CLASS 10 · MATHEMATICS · CHAPTER 11

Areas Related to Circles - Exercise 11.1

Exercise 11.1 with independently verified solutions.

CHAPTER	RESOURCE	SOURCE
Areas Related to Circles	NCERT Exercises	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

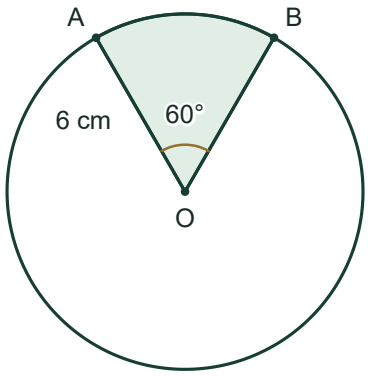
Question 1

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:



Shaded sector between OA and OB

Sector of angle 60° — solution sketch (not to scale).

Given: r = 6 cm and θ = 60°.

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

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

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

Final answer

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

QUESTION

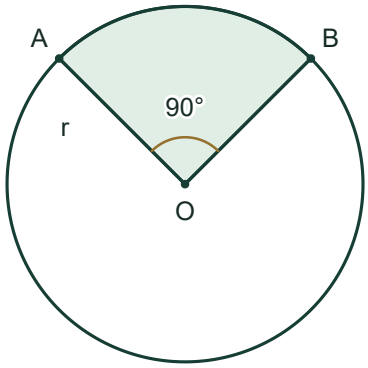
Question 2

quadrant · circumference

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

Solution

Board-exam working:



Shaded sector between OA and OB

Quadrant: one-fourth of a circle — solution sketch (not to scale).

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

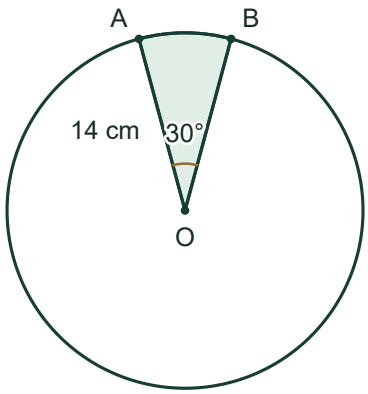
Question 3

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:



Shaded sector between OA and OB

Minute hand sweeps 30° in five minutes — solution sketch (not to scale).

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

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

QUESTION

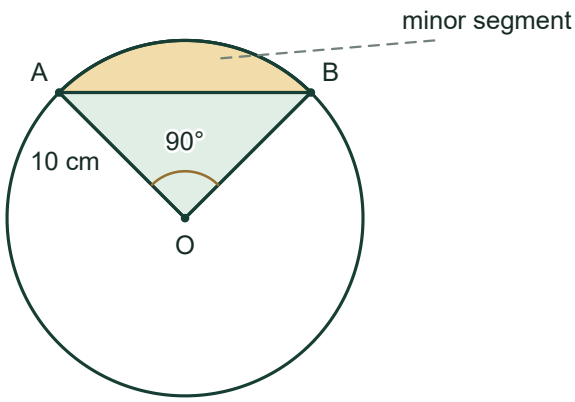
Question 4

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 π = 3.14.

Solution

Board-exam working:



Segment = sector − triangle AOB

Minor segment and 270° major sector — solution sketch (not to scale).

Given: r = 10 cm and θ = 90°.

(i) Area of the 90° sector:

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

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

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

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

(ii) The angle of the major sector is:

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

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

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

Final answer

$$\text{(i) } 28.5 \text{ cm}^2, \qquad \text{(ii) } 235.5 \text{ cm}^2$$

QUESTION

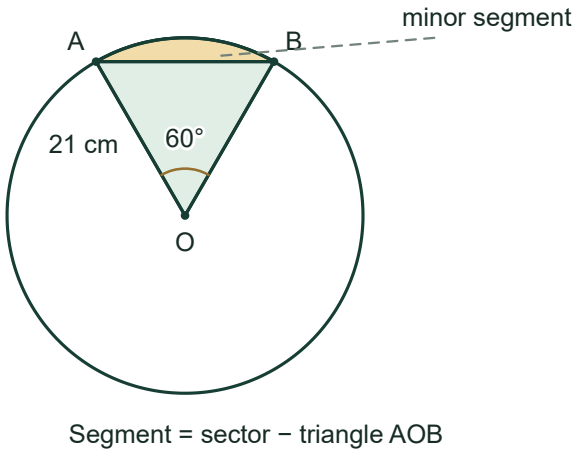
Question 5

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:



Sector and circular segment — solution sketch (not to scale).

Given: r = 21 cm and θ = 60°.

(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:

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

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

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

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

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

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

Final answer

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

QUESTION

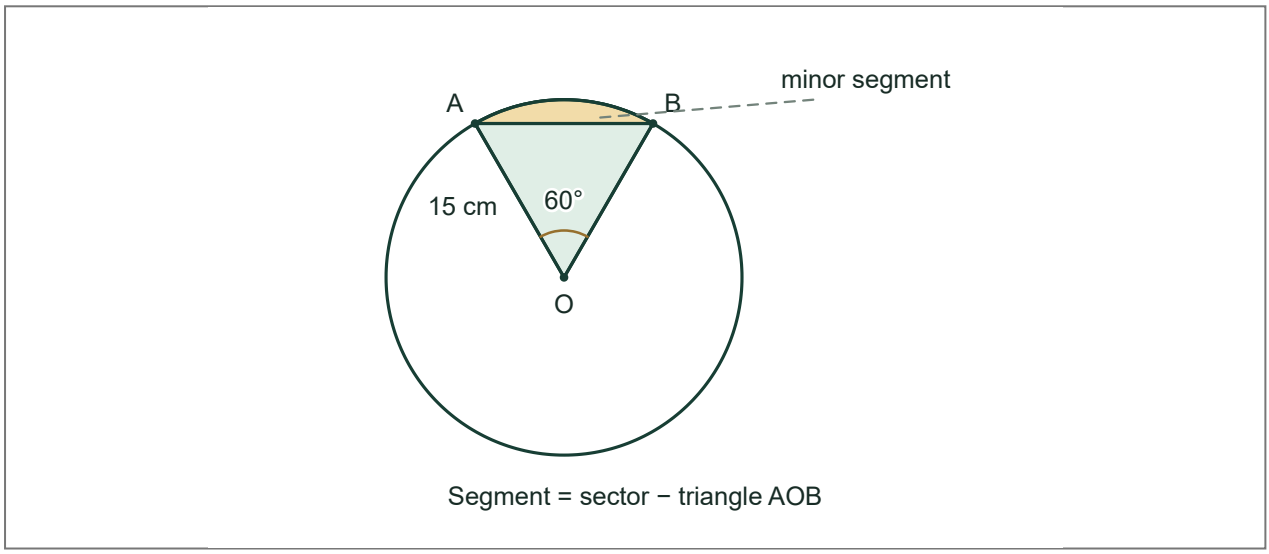
Question 6

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 π = 3.14 and √3 = 1.73.

Solution

Board-exam working:



Minor and major circular segments — solution sketch (not to scale).

Given: r = 15 cm and θ = 60°.

Area of the 60° sector:

$$A_{sector} = \frac{60^\circ}{360^\circ} \times 3.14 \times 15^2$$

$$= \frac{1}{6} \times 3.14 \times 225 = 117.75 \text{ cm}^2$$

The triangle formed is equilateral with side 15 cm.

$$A_{triangle} = \frac{\sqrt{3}}{4} \times 15^2$$

$$= \frac{1.73}{4} \times 225 = 97.3125 \text{ cm}^2$$

Area of the minor segment:

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

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

Area of the circle:

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

Area of the major segment:

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

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

Final answer

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

QUESTION

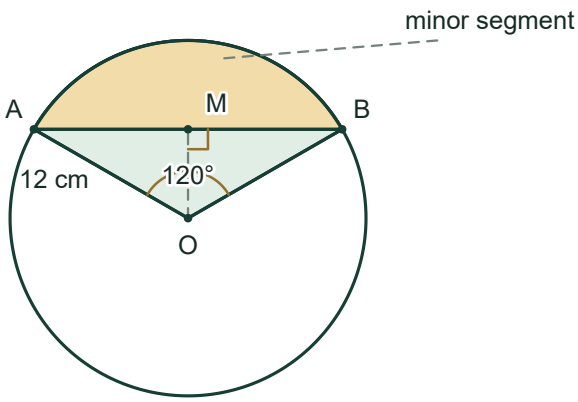
Question 7

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 π = 3.14 and √3 = 1.73.

Solution

Board-exam working:



Segment = sector − triangle AOB

Sector and circular segment — solution sketch (not to scale).

Given: r = 12 cm and θ = 120°.

Area of the 120° sector:

$$A_{sector} = \frac{120^\circ}{360^\circ} \times 3.14 \times 12^2$$

$$= \frac{1}{3} \times 3.14 \times 144 = 150.72 \text{ cm}^2$$

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

$$A_{triangle} = \frac{1}{2} r^2 \sin 120^\circ$$

$$= \frac{1}{2} \times 12^2 \times \frac{\sqrt{3}}{2}$$

$$= 36\sqrt{3} = 36 \times 1.73 = 62.28 \text{ cm}^2$$

Therefore, area of the segment:

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

Final answer

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

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 π = 3.14.

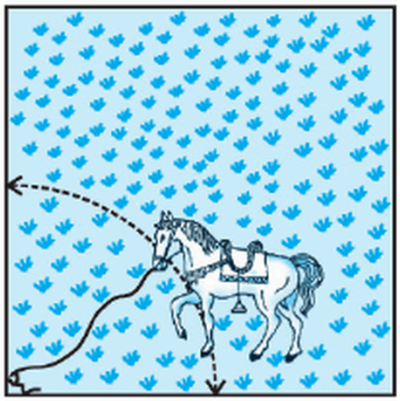


Fig. 11.8

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

$$\text{(i) } 19.625 \text{ m}^2, \qquad \text{(ii) } 58.875 \text{ m}^2$$

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.

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

Final answer

$$\text{(i) } 285 \text{ mm}, \qquad \text{(ii) } 96.25 \text{ mm}^2$$

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

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

QUESTION

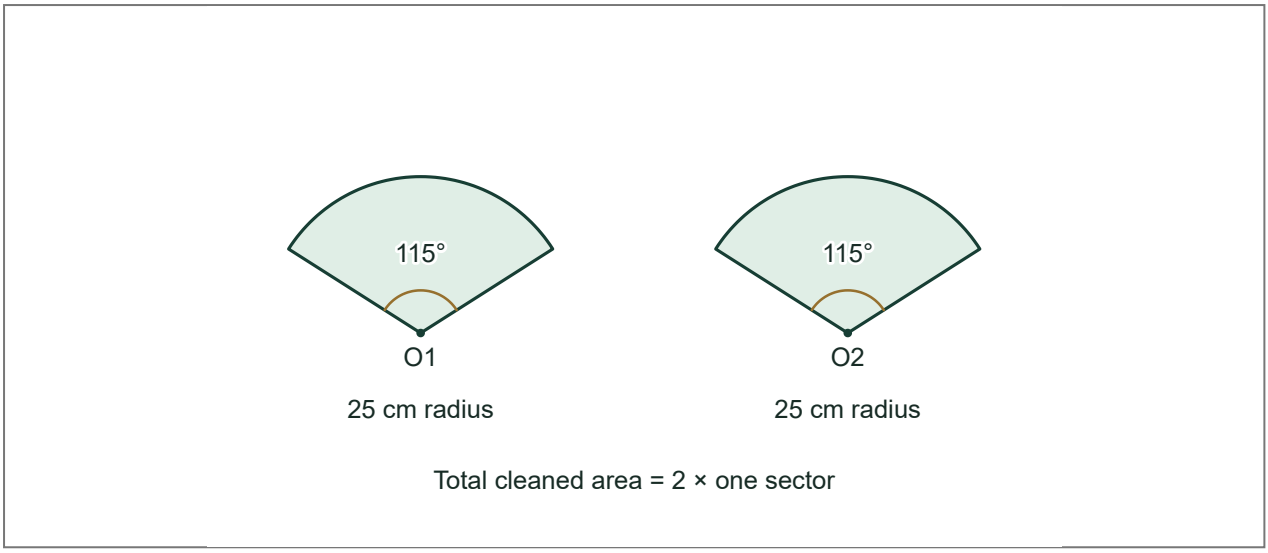
Question 11

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:



Two non-overlapping wiper sectors — solution sketch (not to scale).

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:

$$A_{total} = 2A_1$$

$$= 2 \times \frac{115}{360} \times \frac{22}{7} \times 625$$

$$= \frac{158125}{126}\ \text{cm}^2$$

$$\approx 1254.96\ \text{cm}^2$$

Final answer

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

QUESTION

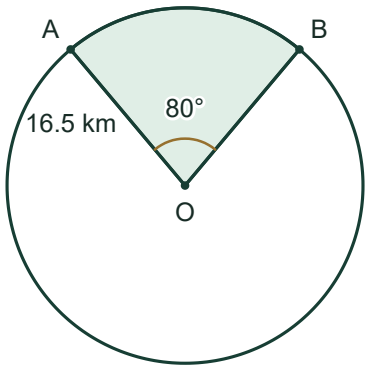
Question 12

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 π = 3.14.

Solution

Board-exam working:



Shaded sector between OA and OB

Lighthouse warning sector — solution sketch (not to scale).

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

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

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 cm². Use √3 = 1.7.

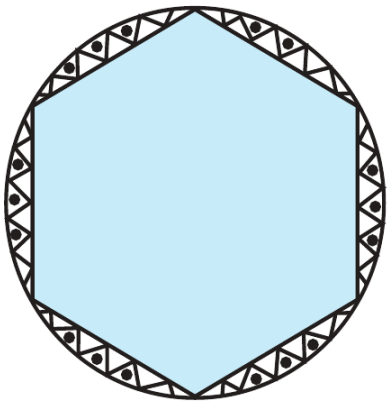


Fig. 11.11

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

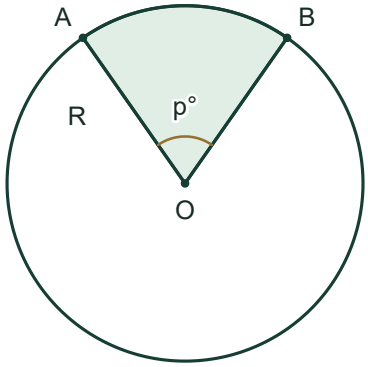
Question 14

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 × 2πR, (B) p/180 × πR², (C) p/360 × 2πR, (D) p/720 × 2πR².

Solution

Board-exam working:



Shaded sector between OA and OB

Sector of general angle p° — solution sketch (not to scale).

The area of a full circle is πR² 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

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