 cm and AC has length 9.6 cm.

(i) Find the value of θ. [2]

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

4037/12/M/J/19

12

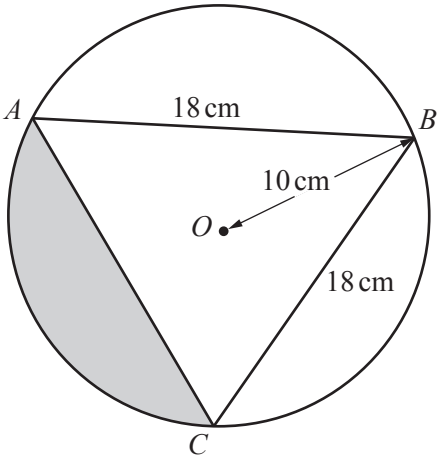


The diagram shows a right-angled triangle ABC with $AB = 8$ cm and angle $ABC = \frac{\pi}{2}$ radians. The points D and E lie on AC and BC respectively. BAD and ECD are sectors of the circles with centres A and C respectively. Angle $BAD = \frac{2\pi}{9}$ radians.

(i) Find the area of the shaded region. [6]

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

13



The diagram shows a circle centre O, radius 10 cm. The points A, B and C lie on the circumference of the circle such that $AB = BC = 18$ cm.

(i) Show that angle $AOB = 2.24$ radians correct to 2 decimal places. [3]

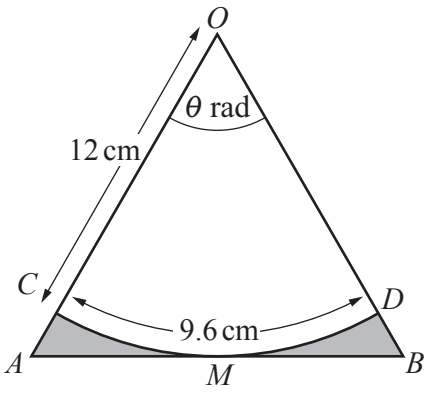
(ii) Find the perimeter of the shaded region. [5]

4037/12/O/N/19

Continuation of working space for Question 10(ii).

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

14



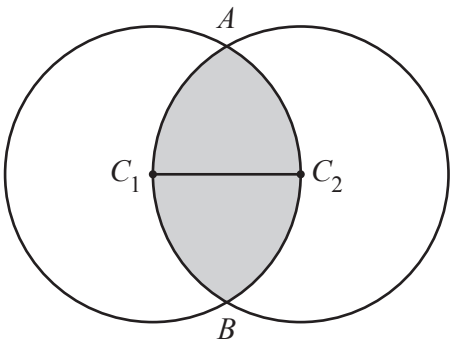
The diagram shows an isosceles triangle OAB such that $OA = OB$ and angle $AOB = \theta$ radians. The points C and D lie on OA and OB respectively. CD is an arc of length 9.6 cm of the circle, centre O, radius 12 cm. The arc CD touches the line AB at the point M.

(a) Find the value of θ. [1]

(b) Find the total area of the shaded regions. [4]

(c) Find the total perimeter of the shaded regions. [3]

15

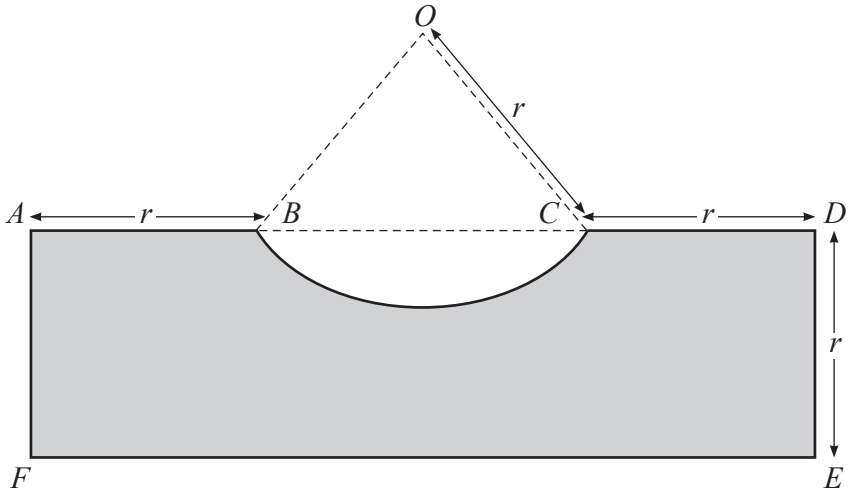


The circles with centres C_1 and C_2 have equal radii of length r cm. The line C_1C_2 is a radius of both circles. The two circles intersect at A and B.

(a) Given that the perimeter of the shaded region is 4π cm, find the value of r. [4]

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

16 In this question all lengths are in centimetres and all angles are in radians.



The diagram shows the rectangle $ADEF$, where $AF = DE = r$. The points B and C lie on AD such that $AB = CD = r$. The curve BC is an arc of the circle, centre O, radius r and has a length of $1.5r$.

(a) Show that the perimeter of the shaded region is $(7.5 + 2\sin 0.75)r$. [5]

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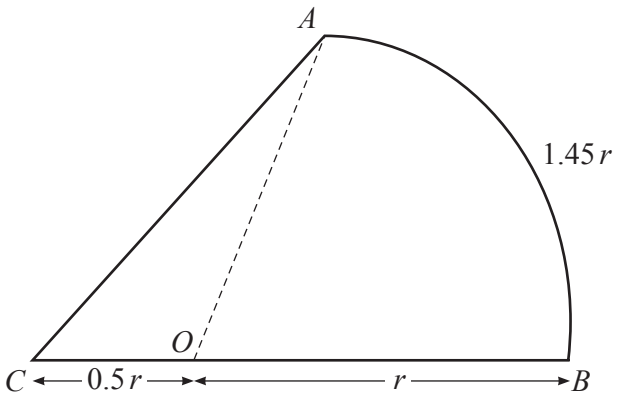
(b) Find the area of the shaded region, giving your answer in the form kr^2, where k is a constant correct to 2 decimal places. [4]

17 In this question all lengths are in centimetres.



The diagram shows the figure ABC. The arc AB is part of a circle, centre O, radius r, and is of length $1.45r$. The point O lies on the straight line CB such that $CO = 0.5r$.

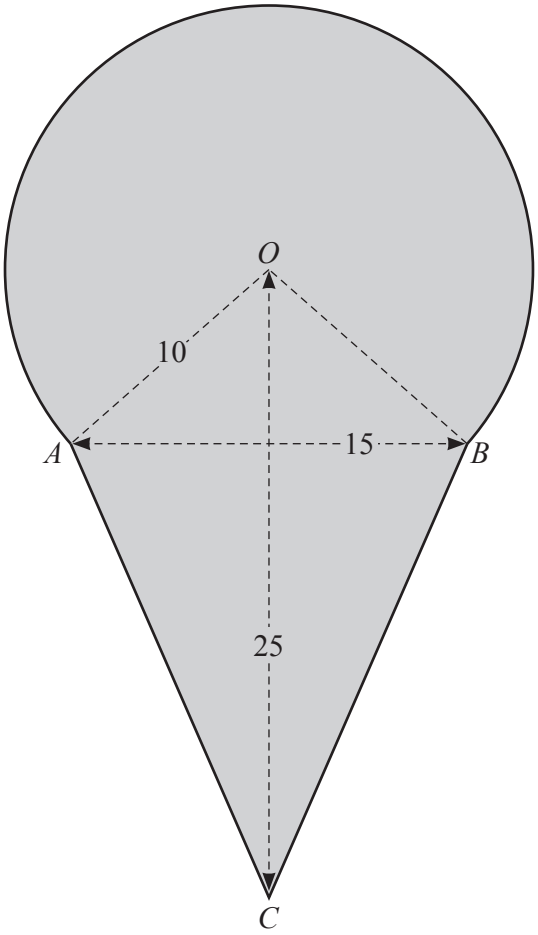
(a) Find, in radians, the angle AOB. [1]

(b) Find the area of ABC, giving your answer in the form kr^2, where k is a constant. [3]

4037/13/O/N/20

(c) Given that the perimeter of ABC is 12 cm, find the value of r. [4]

18 In this question all lengths are in centimetres.



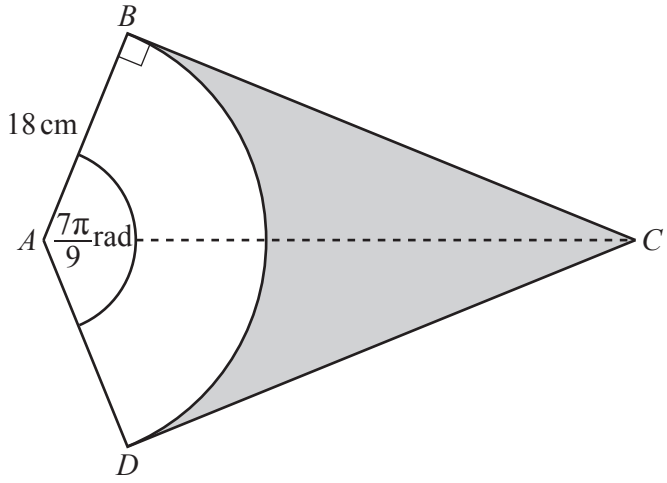
The diagram shows a shaded shape. The arc AB is the major arc of a circle, centre O, radius 10. The line AB is of length 15, the line OC is of length 25 and the lengths of AC and BC are equal.

(a) Show that the angle AOB is 1.70 radians correct to 2 decimal places. [2]

(b) Find the perimeter of the shaded shape. [4]

(c) Find the area of the shaded shape. [5]

19

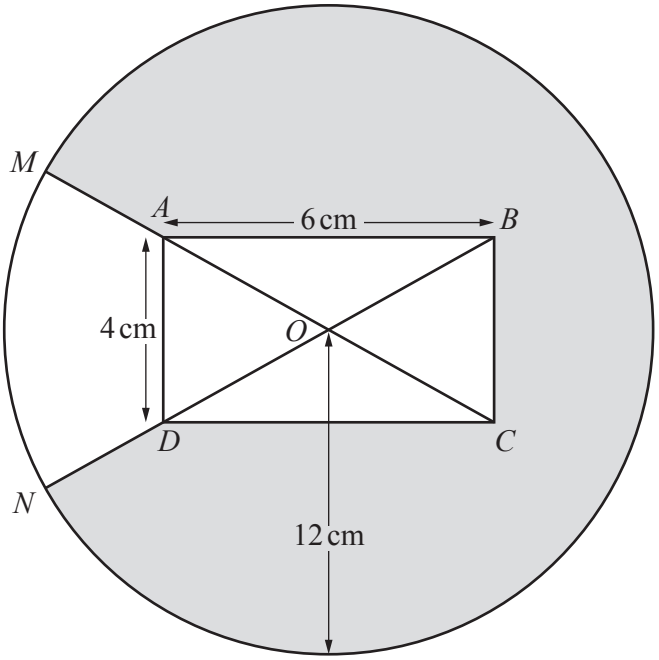


DAB is a sector of a circle, centre *A*, radius 18 cm. The lines *CB* and *CD* are tangents to the circle. Angle *DAB* is $\frac{7\pi}{9}$ radians.

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

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

20



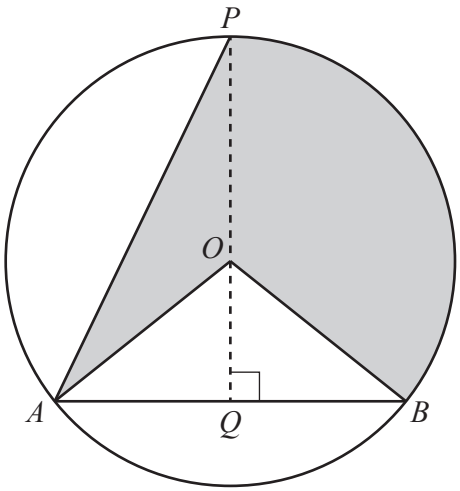
The diagram shows a circle, centre O, radius 12 cm, and a rectangle $ABCD$. The diagonals AC and BD intersect at O. The sides AB and AD of the rectangle have lengths 6 cm and 4 cm respectively. The points M and N lie on the circumference of the circle such that MAC and NDB are straight lines.

(a) Show that angle AOD is 1.176 radians correct to 3 decimal places. [2]

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

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

21



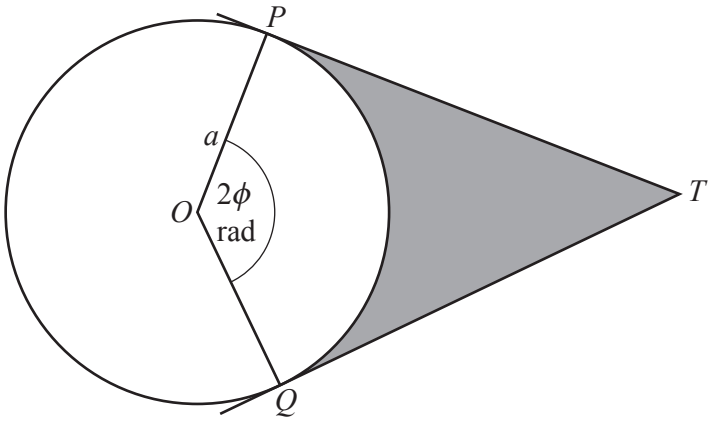
The diagram shows a circle, centre O, radius 10 cm. The points A, B and P lie on the circumference of the circle. The chord AB is of length 14 cm. The point Q lies on AB and the line POQ is perpendicular to AB.

(a) Show that angle POA is 2.366 radians, correct to 3 decimal places. [2]

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

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

22 In this question all lengths are in centimetres.

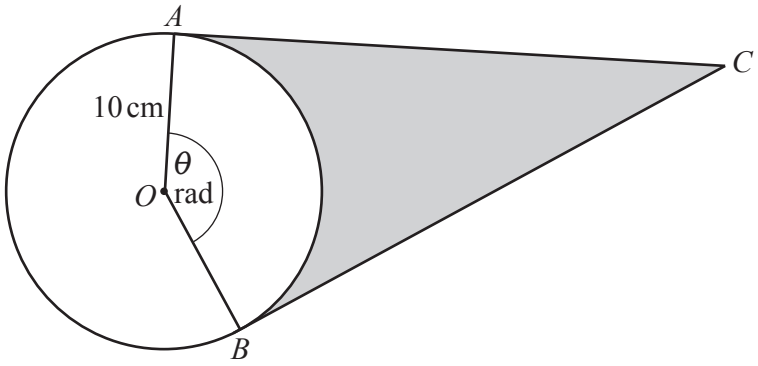


The diagram shows a circle, centre O, radius a. The lines PT and QT are tangents to the circle at P and Q respectively. Angle POQ is 2ϕ radians.

(a) In the case when the area of the sector OPQ is equal to the area of the shaded region, show that $\tan\phi = 2\phi$. [4]

(b) In the case when the perimeter of the sector OPQ is equal to half the perimeter of the shaded region, find an expression for $\tan\phi$ in terms of ϕ. [3]

23



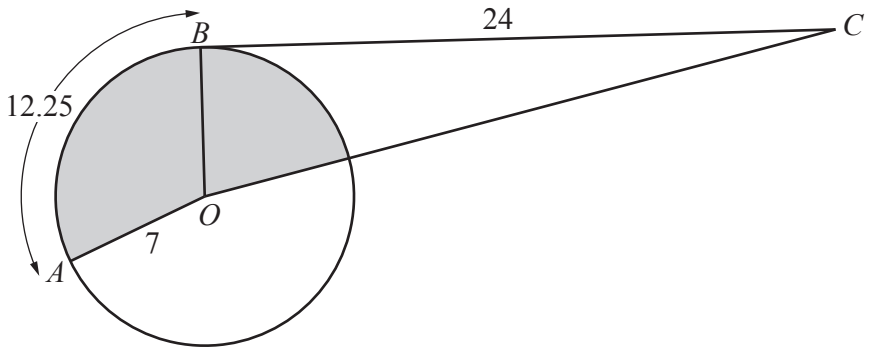
The diagram shows a circle, centre O, radius 10 cm. The points A and B lie on the circumference of the circle. The tangent at A and the tangent at B meet at the point C. The angle AOB is θ radians. The length of the minor arc AB is 28 cm.

(a) Find the value of θ. [1]

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

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

24 In this question all lengths are in metres.



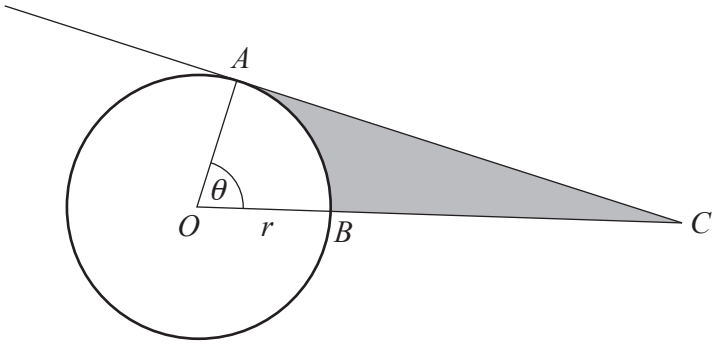
The diagram shows a circle, centre O, radius 7. The points A and B lie on the circumference of the circle. The line BC is a tangent to the circle at the point B such that the length of BC is 24. The length of the minor arc AB is 12.25.

(a) Find the obtuse angle AOB, giving your answer in radians. [1]

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

(c) Find the area of the shaded region. [2]

25 In this question all lengths are in centimetres and all angles are in radians.



The diagram shows a circle with centre O and radius r. The points A and B lie on the circumference of the circle such that the angle AOB is θ and the length of the minor arc AB is 12. The area of the minor sector AOB is $57.6\,\text{cm}^2$. The point C lies on the tangent to the circle at A such that OBC is a straight line.

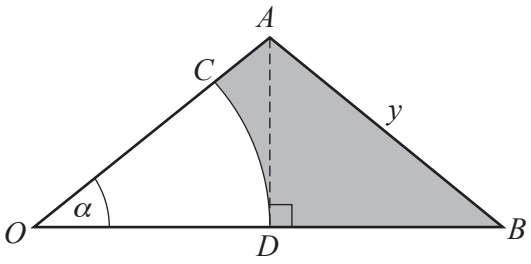
(a) Find the values of r and θ. [4]

(b) Find the area of the shaded region. Give your answer correct to 1 decimal place. [3]

26 In this question all lengths are in centimetres and all angles are in radians.

(a) The area of a sector of a circle of radius 24 is $432\,\text{cm}^2$. Find the length of the arc of the sector. [4]

(b)

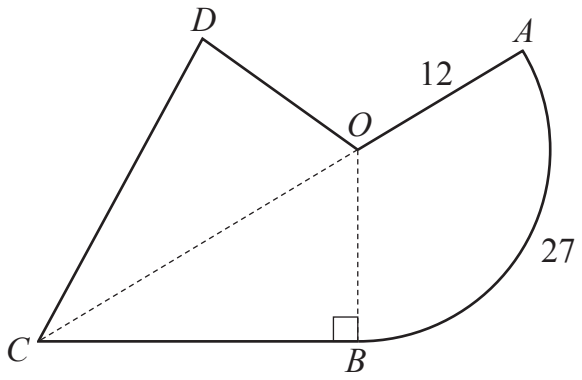


The diagram shows an isosceles triangle, OAB, with $AO = AB = y$ and height AD.
OCD is a sector of the circle with centre O. Angle AOB is α.

(i) Find an expression for OB in terms of y and α. [1]

(ii) Hence show that the area of the shaded region can be written as $\frac{y^2}{2}\cos\alpha(2\sin\alpha - \alpha\cos\alpha)$. [3]

27 In this question all lengths are in centimetres and all angles are in radians.

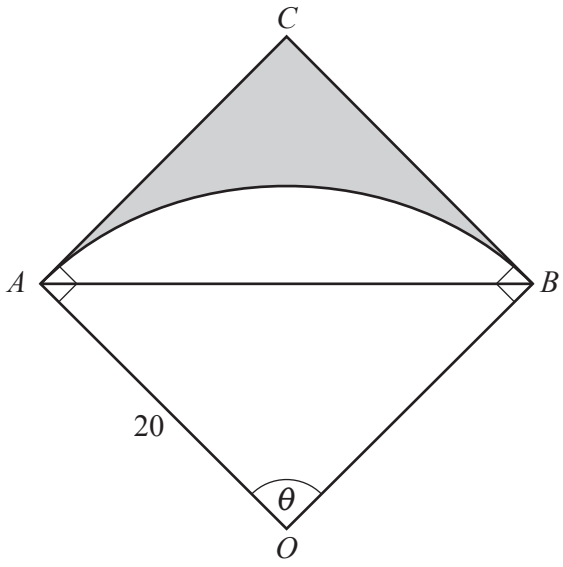


The diagram shows a badge which consists of a minor sector, OAB, of the circle with centre O and radius 12, and a kite $OBCD$, where $OB = OD$ and $CD = CB$. The arc AB has length 27. The line OB is perpendicular to the line CB, and COA is a straight line.

(a) Find the perimeter of the badge. [4]

(b) Find the area of the badge. [3]

28 In this question, all lengths are in centimetres and all angles are in radians.



The diagram shows the sector, OAB, of a circle with centre O and radius 20. The perimeter of this sector is 65. The lines CA and CB are both tangents to the circle at the points A and B, so that the triangle ABC is isosceles, with $AC = CB$. The angle AOB is equal to θ.

Find the area of the shaded region. [9]