

Areas Related to Circles - Exercise 11.1

Exercise 11.1 with independently verified solutions.

CHAPTER

Areas Related to Circles

RESOURCE

NCERT Exercises

SOURCE

NCERT Mathematics, Reprint 2026-27

PART 1

Verified NCERT questions and solutions

Verified NCERT questions and solutions

Solutions are checked independently and follow the supplied NCERT chapter edition.

QUESTION

Question 1

area of sector

Find the area of a sector of a circle with radius 6 cm if the angle of the sector is 60° .

Solution

Board-exam working:

Given: $r = 6$ cm and $\theta = 60^\circ$.

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

$$= \frac{60^\circ}{360^\circ} \times \frac{22}{7} \times 6^2$$

$$= \frac{1}{6} \times \frac{22}{7} \times 36 = \frac{132}{7} \text{ cm}^2$$

Final answer

$$\frac{132}{7} \text{ cm}^2$$

QUESTION

Question 2

quadrant · circumference

Find the area of a quadrant of a circle whose circumference is 22 cm.

Solution

Board-exam working:

Let the radius be r cm.

$$2\pi r = 22$$

$$2 \times \frac{22}{7} \times r = 22$$

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

A quadrant is one-fourth of a circle.

$$A = \frac{1}{4}\pi r^2$$

$$= \frac{1}{4} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^2$$

$$= \frac{77}{8} \text{ cm}^2 = 9.625 \text{ cm}^2$$

Final answer

$$\boxed{\frac{77}{8} \text{ cm}^2}$$

QUESTION

Question 3

clock · area swept

The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand in 5 minutes.

Solution

Board-exam working:

The minute hand turns through 360° in 60 minutes.

$$\theta = \frac{5}{60} \times 360^\circ = 30^\circ$$

The swept area is a sector of radius 14 cm.

$$A = \frac{30^\circ}{360^\circ} \times \frac{22}{7} \times 14^2$$

$$= \frac{1}{12} \times \frac{22}{7} \times 196$$

$$= \frac{154}{3} \text{ cm}^2 \approx 51.33 \text{ cm}^2$$

Final answer

$$\frac{154}{3} \text{ cm}^2 \approx 51.33 \text{ cm}^2$$

QUESTION

Question 4

minor segment · major sector

A chord of a circle of radius 10 cm subtends a right angle at the centre. Find the area of the corresponding: (i) minor segment, (ii) major sector. Use $\pi = 3.14$.

Solution

Board-exam working:

Given: $r = 10 \text{ cm}$ and $\theta = 90^\circ$.

(i) Area of the 90° sector:

$$A_{\text{sector}} = \frac{90^\circ}{360^\circ} \times 3.14 \times 10^2 = 78.5 \text{ cm}^2$$

The two radii form a right triangle whose perpendicular sides are 10 cm each.

$$A_{\text{triangle}} = \frac{1}{2} \times 10 \times 10 = 50 \text{ cm}^2$$

$$A_{\text{minor segment}} = 78.5 - 50 = 28.5 \text{ cm}^2$$

(ii) The angle of the major sector is:

$$360^\circ - 90^\circ = 270^\circ$$

$$A_{\text{major sector}} = \frac{270^\circ}{360^\circ} \times 3.14 \times 10^2$$

$$= 235.5 \text{ cm}^2$$

Final answer

(i) 28.5 cm^2 , (ii) 235.5 cm^2

QUESTION

Question 5

arc length · sector · segment

In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. Find:
(i) the length of the arc, (ii) the area of the sector formed by the arc, (iii) the area of the segment formed by the corresponding chord.

Solution

Board-exam working:

Given: $r = 21 \text{ cm}$ and $\theta = 60^\circ$.

(i) Length of the arc:

$$l = \frac{60^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 21$$

$$= \frac{1}{6} \times 132 = 22 \text{ cm}$$

(ii) Area of the sector:

$$A_{\text{sector}} = \frac{60^\circ}{360^\circ} \times \frac{22}{7} \times 21^2$$

$$= \frac{1}{6} \times 1386 = 231 \text{ cm}^2$$

(iii) The triangle formed by the two radii and chord has all angles 60° , so it is equilateral with side 21 cm.

$$A_{\text{triangle}} = \frac{\sqrt{3}}{4} \times 21^2 = \frac{441\sqrt{3}}{4} \text{ cm}^2$$

$$A_{\text{segment}} = A_{\text{sector}} - A_{\text{triangle}}$$

$$= 231 - \frac{441\sqrt{3}}{4} \text{ cm}^2$$

Final answer

$$(i) 22 \text{ cm}, \quad (ii) 231 \text{ cm}^2, \quad (iii) 231 - \frac{441\sqrt{3}}{4} \text{ cm}^2$$

QUESTION

Question 6

minor segment · major segment

A chord of a circle of radius 15 cm subtends an angle of 60° at the centre. Find the areas of the corresponding minor and major segments. Use $\pi = 3.14$ and $\sqrt{3} = 1.73$.

Solution

Board-exam working:

Given: $r = 15 \text{ cm}$ and $\theta = 60^\circ$.

Area of the 60° sector:

$$\begin{aligned} A_{\text{sector}} &= \frac{60^\circ}{360^\circ} \times 3.14 \times 15^2 \\ &= \frac{1}{6} \times 3.14 \times 225 = 117.75 \text{ cm}^2 \end{aligned}$$

The triangle formed is equilateral with side 15 cm .

$$\begin{aligned} A_{\text{triangle}} &= \frac{\sqrt{3}}{4} \times 15^2 \\ &= \frac{1.73}{4} \times 225 = 97.3125 \text{ cm}^2 \end{aligned}$$

Area of the minor segment:

$$A_{\text{minor}} = 117.75 - 97.3125 = 20.4375 \text{ cm}^2$$

$$A_{\text{minor}} \approx 20.44 \text{ cm}^2$$

Area of the circle:

$$A_{\text{circle}} = 3.14 \times 15^2 = 706.5 \text{ cm}^2$$

Area of the major segment:

$$A_{\text{major}} = 706.5 - 20.4375 = 686.0625 \text{ cm}^2$$

$$A_{\text{major}} \approx 686.06 \text{ cm}^2$$

Final answer

$$A_{\text{minor}} \approx 20.44 \text{ cm}^2, \quad A_{\text{major}} \approx 686.06 \text{ cm}^2$$

QUESTION

Question 7

area of segment · 120 degree sector

A chord of a circle of radius 12 cm subtends an angle of 120° at the centre. Find the area of the corresponding segment. Use $\pi = 3.14$ and $\sqrt{3} = 1.73$.

Solution

Board-exam working:

Given: $r = 12$ cm and $\theta = 120^\circ$.

Area of the 120° sector:

$$\begin{aligned}A_{\text{sector}} &= \frac{120^\circ}{360^\circ} \times 3.14 \times 12^2 \\&= \frac{1}{3} \times 3.14 \times 144 = 150.72 \text{ cm}^2\end{aligned}$$

Drop a perpendicular from the centre to the chord. The triangle splits into two congruent right triangles.

$$\begin{aligned}A_{\text{triangle}} &= \frac{1}{2} r^2 \sin 120^\circ \\&= \frac{1}{2} \times 12^2 \times \frac{\sqrt{3}}{2} \\&= 36\sqrt{3} = 36 \times 1.73 = 62.28 \text{ cm}^2\end{aligned}$$

Therefore, area of the segment:

$$A_{\text{segment}} = 150.72 - 62.28 = 88.44 \text{ cm}^2$$

Final answer

$$88.44 \text{ cm}^2$$

QUESTION

Question 8

grazing area · quadrant

A horse is tied to a peg at one corner of a square-shaped grass field of side 15 m by a 5 m long rope, as shown in Figure 11.8. Find: (i) the area of the part of the field in which the horse can graze, (ii) the increase in grazing area if the rope were 10 m long instead of 5 m. Use $\pi = 3.14$.

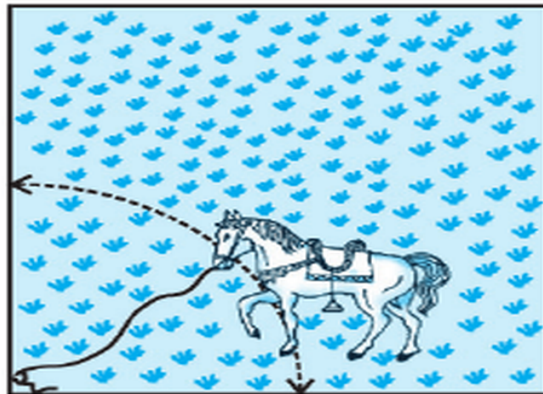


Fig. 11.8

Figure 11-8 from the supplied NCERT chapter.

Solution

Board-exam working:

The peg is at a corner, so the grazing region is a quadrant.

(i) For a 5 m rope:

$$A_5 = \frac{1}{4}\pi r^2$$

$$= \frac{1}{4} \times 3.14 \times 5^2 = 19.625 \text{ m}^2$$

(ii) For a 10 m rope:

$$A_{10} = \frac{1}{4} \times 3.14 \times 10^2 = 78.5 \text{ m}^2$$

Increase in grazing area:

$$A_{10} - A_5 = 78.5 - 19.625 = 58.875 \text{ m}^2$$

Final answer

(i) 19.625 m^2 , (ii) 58.875 m^2

QUESTION

Question 9

brooch · circumference · equal sectors

A brooch is made with silver wire in the form of a circle of diameter 35 mm. The wire is also used in making 5 diameters which divide the circle into 10 equal sectors, as shown in Figure 11.9. Find: (i) the total length of silver wire required, (ii) the area of each sector of the brooch.

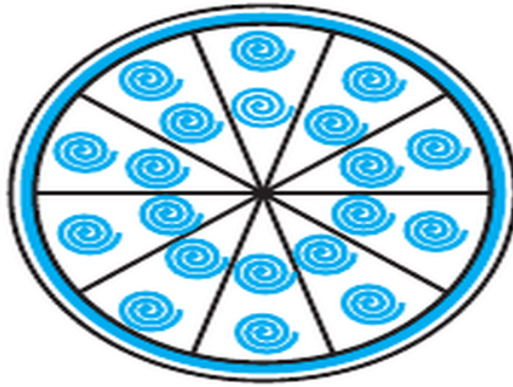


Fig. 11.9

Figure 11-9 from the supplied NCERT chapter.

Solution

Board-exam working:

Given: diameter $d = 35$ mm, so radius $r = 17.5$ mm.

(i) Length of wire used for the circumference:

$$C = \pi d = \frac{22}{7} \times 35 = 110 \text{ mm}$$

Length of wire used for 5 diameters:

$$5d = 5 \times 35 = 175 \text{ mm}$$

Total wire required:

$$110 + 175 = 285 \text{ mm}$$

(ii) Area of the circle:

$$A = \pi r^2 = \frac{22}{7} \times 17.5^2 = 962.5 \text{ mm}^2$$

The 5 diameters form 10 equal sectors.

$$A_{\text{onesector}} = \frac{962.5}{10} = 96.25 \text{ mm}^2$$

Final answer

(i) 285 mm, (ii) 96.25 mm²

QUESTION

Question 10

umbrella · equal sectors

An umbrella has 8 ribs which are equally spaced, as shown in Figure 11.10. Assuming the umbrella to be a flat circle of radius 45 cm, find the area between two consecutive ribs.

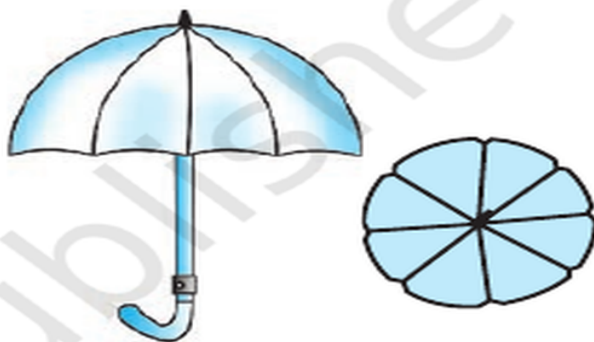


Fig. 11.10

Figure 11-10 from the supplied NCERT chapter.

Solution

Board-exam working:

Eight equally spaced ribs divide the circle into 8 equal sectors.

$$\theta = \frac{360^\circ}{8} = 45^\circ$$

Area between two consecutive ribs:

$$A = \frac{45^\circ}{360^\circ} \times \frac{22}{7} \times 45^2$$

$$= \frac{1}{8} \times \frac{22}{7} \times 2025$$

$$= \frac{22275}{28} \text{ cm}^2$$

$$\approx 795.54 \text{ cm}^2$$

Final answer

$$\frac{22275}{28} \text{ cm}^2 \approx 795.54 \text{ cm}^2$$

QUESTION

Question 11

car wipers · sector area

A car has two wipers which do not overlap. Each wiper has a blade of length 25 cm sweeping through an angle of 115° . Find the total area cleaned at each sweep of the blades.

Solution

Board-exam working:

Each wiper cleans a sector of radius 25 cm and angle 115° .

Area cleaned by one wiper:

$$A_1 = \frac{115^\circ}{360^\circ} \times \frac{22}{7} \times 25^2$$

Since the two swept regions do not overlap:

$$\begin{aligned}A_{total} &= 2A_1 \\&= 2 \times \frac{115}{360} \times \frac{22}{7} \times 625 \\&= \frac{158125}{126} \text{ cm}^2 \\&\approx 1254.96 \text{ cm}^2\end{aligned}$$

Final answer

$$\frac{158125}{126} \text{ cm}^2 \approx 1254.96 \text{ cm}^2$$

QUESTION

Question 12

lighthouse · sector area

To warn ships of underwater rocks, a lighthouse spreads a red-coloured light over a sector of angle 80° to a distance of 16.5 km. Find the area of the sea over which the ships are warned. Use $\pi = 3.14$.

Solution

Board-exam working:

The warned region is a sector with radius 16.5 km and angle 80° .

$$A = \frac{80^\circ}{360^\circ} \times 3.14 \times 16.5^2$$

$$= \frac{2}{9} \times 3.14 \times 272.25$$

$$= 189.97 \text{ km}^2$$

Final answer

$$189.97 \text{ km}^2$$

QUESTION

Question 13

table cover · regular hexagon · cost

A round table cover has six equal designs as shown in Figure 11.11. If the radius of the cover is 28 cm, find the cost of making the designs at ₹0.35 per cm^2 . Use $\sqrt{3} = 1.7$.

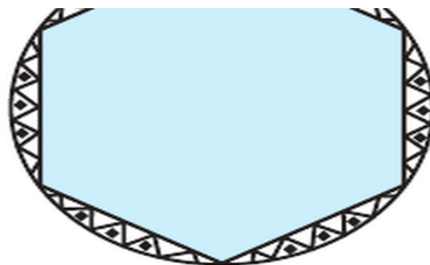


Fig. 11.11

Figure 11-11 from the supplied NCERT chapter.

Solution

Board-exam working:

The six radii form a regular hexagon inside the circle. Each of its six triangles is equilateral with side 28 cm.

Area of the circle:

$$A_{circle} = \pi r^2 = \frac{22}{7} \times 28^2 = 2464 \text{ cm}^2$$

Area of one equilateral triangle:

$$A_1 = \frac{\sqrt{3}}{4} a^2$$

$$= \frac{1.7}{4} \times 28^2 = 333.2 \text{ cm}^2$$

Area of the regular hexagon:

$$A_{hexagon} = 6 \times 333.2 = 1999.2 \text{ cm}^2$$

Total area of the six designs:

$$A_{designs} = 2464 - 1999.2 = 464.8 \text{ cm}^2$$

Cost at ₹0.35 per cm²:

$$Cost = 464.8 \times 0.35 = \text{Rs. } 162.68$$

Final answer

₹162.68

QUESTION

Question 14

multiple choice · area of sector

Tick the correct answer. The area of a sector of angle p (in degrees) of a circle with radius R is: (A) $p/180 \times 2\pi R$, (B) $p/180 \times \pi R^2$, (C) $p/360 \times 2\pi R$, (D) $p/720 \times 2\pi R^2$.

Solution

Board-exam working:

The area of a full circle is πR^2 and its angle is 360° .

Therefore, the area of a sector of angle p is:

$$A = \frac{p}{360} \times \pi R^2$$

Rewrite this to match the options:

$$\frac{p}{360} \times \pi R^2 = \frac{p}{720} \times 2\pi R^2$$

This is option (D).

Final answer

$$\text{Option (D): } \frac{p}{720} \times 2\pi R^2$$