

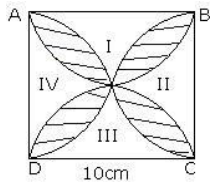
CBSE Test Paper 03
Chapter 12 Area Related to Circle

1. If the radius of the circle is $\frac{7}{\sqrt{\pi}}$ cm, then its area is **(1)**
 - a. 98sq. cm
 - b. 45sq. cm
 - c. 22 sq. cm
 - d. 49 sq. cm
2. If the circumference of a circle and the perimeter of a square are equal, then **(1)**
 - a. Area of the circle = $\frac{1}{2}$ Area of the square
 - b. area of the circle > area of the square
 - c. area of the circle < area of the square
 - d. area of the circle = area of the square
3. If a chord subtends an angle of 60° at the centre, then the area of the corresponding segment is **(1)**
 - a. $\left(\frac{\pi}{6} - \frac{\sqrt{3}}{4}\right) r^2$ sq. units
 - b. $\left(\frac{\pi}{2} - \frac{\sqrt{3}}{2}\right) r^2$ sq. units
 - c. $\left(\frac{\pi}{6} + \frac{\sqrt{3}}{2}\right) r^2$ sq. units
 - d. $\left(\frac{\pi}{2} + \frac{\sqrt{3}}{2}\right) r^2$ sq. units
4. The length of the minute hand of a clock is 14cm. The area swept by the minute hand in 1 hour is **(1)**
 - a. 616 sq. cm
 - b. 516 sq. cm
 - c. 628 sq. cm
 - d. 542 sq. cm
5. A horse is tied to a peg at one corner of a square-shaped gross field of side 25 m by means of a 14m long rope. The area of that part of the field in which the horse can graze is **(1)**
 - a. 156 sq. cm
 - b. 142 sq. cm
 - c. 102 sq. cm

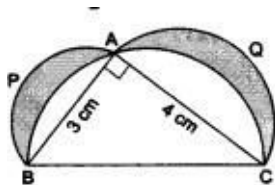
d. 128 sq. cm

6. What is the perimeter of a sector of angle 45° of a circle with radius 7 cm? **(1)**
7. Radius of a circle is 1m. If diameter is increased by 100% then find the percentage increase in its area. **(1)**
8. If the perimeter of a semicircular protactor is 66 cm, find the radius of the protactor. **(1)**
9. If the circumference is numerically equal to 3 times the area of a circle, then find the radius of the circle. **(1)**
10. The area of two concentric circles forming a ring are 154 cm^2 and 616 cm^2 . Find the breadth of the ring. **(1)**
11. The area of a sector of a circle of radius 2 cm is $\pi \text{ cm}^2$. Find the angle contained by the sector. **(2)**
12. Find the area of the shaded region in the given figure where ABCD is a square of side 10cm and semi-circles are drawn with each side of the square as diameter.

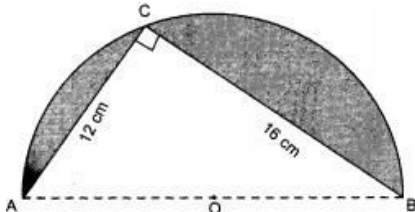
$[\pi = 3.14]$ **(2)**



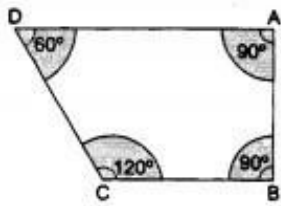
13. Find the area of a quadrant of a circle, whose circumference is 22 cm. **(2)**
14. In the given figure, $\triangle ABC$ is right-angled at A. Semicircles are drawn on AB, AC and BC as diameters. It is given that AB = 3 cm and AC = 4 cm. Find the area of the shaded region. **(3)**



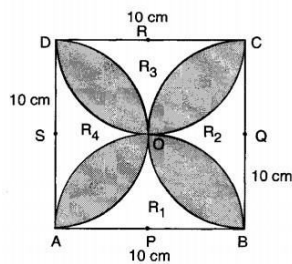
15. In figure, O is the centre of a circular arc and AOB is a straight line. Find the perimeter and the area of the shaded region correct to one decimal place. (Take $\pi = 3.142$) **(3)**



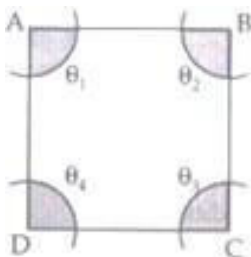
16. ABCD is a field in the shape of a trapezium, $AD \parallel BC$, $\angle ABC = 90^\circ$ and $\angle ADC = 60^\circ$. Four sectors are formed with centres A, B, C and D, as shown in the figure. The radius of each sector is 14 m. Find the following: **(3)**



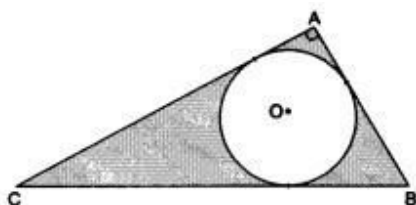
- i. total area of the four sectors,
 - ii. area of the remaining portion, given that $AD = 55$ m, $BC = 45$ m and $AB = 30$ m
17. In Fig. ABCD is a square of side 10 cm. Semi-circles are drawn with each side of square as diameter. Find the area of



- i. the unshaded region (R_1, R_2, R_3, R_4)
 - ii. the shaded region **(3)**
18. In the given figure, arcs have been drawn of radius 21 cm each with vertices A, B, C and D of quadrilateral ABCD as centre. Find the area of shaded region. **(4)**



19. A semicircular region and a square region have equal perimeters. The area of the square region exceeds that of the semicircular region by 4 cm^2 . Find the perimeters and areas of the two regions. **(4)**
20. In the given figure, $\triangle ABC$ is right-angled at A. Find the area of the shaded region if $AB = 6$ cm, $BC = 10$ cm and O is the centre of the incircle of $\triangle ABC$. [Take $\pi = 3.14$.] **(4)**



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Solution

1. d. 49 sq. cm

Explanation: Area of the circle = πr^2

$$\Rightarrow \text{Area of the circle} = \pi \left(\frac{7}{\sqrt{\pi}} \right)^2 = \pi \times \frac{49}{\pi} = 49 \text{ sq. cm}$$

2. b. area of the circle > area of the square

Explanation: Let the radius of the circle be r and side of the square be a .

Then, according to the question,

$$2\pi r = 4a$$

$$\Rightarrow a = \frac{2\pi r}{4} = \frac{\pi r}{2} \dots\dots\dots(i)$$

Now, the ratio of their areas,

$$\pi r^2 \text{ and } a^2$$

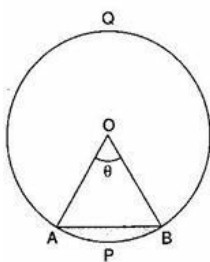
$$\Rightarrow \pi r^2 \text{ and } \left(\frac{\pi r}{2} \right)^2 \text{ [From eq. (i)]}$$

$$\Rightarrow \pi r^2 \text{ and } \frac{\pi^2 r^2}{4}$$

Therefore, Area of the circle > Area of the square

3. a. $\left(\frac{\pi}{6} - \frac{\sqrt{3}}{4} \right) r^2$ sq. units

Explanation:



$$\text{Area of segment} = \frac{\theta}{360^\circ} \times \pi r^2 - \frac{1}{2} r^2 \sin \theta$$

$$\Rightarrow \text{Area of segment} = \frac{60^\circ}{360^\circ} \times \pi r^2 - \frac{1}{2} r^2 \sin 60^\circ$$

$$\Rightarrow \text{Area of segment} = \frac{\pi r^2}{6} - \frac{r^2}{2} \times \frac{\sqrt{3}}{2}$$

$$\Rightarrow \text{Area of segment} = \left(\frac{\pi}{6} - \frac{\sqrt{3}}{4} \right) r^2 \text{ sq. units}$$

4. a. 616 sq. cm

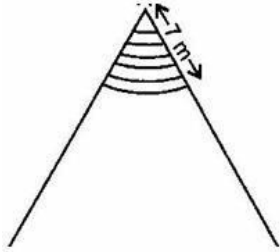
Explanation: \therefore Angle describe by minute hand in 1 hour = 360°

$$\therefore \theta = 360^\circ$$

$$\therefore \text{Area of the sector} = \frac{\theta}{360^\circ} \times \pi r^2 = \frac{360^\circ}{360^\circ} \times \frac{22}{7} \times 14 \times 14 = 616 \text{ sq. cm}$$

5. c. 102 sq. cm

Explanation:



$$\text{Area of the shaded region} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\Rightarrow \text{Area of the shaded region} = \frac{60^\circ}{360^\circ} \times \frac{22}{7} \times 14 \times 14$$

$$\Rightarrow \text{Area of the shaded region} = 102 \text{ sq. cm}$$

6. Given radius r of circle = 7 cm.

$$l = \text{length of the arc} = \frac{\theta \pi r}{180^\circ}$$

$$= \frac{45^\circ}{180^\circ} \times \frac{22}{7} \times 7 = \frac{11}{2} \text{ cm}$$

Hence, perimeter of sector = $(r + r + l)$

$$= \left(7 + 7 + \frac{11}{2}\right) \text{ cm}$$

$$= \left(14 + \frac{11}{2}\right) \text{ cm} = \left(\frac{28+11}{2}\right) \text{ cm}$$

$$= \frac{39}{2} \text{ cm} = 19.5 \text{ cm}$$

7. Area of circle = πm^2

$$\text{New diameter} = 2 \text{ m} + \frac{100}{100} \times 2 \text{ m} = 4 \text{ m}$$

$$\text{New radius} = 2 \text{ m}$$

$$\text{New area} = 4\pi \text{ m}^2$$

$$\text{Increase in area} = 4\pi - \pi = 3\pi \text{ m}^2$$

$$\% \text{ increase in area} = \frac{3\pi}{\pi} \times 100 = 300\%$$

8. Let radius of the protractor be r cm.

$$\text{Perimeter} = \left[\frac{1}{2} \times 2\pi r + 2r\right]$$

$$66 \text{ cm} = [\pi r + 2r]$$

$$\Rightarrow 66 = (\pi + 2)r$$

$$\begin{aligned} \Rightarrow 66 &= \left(\frac{22}{7} + 2\right)r = \left(\frac{22+14}{7}\right)r \\ &= \left(\frac{36}{7}\right)r \\ \Rightarrow \frac{7 \times 66}{36} &= r \Rightarrow r = \frac{77}{6} \text{ cm} \end{aligned}$$

9. Let *radius* = r units

According to the question,

$$2\pi r = 3\pi r^2$$

$$\Rightarrow r = \frac{2}{3} \text{ units}$$

10. Area of bigger circle = $\pi R^2 = 616$

$$\Rightarrow R = 14 \text{ cm}$$

and area of smaller circle = $\pi r^2 = 154$

$$\Rightarrow r = 7 \text{ cm}$$

Breadth of the ring = $14 - 7 = 7 \text{ cm}$

11. Radius of circle = 2cm

Area of sector = πcm^2

$$\therefore \text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\Rightarrow \pi = \frac{\theta}{360^\circ} \times \pi \times 2 \times 2$$

$$\Rightarrow \theta = \frac{\pi \times 360^\circ}{\pi \times 2 \times 2} = 90^\circ$$

12. Area of region I + II = area of ABCD - area of 2 semicircles of each radius 5cm

$$= 10 \times 10 - 2 \times \frac{1}{2} \times \pi \times 5^2$$

$$= 100 - 25\pi = 100 - 25 \times 3.14$$

$$= 21.5 \text{ cm}^2$$

Similarly, the area of III + area of IV = 21.5 cm^2

Area of the region I, II, III, and IV = $2 \times 21.5 = 43 \text{ cm}^2$

Thus, the area of shaded region = Area ABCD - Area of (I, II, III, IV)

$$= 100 - 43 = 57 \text{ cm}^2$$

13. Given, Circumference = 22 cm

$$\Rightarrow 2\pi r = 22$$

$$\Rightarrow r = \frac{7}{2} = 3.5 \text{ cm}$$

$$\text{Area of Circle} = \pi r^2 = \frac{22}{7} \times (3.5)^2 = 38.5 \text{ cm}^2$$

$$\begin{aligned} \text{Area of quadrant of circle} &= \frac{\text{Area of circle}}{4} \\ &= \frac{38.5}{4} = 9.625 \text{ cm}^2 \end{aligned}$$

$$\therefore \text{Area of the quadrant of circle} = 9.625 \text{ cm}^2$$

14. In triangle ABC, by pythagoras theorem, we have,

$$BC = \sqrt{AB^2 + AC^2}$$

$$BC = \sqrt{9 + 16}$$

$$BC = \sqrt{25}$$

$$= 5 \text{ cm}$$

$$\begin{aligned} \text{Ar}(\text{shaded part}) &= \text{Ar}(\triangle ABC) + \text{Ar}(\text{semicircle APB}) + \text{Ar}(\text{semicircle AQC}) - \text{Ar} \\ &(\text{semicircle BAC}) \end{aligned}$$

$$= \left(\frac{1}{2} \times 3 \times 4\right) + \left(\frac{1}{2} \pi \times 1.5 \times 1.5\right) + \left(\frac{1}{2} \pi \times 2 \times 2\right) - \left(\frac{1}{2} \pi \times 2.5 \times 2.5\right)$$

$$= 6 + \frac{1}{2} \pi \left(4 + \frac{9}{4} - \frac{25}{4}\right)$$

$$= 6 + 0$$

$$= 6 \text{ cm}^2$$

15. AC = 12 cm, BC = 16 cm

In $\triangle ACB$, by pythagoras theorem

$$AB^2 = AC^2 + BC^2$$

$$\Rightarrow AB^2 = 12^2 + 16^2$$

$$\Rightarrow AB^2 = 144 + 256 = 400$$

$$\Rightarrow AB = \sqrt{400} = 20 \text{ cm}$$

$$\therefore \text{radius of semi-circle} = \frac{20}{2} = 10 \text{ cm}$$

$$\therefore \text{Area of shaded region} = \text{Area of semi-circle} - \text{Area of } \triangle ACB$$

$$= \frac{1}{2} \pi (10)^2 - \frac{1}{2} AC \times BC$$

$$= \frac{1}{2} \times 3.142 \times 100 - \frac{1}{2} \times 12 \times 16$$

$$= 157.1 - 96$$

$$= 61.1 \text{ cm}^2$$

Perimeter of shaded region

$$= AC + BC + \text{circumference of semi-circle}$$

$$= 12 + 16 + \pi(10)$$

$$= 28 + 3.142 \times 10$$

$$= 28 + 31.42$$

$$= 59.42 \text{ cm}$$

$$\begin{aligned}
 16. \quad \text{i. Total area of 4 sectors} &= \left\{ \frac{22}{7} \times (14)^2 \times \left(\frac{90}{360} + \frac{90}{360} + \frac{120}{360} + \frac{60}{360} \right) \right\} \text{m}^2 \\
 &= \left\{ 22 \times 2 \times 14 \times \left(\frac{1}{4} + \frac{1}{4} + \frac{1}{3} + \frac{1}{6} \right) \right\} \text{m}^2 \\
 &= \left\{ 616 \times \frac{3+3+4+2}{12} \right\} \text{m}^2 \\
 &= \left\{ 616 \times \frac{12}{12} \right\} \text{m}^2 \\
 &= 616 \text{ m}^2
 \end{aligned}$$

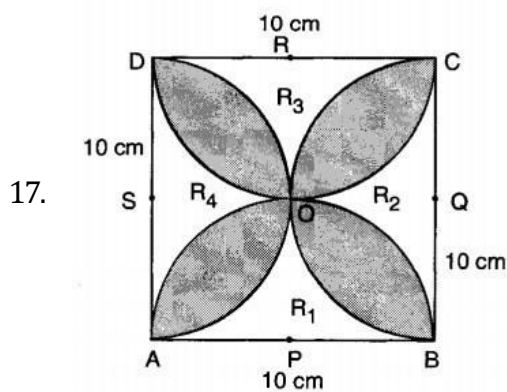
$$\begin{aligned}
 \text{ii. Area of trapezium ABCD} &= \frac{1}{2} \times (AD + BC) \times AB \\
 &= \frac{1}{2} \times (55 + 45) \times 30 \\
 &= 100 \times 15 \\
 &= 1500 \text{ m}^2
 \end{aligned}$$

Therefore, required area

$$= \text{Ar (trapezium ABCD)} - \text{Total area of 4 sectors}$$

$$= (1500 - 616) \text{ m}^2$$

$$= 884 \text{ m}^2$$



Clearly,

Area of R_1 + Area of R_3

= Area of square ABCD - Area of two semi-circles having centres at Q and S

$$= (10 \times 10 - 2 \times \frac{1}{2} \times 3.14 \times 5^2) \text{ cm}^2 \quad [\because \text{Radius} = AP = 5 \text{ cm}]$$

$$= (100 - 3.14 \times 25) \text{ cm}^2 = (100 - 78.5) \text{ cm}^2 = 21.5 \text{ cm}^2$$

Similarly, we have

$$\text{Area of } R_2 + \text{Area of } R_4 = 21.5 \text{ cm}^2$$

$$\text{i. Area of the unshaded region} = \text{Area } R_1 + \text{Area } R_2 + \text{Area } R_3 + \text{Area } R_4$$

$$= (\text{Area } R_1 + \text{Area } R_3) + (\text{Area } R_2 + \text{Area } R_4)$$

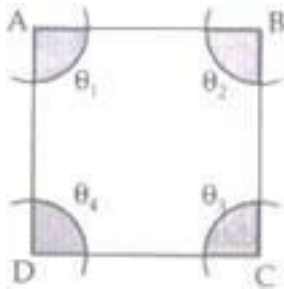
$$= 2 (21.5) \text{ cm}^2 = 43 \text{ cm}^2$$

ii. Area of the shaded region

$$= \text{Area of square ABCD} - (\text{Area of } R_1 + \text{Area of } R_2 + \text{Area of } R_3 + \text{Area of } R_4)$$

$$= (100 - 2 \times 21.5) \text{ cm}^2 = 57 \text{ cm}^2$$

18.



Specification of quadrilateral are not given, so quadrilateral may be of any shape.

As the radius of all 4 arcs are same equal to $r = 21 \text{ cm}$ but not different angles $\angle A$, $\angle B$, $\angle C$ and $\angle D$.

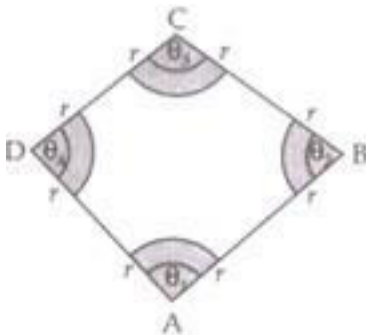
Therefore, there are four sectors of $\angle A$, $\angle B$, $\angle C$ and $\angle D$ with $r = 21 \text{ cm}$.

Therefore, Area of shaded region

$$= \frac{\pi r_1^2 (\theta_1)}{360^\circ} + \frac{\pi r_2^2 (\theta_2)}{360^\circ} + \frac{\pi r_3^2 (\theta_3)}{360^\circ} + \frac{\pi r_4^2 (\theta_4)}{360^\circ}$$

because $r_1 = r_2 = r_3 = r_4 = r$ and

$$\angle \theta_1 + \angle \theta_2 + \angle \theta_3 + \angle \theta_4 = 360^\circ \text{ [Interior } \angle \text{s of a quad.]}$$



$$\text{Therefore, Area of shaded region} = \frac{\pi r^2 (\theta_1)}{360^\circ} + \frac{\pi r^2 (\theta_2)}{360^\circ} + \frac{\pi r^2 (\theta_3)}{360^\circ} + \frac{\pi r^2 (\theta_4)}{360^\circ}$$

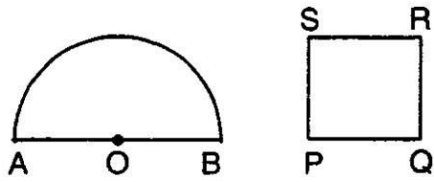
$$= \frac{\pi r^2}{360^\circ} (\theta_1 + \theta_2 + \theta_3 + \theta_4)$$

$$= \frac{\pi r^2}{360^\circ} (360^\circ)$$

$$= \pi r^2 = \frac{22}{7} \times 21 \times 21 = 22 \times 63 = 1386 \text{ cm}^2$$

Therefore, the area of shaded region = 1386 cm^2 .

19.



Let radius of semicircular region be r units.

$$\text{Perimeter} = 2r + \pi r$$

Let side of square be x units

$$\text{Perimeter} = 4x \text{ units.}$$

$$\text{A.T.Q, } 4x = 2r + \pi r \Rightarrow x = \frac{2r + \pi r}{4}$$

$$\text{Area of semicircle} = \frac{1}{2} \pi r^2$$

$$\text{Area of square} = x^2$$

$$\text{A.T.Q, } x^2 = \frac{1}{2} \pi r^2 + 4$$

$$\Rightarrow \left(\frac{2r + \pi r}{4} \right)^2 = \frac{1}{2} \pi r^2 + 4$$

$$\Rightarrow \frac{1}{16} (4r^2 + \pi^2 r^2 + 4\pi r^2) = \frac{1}{2} \pi r^2 + 4$$

$$\Rightarrow 4r^2 + \pi^2 r^2 + 4\pi r^2 = 8\pi r^2 + 64$$

$$\Rightarrow 4r^2 + \pi^2 r^2 - 4\pi r^2 = 64$$

$$\Rightarrow r^2 (4 + \pi^2 - 4\pi) = 64$$

$$\Rightarrow r^2 (\pi - 2)^2 = 64$$

$$\Rightarrow r = \sqrt{\frac{64}{(\pi - 2)^2}}$$

$$\Rightarrow r = \frac{8}{\pi - 2} = \frac{8}{\frac{22}{7} - 2} = 7 \text{ cm}$$

$$\text{Perimeter of semicircle} = 2 \times 7 + \frac{22}{7} \times 7 = 36 \text{ cm}$$

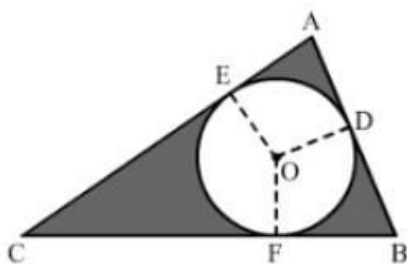
$$\text{Perimeter of square} = 36 \text{ cm}$$

$$\text{Side of square} = \frac{36}{4} = 9 \text{ cm}$$

$$\text{Area of square} = 9 \times 9 = 81 \text{ cm}^2$$

$$\text{Area of semicircle} = \frac{\pi r^2}{2} = \frac{22}{2 \times 7} \times 7 \times 7 = 77 \text{ cm}^2$$

20.



Using Pythagoras theorem for triangle ABC, we have:

$$CA^2 + AB^2 = BC^2$$

$$CA^2 = BC^2 - AB^2$$

$$CA = \sqrt{BC^2 - AB^2}$$

$$CA = \sqrt{100 - 36}$$

$$CA = \sqrt{64}$$

$$= 8 \text{ cm}$$

Now, we must find the radius of the incircle. Draw OE, OD and OF Perpendicular to AC, AB and BC respectively.

Here,

$$EO = OD \text{ (Both are radii)}$$

Because the circle is an incircle. AE and AD are tangents to the circle

$$\angle AEO = \angle ADO = 90^\circ$$

Also,

$$\angle A = 90^\circ$$

Therefore, AEOD is a square.

Thus, we can say that $AE = EO = OD = AD = r$

$$CE = CF$$

$$= 8 - r$$

$$BD = DB$$

$$= 6 - r$$

$$CF + BF = 10$$

$$\Rightarrow (8 - r) + (6 - r) = 10$$

$$\Rightarrow 14 - 2r$$

$$= 10$$

$$\Rightarrow r = 2 \text{ cm}$$

Area of the shaded portion

= Area of the triangle - Area of the circle

$$= \left(\frac{1}{2} \times 6 \times 8\right) - (\pi \times 2 \times 2)$$

$$= 24 - 12.56$$

$$= 11.44 \text{ cm}^2$$

