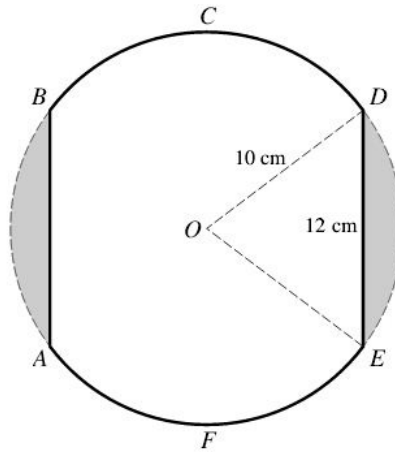


Q1.

7

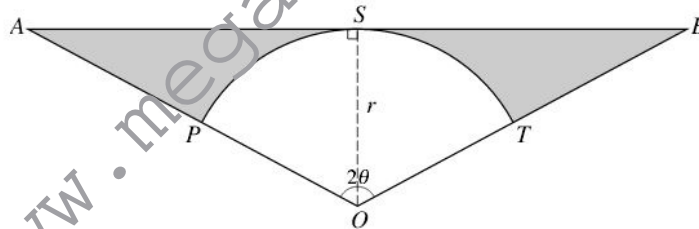


The diagram shows a metal plate $ABCDEF$ which has been made by removing the two shaded regions from a circle of radius 10 cm and centre O . The parallel edges AB and ED are both of length 12 cm.

- (i) Show that angle DOE is 1.287 radians, correct to 4 significant figures. [2]
- (ii) Find the perimeter of the metal plate. [3]
- (iii) Find the area of the metal plate. [3]

Q2.

9

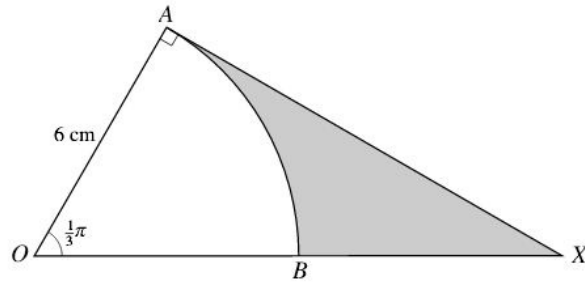


In the diagram, OAB is an isosceles triangle with $OA = OB$ and angle $AOB = 2\theta$ radians. Arc PST has centre O and radius r , and the line ASB is a tangent to the arc PST at S .

- (i) Find the total area of the shaded regions in terms of r and θ . [4]
- (ii) In the case where $\theta = \frac{1}{3}\pi$ and $r = 6$, find the total perimeter of the shaded regions, leaving your answer in terms of $\sqrt{3}$ and π . [5]

Q3.

7



In the diagram, AB is an arc of a circle, centre O and radius 6 cm, and angle $AOB = \frac{1}{3}\pi$ radians. The line AX is a tangent to the circle at A , and OBX is a straight line.

(i) Show that the exact length of AX is $6\sqrt{3}$ cm. [1]

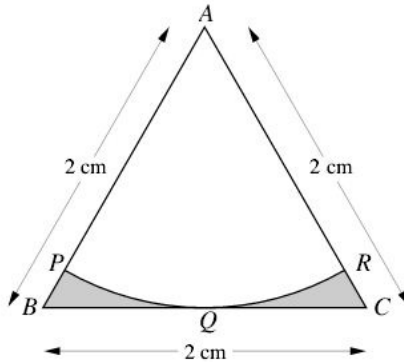
Find, in terms of π and $\sqrt{3}$,

(ii) the area of the shaded region, [3]

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

Q4.

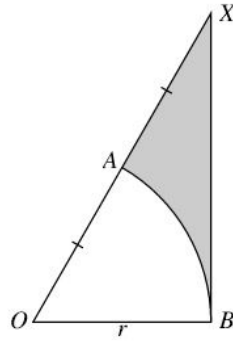
3



In the diagram, ABC is an equilateral triangle of side 2 cm. The mid-point of BC is Q . An arc of a circle with centre A touches BC at Q , and meets AB at P and AC at R . Find the total area of the shaded regions, giving your answer in terms of π and $\sqrt{3}$. [5]

Q5.

8



In the diagram, AB is an arc of a circle with centre O and radius r . The line XB is a tangent to the circle at B and A is the mid-point of OX .

(i) Show that angle $AOB = \frac{1}{3}\pi$ radians. [2]

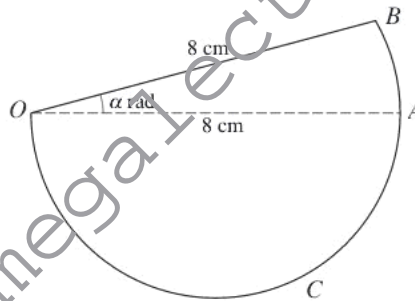
Express each of the following in terms of r , π and $\sqrt{3}$:

(ii) the perimeter of the shaded region, [3]

(iii) the area of the shaded region. [2]

Q6.

3



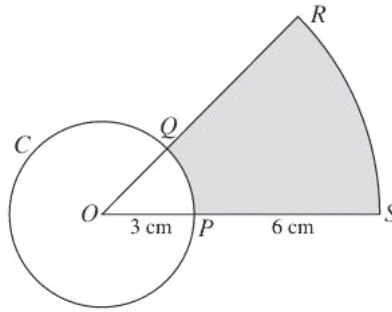
In the diagram, OAB is a sector of a circle with centre O and radius 8 cm. Angle BOA is α radians. OAC is a semicircle with diameter OA . The area of the semicircle OAC is twice the area of the sector OAB .

(i) Find α in terms of π . [3]

(ii) Find the perimeter of the complete figure in terms of π . [2]

Q7.

2

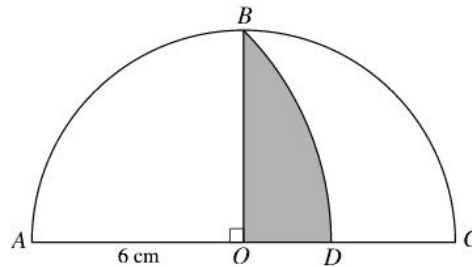


The diagram shows a circle C with centre O and radius 3 cm. The radii OP and OQ are extended to S and R respectively so that ORS is a sector of a circle with centre O . Given that $PS = 6$ cm and that the area of the shaded region is equal to the area of circle C ,

- (i) show that angle $POQ = \frac{1}{4}\pi$ radians, [3]
- (ii) find the perimeter of the shaded region. [2]

Q8.

5

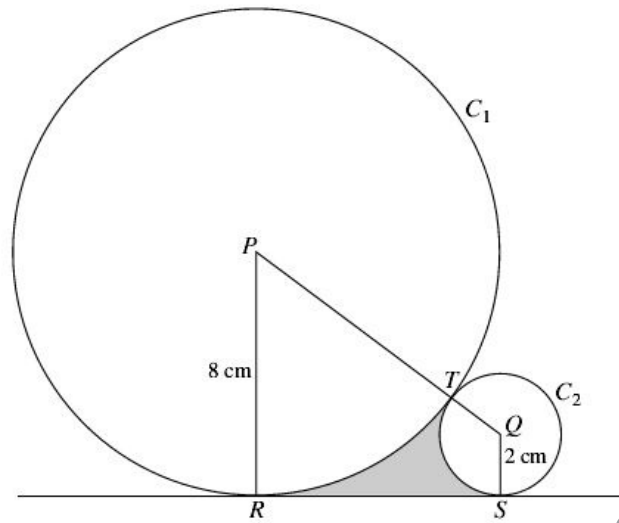


The diagram shows a semicircle ABC with centre O and radius 6 cm. The point B is such that angle BOA is 90° and BD is an arc of a circle with centre A . Find

- (i) the length of the arc BD , [4]
- (ii) the area of the shaded region. [3]

Q9.

9

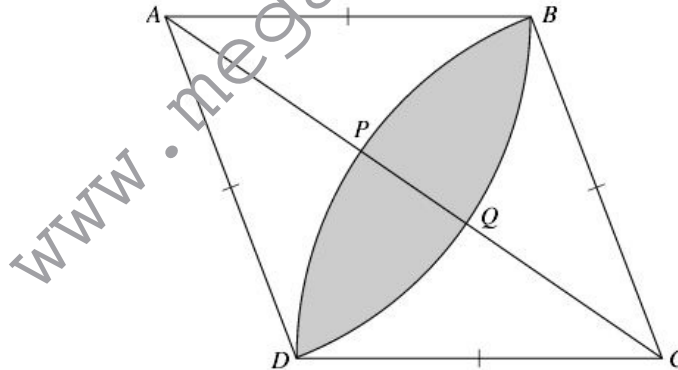


The diagram shows two circles, C_1 and C_2 , touching at the point T . Circle C_1 has centre P and radius 8 cm; circle C_2 has centre Q and radius 2 cm. Points R and S lie on C_1 and C_2 respectively, and RS is a tangent to both circles.

- (i) Show that $RS = 8$ cm. [2]
- (ii) Find angle RPQ in radians correct to 4 significant figures. [2]
- (iii) Find the area of the shaded region. [4]

Q10.

8



The diagram shows a rhombus $ABCD$. Points P and Q lie on the diagonal AC such that BPD is an arc of a circle with centre C and BQD is an arc of a circle with centre A . Each side of the rhombus has length 5 cm and angle $BAD = 1.2$ radians.

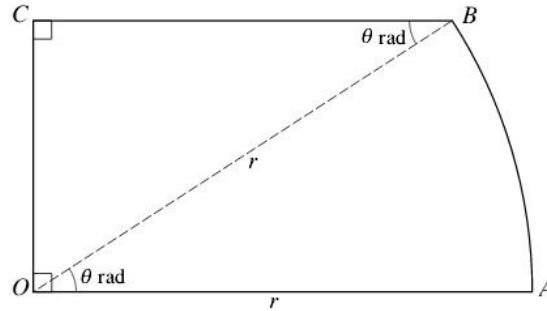
- (i) Find the area of the shaded region $BPDQ$. [4]
- (ii) Find the length of PQ . [4]

Q11.

5

MEGA LECTURE

5

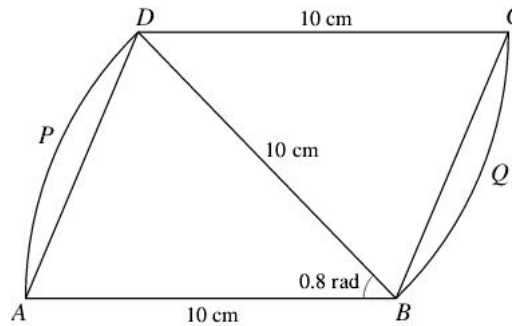


The diagram represents a metal plate $OABC$, consisting of a sector OAB of a circle with centre O and radius r , together with a triangle OCB which is right-angled at C . Angle $AOB = \theta$ radians and OC is perpendicular to OA .

- (i) Find an expression in terms of r and θ for the perimeter of the plate. [3]
- (ii) For the case where $r = 10$ and $\theta = \frac{1}{5}\pi$, find the area of the plate. [3]

Q12.

4

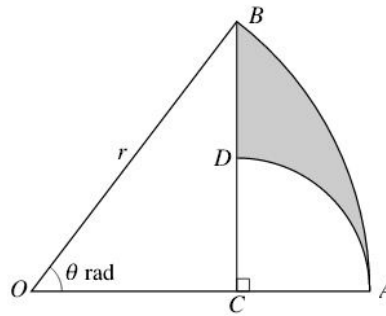


In the diagram, $ABCD$ is a parallelogram with $AB = BD = DC = 10$ cm and angle $ABD = 0.8$ radians. APD and BQC are arcs of circles with centres B and D respectively.

- (i) Find the area of the parallelogram $ABCD$. [2]
- (ii) Find the area of the complete figure $ABQCDP$. [2]
- (iii) Find the perimeter of the complete figure $ABQCDP$. [2]

Q13.

6

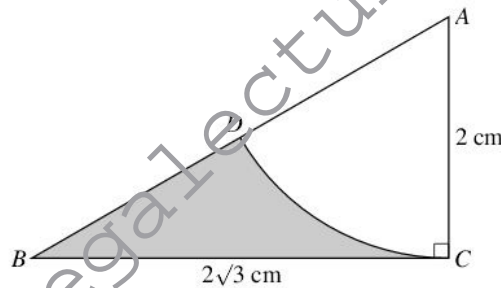


The diagram shows a sector OAB of a circle with centre O and radius r . Angle AOB is θ radians. The point C on OA is such that BC is perpendicular to OA . The point D is on BC and the circular arc AD has centre C .

- (i) Find AC in terms of r and θ . [1]
- (ii) Find the perimeter of the shaded region ABD when $\theta = \frac{1}{3}\pi$ and $r = 4$, giving your answer as an exact value. [6]

Q14.

4

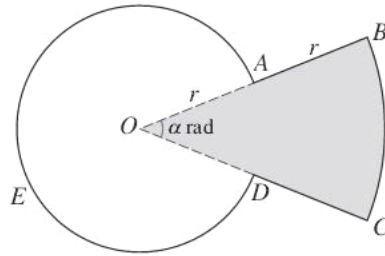


In the diagram, D lies on the side AB of triangle ABC and CD is an arc of a circle with centre A and radius 2 cm. The line BC is of length $2\sqrt{3}$ cm and is perpendicular to AC . Find the area of the shaded region BDC , giving your answer in terms of π and $\sqrt{3}$. [4]

Q15.

7

6



The diagram shows a metal plate made by fixing together two pieces, $OABCD$ (shaded) and $OADE$ (unshaded). The piece $OABCD$ is a minor sector of a circle with centre O and radius $2r$. The piece $OADE$ is a major sector of a circle with centre O and radius r . Angle AOD is α radians. Simplifying your answers where possible, find, in terms of α , π and r ,

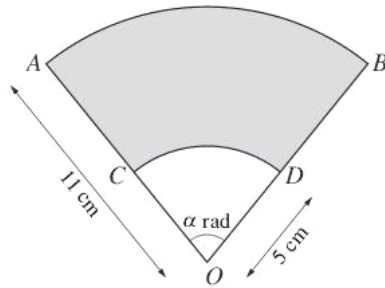
- (i) the perimeter of the metal plate, [3]
- (ii) the area of the metal plate. [3]

It is now given that the shaded and unshaded pieces are equal in area.

- (iii) Find α in terms of π . [2]

Q16.

6



The diagram shows sector OAB with centre O and radius 11 cm. Angle $AOB = \alpha$ radians. Points C and D lie on OA and OB respectively. Arc CD has centre O and radius 5 cm.

- (i) The area of the shaded region $ABDC$ is equal to k times the area of the unshaded region OCD . Find k . [3]
- (ii) The perimeter of the shaded region $ABDC$ is equal to twice the perimeter of the unshaded region OCD . Find the exact value of α . [4]



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