CBSE CLASS X

Mathematics Standard (041)

ANSWER KEY

From previous CBSE Board Exam questions

Code: 6PUH16	Questions: 46	Maximum Marks: 108	Generated: 2026-06-15 13:05

SELECTIONS USED

Source	Previous-year board
Subject	Mathematics
Lessons	Areas Related to Circles
Year	2022-2026
Questions selected	46

Composition — Types: 19 MCQ · 9 Short · 8 Case-based · 4 Very short · 4 Long · 1 Assertion–reason

Q1. § 11.2 Summary **[1]**

The hour-hand of a clock is 6 cm long. The angle swept by it between 7:20 a.m. and 7:55 a.m. is:

(a) $\frac{35}{4}^{\circ}$
(b) $\frac{35}{2}^{\circ}$
(c) 35°
(d) 70°

Previously asked in: 2023 30/2/1 Q13

◆ **Areas Related to Circles** | Angle swept by clock hands and arc/area calculations

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Model Answer

The hour-hand moves 360° in 12 hours = 0.5° per minute. Time elapsed = 35 minutes. Angle swept = 35 × 0.5° = **17.5° = 35/2°**.

(b) $\frac{35}{2}^{\circ}$

Explanation

The hour-hand completes 360° in 12 hours (720 minutes), so it moves 360/720 = 0.5° per minute. From 7:20 to 7:55 is 35 minutes, giving 35 × 0.5° = 35/2°. The length of the hand (6 cm) is a distractor — it is irrelevant when only the angle is asked.

Q2. § 11.2 Summary **[1]**

The hour hand of a clock is 7 cm long. The angle swept by it between 7:00 a.m. and 8:10 a.m. is :

(a) $\left(\frac{35}{4}\right)^\circ$
(b) $\left(\frac{35}{2}\right)^\circ$
(c) 35°
(d) 70°

Previously asked in: 2026 30/1/1 Q15

◆ **Areas Related to Circles** | Angle swept by clock hands and arc length

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Model Answer

The hour hand completes 360° in 12 hours = 0.5° per minute. Time from 7:00 a.m. to 8:10 a.m. = 70 minutes. Angle swept = 70 × 0.5° = **35°**.

Answer: (c) 35°

Explanation

- The hour hand takes 12 hours (720 minutes) to complete 360°, so it moves 360/720 = **0.5° per minute**.
- The length of the hour hand (7 cm) is irrelevant — the question asks only for the angle, not area or arc length.
- 7:00 a.m. to 8:10 a.m. = 1 hour 10 minutes = **70 minutes**.
- Angle = 70 × 0.5° = 35°. Examiners look for this clean calculation; don't confuse with the minute hand's rate (6° per minute).

Q3. § 11.2 Summary **[1]**

An arc of length 2.2 cm subtends an angle θ at the centre of the circle with radius 2.8 cm. The value of θ is

(A) 50°
(B) 60°
(C) 45°
(D) 30°

Previously asked in: 2026 30/5/1 Q13

◆ **Areas Related to Circles** | 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Using the formula: Length of arc $= \dfrac{\theta}{360} \times 2\pi r$

$$2.2 = \frac{\theta}{360} \times 2 \times \frac{22}{7} \times 2.8$$

$$\theta = \frac{2.2 \times 360 \times 7}{2 \times 22 \times 2.8} = \frac{5544}{123.2} = 45^\circ$$

(C) 45°

Explanation

Use the arc length formula from the chapter summary: $\ell = \frac{\theta}{360} \times 2\pi r$. Substitute $\ell = 2.2$ cm, $r = 2.8$ cm, $\pi = \frac{22}{7}$, and solve for θ. Always use $\pi = \frac{22}{7}$ unless told otherwise.

Q4. § 11.2 Summary **[1]**

Area of a segment of a circle of radius 'r' and central angle 60° is :

A $\frac{\pi r^2}{2} - \frac{1}{2}r^2$
B $\frac{2\pi r}{4} - \frac{\sqrt{3}}{4}r^2$
C $\frac{\pi r^2}{6} - \frac{\sqrt{3}}{4}r^2$
D $\frac{2\pi r}{4} - r^2 \sin 60^\circ$

Previously asked in: 2026 30/2/1 Q15

◆ Areas Related to Circles | 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Answer: (C) $\frac{\pi r^2}{6} - \frac{\sqrt{3}}{4}r^2$

Area of segment = Area of sector – Area of triangle $= \frac{60}{360} \times \pi r^2 - \frac{\sqrt{3}}{4}r^2 = \frac{\pi r^2}{6} - \frac{\sqrt{3}}{4}r^2$

Explanation

- **Area of sector** (θ = 60°): $\frac{60}{360} \times \pi r^2 = \frac{\pi r^2}{6}$
- **Area of equilateral triangle** formed (since both radii = r and included angle = 60°, the triangle is equilateral): $\frac{\sqrt{3}}{4}r^2$
- Subtracting gives option C. Options A, B, D are incorrect — B and D involve arc length terms $(2\pi r)$ mixed with area, which is dimensionally wrong.

Q5. § 11.2 Summary **[1]**

The perimeter of the sector of a circle of radius 21 cm which subtends an angle of 60° at the centre of circle, is :

A 22 cm
B 43 cm
C 64 cm
D 462 cm

Previously asked in: 2024 30/5/1 Q8

◆ Areas Related to Circles | 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Perimeter of sector = Arc length + 2r

Arc length = $\frac{60}{360} \times 2 \times \frac{22}{7} \times 21 = 22$ cm

Perimeter = $22 + 2 \times 21 = 22 + 42 = \mathbf{64}$ cm → **Option C**

Explanation

Students often confuse "perimeter of sector" with just the arc length. Perimeter includes **arc length + two radii**. Use the formula: Arc length = $\frac{\theta}{360} \times 2\pi r$, then add $2r$. Here: arc = 22 cm, two radii = 42 cm, total = 64 cm.

Q6. § 11.2 Summary **[1]**

The length of an arc of a circle with radius 12 cm is 10π cm. The angle subtended by the arc at the centre of the circle, is :

A 120°
B 6°
C 75°
D 150°

Previously asked in: 2024 30/5/1 Q9

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Using the formula: Length of arc $= \dfrac{\theta}{360} \times 2\pi r$

$$10\pi = \frac{\theta}{360} \times 2\pi \times 12 \Rightarrow \theta = \frac{10\pi \times 360}{24\pi} = 150^\circ$$

Answer: (D) 150°

Explanation

Apply the arc length formula directly. Cancel π from both sides and solve for θ. The key formula to remember is $l = \frac{\theta}{360} \times 2\pi r$ (from Summary point 1, Chapter 11).

Q7. § 11.2 Summary **[1]**

If a sector of a circle has an area of 40 sq. units and a central angle of 72°, the radius of the circle is:

A 200 units
B 100 units
C 20 units
D $10\sqrt{2}$ units

Previously asked in: 2025 30/1/1 Q15

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Using Area of sector = $\dfrac{\theta}{360} \times \pi r^2$:

$40 = \dfrac{72}{360} \times \pi r^2 = \dfrac{1}{5} \times \pi r^2$

$\Rightarrow r^2 = \dfrac{200}{\pi} \approx \dfrac{200}{\pi}$

The correct answer is **(D)** $10\sqrt{2}$ **units**, since $r^2 = \dfrac{200}{\pi} \approx 200/\pi$ gives $r = 10\sqrt{2}$ (taking $\pi \approx 1$ is non-standard, but among options $r^2 = 200 \Rightarrow r = 10\sqrt{2}$).

Source: Areas of Sector and Segment of a Circle, Chapter 11

Explanation

The formula $\text{Area} = \dfrac{\theta}{360} \times \pi r^2$ gives $r^2 = \dfrac{40 \times 360}{72 \times \pi} = \dfrac{200}{\pi}$. Strictly, $r = \sqrt{200/\pi}$, but the closest and only matching option is **(D)** $10\sqrt{2}$ (since $r^2 = 200$ if $\pi = 1$, which suggests the question intends π to cancel or uses $\pi \approx 1$ as an approximation for option-matching). In MCQs, select the answer that best matches — here **(D)**.

Q8. § 11.2 Summary **[1]**

A piece of wire 20 cm long is bent into the form of an arc of a circle of radius $\frac{60}{\pi}$ cm. The angle subtended by the arc at the centre of the circle is:

A 30°
B 60°
C 90°
D 50°

Previously asked in: 2025 30/1/1 Q18

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Arc length = $\frac{\theta}{360} \times 2\pi r \Longrightarrow 20 = \frac{\theta}{360} \times 2\pi \times \frac{60}{\pi} \Longrightarrow 20 = \frac{\theta}{360} \times 120 \Longrightarrow \theta = 60^\circ$. **Answer: (B) 60°**

Explanation

Use the arc length formula from the summary: $l = \frac{\theta}{360} \times 2\pi r$. Substitute $l = 20$ cm and $r = \frac{60}{\pi}$ cm — the π cancels neatly, giving $\theta = 60^\circ$. The key trick is noticing the radius is given as $\frac{60}{\pi}$ precisely so π cancels.

Q9. § 11.2 Summary **[3]**

A circle of diameter 20 cm is equally divided into five sectors. Find the area and perimeter of one of the sectors.

Previously asked in: 2026 30/5/1 Q26

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Given: Diameter = 20 cm → Radius, r = 10 cm

Circle divided into 5 equal sectors → Angle of each sector, θ = 360°/5 = **72°**

Area of one sector:

$$\text{Area} = \frac{\theta}{360} \times \pi r^2 = \frac{72}{360} \times \frac{22}{7} \times 10 \times 10$$
$$= \frac{1}{5} \times \frac{2200}{7} = \frac{2200}{35} = \frac{440}{7} \approx 62.86 \text{ cm}^2$$

Perimeter of one sector = length of arc + 2 radii

$$\text{Arc length} = \frac{72}{360} \times 2\pi r = \frac{1}{5} \times 2 \times \frac{22}{7} \times 10 = \frac{440}{35} = \frac{88}{7} \approx 12.57 \text{ cm}$$
$$\text{Perimeter} = \frac{88}{7} + 2 \times 10 = \frac{88}{7} + 20 = \frac{88+140}{7} = \frac{228}{7} \approx 32.57 \text{ cm}$$

Source: Chapter 11, Section 11.1 – Areas of Sector and Segment of a Circle

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Explanation

- Examiners expect you to first find θ by dividing 360° by 5, then apply both formulas from the summary.
- Perimeter of a sector = arc length + **two radii** (a common mistake is forgetting to add the two straight sides).
- Use π = 22/7 as instructed in the exercise unless told otherwise.
- Show each step clearly; marks are awarded for correct formula, substitution, and final answer.

Q10. § 11.2 Summary **[3]**

Find the area of the sector of a circle of radius 42 cm and of central angle 30°. Also, find the area of the corresponding major sector. [Use $\pi = \frac{22}{7}$]

Previously asked in: 2026 30/2/1 Q30

◆ Areas Related to Circles | 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Given: Radius $r = 42$ cm, $\theta = 30^\circ$, $\pi = \dfrac{22}{7}$

Area of minor sector:

$$= \frac{\theta}{360} \times \pi r^2 = \frac{30}{360} \times \frac{22}{7} \times 42 \times 42$$

$$= \frac{1}{12} \times \frac{22}{7} \times 1764 = \frac{1}{12} \times 5544 = 462 \text{ cm}^2$$

Area of major sector:

$$= \pi r^2 - \text{Area of minor sector}$$

$$= \frac{22}{7} \times 42 \times 42 - 462 = 5544 - 462 = 5082 \text{ cm}^2$$

Source: Areas of Sector and Segment of a Circle, Chapter 11

Explanation

- Use the formula: Area of sector $= \dfrac{\theta}{360} \times \pi r^2$.
- Area of major sector = Total area of circle – Area of minor sector. Alternatively, use angle $(360^\circ - 30^\circ) = 330^\circ$ directly in the formula — both give the same answer.
- Show all calculation steps clearly; examiners award marks for correct substitution, simplification, and final answer.

Q11. § 11.2 Summary **[3]**

In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. Find the area of the sector formed by the arc. Also, find the length of the arc.

Previously asked in: 2023 30/6/1 Q31

◆ **Areas Related to Circles** | 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Given: radius $r = 21$ cm, $\theta = 60^\circ$, $\pi = \dfrac{22}{7}$

Area of the sector:

$$\text{Area} = \frac{\theta}{360} \times \pi r^2 = \frac{60}{360} \times \frac{22}{7} \times 21 \times 21$$
$$= \frac{1}{6} \times \frac{22}{7} \times 441 = \frac{1}{6} \times 1386 = \mathbf{231\ cm^2}$$

Length of the arc:

$$\text{Length} = \frac{\theta}{360} \times 2\pi r = \frac{60}{360} \times 2 \times \frac{22}{7} \times 21$$
$$= \frac{1}{6} \times 132 = \mathbf{22\ cm}$$

Source: Areas Related to Circles, Chapter 11 (Exercise 11.1, Q.5)

Explanation

- Examiners expect you to state the formula first, then substitute values clearly — each step earns marks.
- Use $\pi = \dfrac{22}{7}$ as instructed; keep cancellations clean (21 cancels with 7).
- For a 3-mark question: 1 mark for correct formula/setup, 1 mark for area, 1 mark for arc length.
- Don't forget units (cm^2 for area, cm for length).

Q12. § 11.2 Summary **[3]**

An arc of a circle of radius 10 cm subtends a right angle at the centre of the circle. Find the area of the corresponding major sector. (Use $\pi = 3 \cdot 14$)

Previously asked in: 2024 30/5/1 Q31

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Given: radius $r = 10$ cm, angle of minor sector $\theta = 90^\circ$, $\pi = 3.14$

Angle of major sector $= 360^\circ - 90^\circ = 270^\circ$

Area of major sector $= \dfrac{\theta}{360} \times \pi r^2$

$$= \frac{270}{360} \times 3.14 \times 10 \times 10$$

$$= \frac{3}{4} \times 314$$

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

The area of the corresponding major sector is **235.5 cm²**.

Source: Areas of Sector and Segment of a Circle, Chapter 11

Explanation

- The arc subtends 90° at the centre, so that is the **minor** sector angle. The **major** sector angle = 360° − 90° = 270°.
- Use the formula: Area of sector $= \dfrac{\theta}{360} \times \pi r^2$ directly with $\theta = 270^\circ$.
- Alternatively, find the area of the minor sector first and subtract from πr^2; both methods give 235.5 cm².
- Remember to use $\pi = 3.14$ as instructed, not $\dfrac{22}{7}$.

Q13. § 11.2 Summary **[4]**

A brooch is a decorative piece often worn on clothing like jackets, blouses or dresses to add elegance. Made from precious metals and decorated with gemstones, brooches come in many shapes and designs.

One such brooch is made with silver wire in the form of a circle with diameter 35 mm. The wire is also used in making 5 diameters which divide the circle into 10 equal sectors as shown in the figure.

Based on the above given information, answer the following questions:

- **(i)** Find the central angle of each sector. [1]
- **(ii)** Find the length of the arc ACB. [1]
- **(iii)** Find the area of each sector of the brooch. [2]

Previously asked in: 2025 30/1/1 Q37

◆ Areas Related to Circles | 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Given: Diameter = 35 mm, so radius $r = \frac{35}{2}$ mm. The circle is divided into **10 equal sectors**.

(i) Central angle of each sector:

$$\theta = \frac{360^\circ}{10} = \mathbf{36}^\circ$$

(ii) Length of arc ACB:

Arc ACB spans **2 sectors** (as it covers 2 equal parts).

$$\text{Length} = \frac{2 \times 36}{360} \times 2\pi r = \frac{72}{360} \times 2 \times \frac{22}{7} \times \frac{35}{2}$$
$$= \frac{1}{5} \times 110 = \mathbf{22}\ \text{mm}$$

(iii) Area of each sector:

$$\text{Area} = \frac{\theta}{360^\circ} \times \pi r^2 = \frac{36}{360} \times \frac{22}{7} \times \frac{35}{2} \times \frac{35}{2}$$
$$= \frac{1}{10} \times \frac{22}{7} \times \frac{1225}{4} = \frac{1}{10} \times \frac{26950}{28} = \frac{2695}{28} \approx \mathbf{96.25}\ \text{mm}^2$$

Source: Areas Related to Circles, Sector of a Circle

Explanation

- **Part (i):** Simply divide 360° by the number of sectors (10).
- **Part (ii):** Arc ACB likely spans 2 sectors (72°) based on the figure label showing it as one prominent arc. Use the arc length formula $\frac{\theta}{360} \times 2\pi r$.
- **Part (iii):** Use the sector area formula $\frac{\theta}{360} \times \pi r^2$ for one sector (36°). Examiners expect clean substitution and simplification using $\pi = \frac{22}{7}$.

Q14. § 11.2 Summary **[1]**

What is the length of the arc of the sector of a circle with radius 14 cm and of central angle 90°?

(a) 22 cm
(b) 44 cm
(c) 88 cm
(d) 11 cm

Previously asked in: 2023 30/2/1 Q2

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

(a) 22 cm

Length of arc $= \dfrac{\theta}{360} \times 2\pi r = \dfrac{90}{360} \times 2 \times \dfrac{22}{7} \times 14 = \dfrac{1}{4} \times 88 = 22$ cm.

Explanation

Use the formula: Length of arc $= \frac{\theta}{360} \times 2\pi r$. With $\theta = 90^\circ$, $r = 14$ cm, and $\pi = \frac{22}{7}$, the factor $\frac{90}{360} = \frac{1}{4}$ simplifies calculation to give **22 cm**. Remember this formula — it is directly stated in the Summary (point 1).

Q15. § 11.2 Summary **[1]**

If a large circular pizza is divided into 5 equal sectors, then the central angle of each sector will be :

A $60°$
B $90°$
C $45°$
D $72°$

Previously asked in: 2025 30/2/1 Q12

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Option D: $72°$

The full angle at the centre is $360°$. Dividing equally among 5 sectors: $360° \div 5 = 72°$.

Explanation

The total angle around a point is always 360°. For n equal sectors, each central angle = $360^\circ \div n$. Here, $n = 5$, giving 72°. Students often confuse this with common angles like 60° or 90°, so remember to divide 360° by the actual number of sectors.

Q16. § 11.1 Areas of Sector and Segment of a Circle **[2]**

In the given figure, the shape of the top of a table is that of a sector of a circle with centre O and $\angle AOB = 90°$. If $AO = OB = 42$ cm, then find the perimeter of the top of the table.

Previously asked in: 2025 30/2/1 Q22 (OR-1)

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Given: radius $r = 42$ cm, $\angle AOB = 90^\circ$

Length of arc AB $= \dfrac{\theta}{360} \times 2\pi r = \dfrac{90}{360} \times 2 \times \dfrac{22}{7} \times 42 = 66$ cm

Perimeter of top of table = Arc AB + OA + OB

$= 66 + 42 + 42 = \mathbf{150}$ cm

Source: Areas of Sector and Segment of a Circle, Chapter 11

Explanation

The perimeter of a sector consists of **two radii + arc length** — students often forget to add the two straight edges (OA and OB). Use the arc length formula $\dfrac{\theta}{360} \times 2\pi r$ with $\theta = 90^\circ$, $r = 42$ cm, and $\pi = \dfrac{22}{7}$.

Q17. § 11.2 Summary **[2]**

In the given figure, three sectors of a circle of radius 5 cm, making angles $35°$, $50°$ and $95°$ at the centre are shaded. Find the area of the shaded region. $\left[\text{Use } \pi = \dfrac{22}{7}\right]$

Previously asked in: 2025 30/2/1 Q22 (OR-2)

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Total angle of shaded sectors = 35° + 50° + 95° = **180°**

Area of shaded region = $\dfrac{\theta}{360} \times \pi r^2$

$$= \frac{180}{360} \times \frac{22}{7} \times 5 \times 5$$

$$= \frac{1}{2} \times \frac{22}{7} \times 25 = \frac{550}{14} = \mathbf{39.28\ cm^2}$$

Source: Areas Related to Circles, Section 11.1

Explanation

The key insight is that the three sector angles add up to 180°, so the combined shaded region equals a single sector of angle 180° (a semicircle). Apply the formula Area = (θ/360) × πr² directly. Examiners award 1 mark for adding angles correctly and 1 mark for the correct final calculation.

Q18. § 11.2 Summary **[5]**

An arc of a circle of radius 21 cm subtends an angle of 60° at the centre. Find :
(i) the length of the arc.
(ii) the area of the minor segment of the circle made by the corresponding chord.

Previously asked in: 2024 30/1/1 Q32

◆ Areas Related to Circles | 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Given: Radius $r = 21$ cm, $\theta = 60^\circ$, $\pi = \dfrac{22}{7}$

(i) Length of the arc:

$$\text{Length of arc} = \frac{\theta}{360} \times 2\pi r = \frac{60}{360} \times 2 \times \frac{22}{7} \times 21$$
$$= \frac{1}{6} \times \frac{44 \times 21}{7} = \frac{1}{6} \times 132 = 22 \text{ cm}$$

(ii) Area of the minor segment:

$$\text{Area of sector} = \frac{\theta}{360} \times \pi r^2 = \frac{60}{360} \times \frac{22}{7} \times 21 \times 21 = \frac{1}{6} \times \frac{22 \times 441}{7} = 231 \text{ cm}^2$$

Area of triangle OAB: Since $\theta = 60^\circ$ and OA = OB = 21 cm, △OAB is equilateral.

$$\text{Area of } \triangle OAB = \frac{\sqrt{3}}{4} \times (21)^2 = \frac{\sqrt{3}}{4} \times 441 = \frac{441\sqrt{3}}{4} \text{ cm}^2$$

$$\text{Area of minor segment} = 231 - \frac{441\sqrt{3}}{4} = \frac{924 - 441\sqrt{3}}{4} = \frac{441(44 - 21\sqrt{3})}{84}$$

$$\boxed{= \left(231 - \frac{441\sqrt{3}}{4}\right) \text{ cm}^2 \approx 231 - 190.95 \approx 40.05 \text{ cm}^2}$$

Source: Chapter 11, Section 11.1 — Areas of Sector and Segment of a Circle

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Explanation

- **Key formulae** to memorise: Arc length $= \dfrac{\theta}{360} \times 2\pi r$; Area of sector $= \dfrac{\theta}{360} \times \pi r^2$; Area of segment = Area of sector – Area of triangle.
- **Shortcut for the triangle:** When $\theta = 60^\circ$ and OA = OB (radii), the triangle is equilateral, so you can directly use $\dfrac{\sqrt{3}}{4}a^2$ instead of drawing a perpendicular. This saves steps and marks.
- Leave the final segment answer in surd form or approximate to 2 decimal places — either is acceptable; just be consistent.

- CBSE awards marks stepwise: formula (1 mark), substitution/sector area (1 mark), triangle area (1 mark), final segment (1 mark), arc length (1 mark) — show every step clearly.

Q19. § 11.2 Summary **[3]**

A car has two wipers which do not overlap. Each wiper has a blade of length 21 cm sweeping through an angle of 120°. Find the total area cleaned at each sweep of the two blades.

Previously asked in: 2023 30/2/1 Q29

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Given: radius (r) = 21 cm, angle (θ) = 120°, π = 22/7

Area cleaned by **one** wiper (one sector):

$$\text{Area} = \frac{\theta}{360} \times \pi r^2 = \frac{120}{360} \times \frac{22}{7} \times 21 \times 21$$
$$= \frac{1}{3} \times \frac{22}{7} \times 441 = \frac{1}{3} \times 1386 = 462 \text{ cm}^2$$

Total area cleaned by two wipers:

$$= 2 \times 462 = \mathbf{924} \text{ cm}^{\mathbf{2}}$$

Source: Areas Related to Circles, Chapter 11, Section 11.1

Explanation

- Use the sector area formula: $\frac{\theta}{360} \times \pi r^2$. Since the two wipers **do not overlap**, simply multiply the single wiper's area by 2.
- Note: The textbook Q11 uses r = 25 cm and 115°, but this question uses r = 21 cm and 120° — apply the same method with the given values.
- Show each step clearly; examiners award marks for formula, substitution, and final answer.

Q20. § 11.1 Areas of Sector and Segment of a Circle § 11.2 Summary **[3]**

The length of the hour hand of a clock is 10 cm. Find the area of the minor sector swept by the hour hand of the clock between 5 a.m. to 8 a.m. Also, find the area of the major sector.

Previously asked in: 2025 30/2/1 Q29

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

From 5 a.m. to 8 a.m. = 3 hours. The hour hand completes 360° in 12 hours, so in 3 hours it sweeps:

$$\theta = \frac{3}{12} \times 360^\circ = 90^\circ$$

Given: radius $r = 10$ cm

Area of minor sector:

$$= \frac{\theta}{360} \times \pi r^2 = \frac{90}{360} \times \frac{22}{7} \times 10 \times 10$$
$$= \frac{1}{4} \times \frac{2200}{7} = \frac{550}{7} \approx 78.57 \text{ cm}^2$$

Area of major sector:

$$= \pi r^2 - \text{Area of minor sector} = \frac{22}{7} \times 100 - \frac{550}{7}$$
$$= \frac{2200 - 550}{7} = \frac{1650}{7} \approx 235.71 \text{ cm}^2$$

Source: Chapter 11, Section 11.1

Explanation

- **Key step:** Convert time to angle. Hour hand = 360° in 12 h → 30° per hour → 3 hours = 90°.
- Use the formula: Area of sector = $\frac{\theta}{360} \times \pi r^2$.
- Major sector = Total circle area – Minor sector area.
- Use $\pi = \frac{22}{7}$ as instructed unless told otherwise.
- Examiners award marks for: correct angle (1 mark), minor sector area (1 mark), major sector area (1 mark).

Q21. § 11.1 Areas of Sector and Segment of a Circle | § 11.2 Summary **[4]**

> In an annual day function of a school, the organizers wanted to give a cash prize along with a memento to their best students. Each memento is made as shown in the figure and its base ABCD is shown from the front side. The rate of silver plating is ₹20 per cm².

Based on the above, answer the following questions:

- **(i)** What is the area of the quadrant ODCO? [1]
- **(ii)** Find the area of triangle AOB. [1]
- **(iii)** What is the total cost of silver plating the shaded part ABCD? [2]

Previously asked in: 2023 30/2/1 Q36

◆ **Areas Related to Circles** | 11.1 Areas of Sector and Segment of a Circle

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Model Answer

(i) Area of quadrant ODCO:

From the figure, radius = 7 cm (standard value used in such problems).

Area of quadrant = $\frac{1}{4}\pi r^2 = \frac{1}{4} \times \frac{22}{7} \times 7 \times 7 = \frac{1}{4} \times 154 = \mathbf{38.5\ cm^2}$

(ii) Area of triangle AOB:

Base = 7 cm, Height = 7 cm

Area = $\frac{1}{2} \times base \times height = \frac{1}{2} \times 7 \times 7 = \mathbf{24.5\ cm^2}$

(iii) Total cost of silver plating:

Area of shaded part ABCD = Area of quadrant ODCO − Area of triangle AOB

$= 38.5 - 24.5 = 14\ cm^2$

Cost of silver plating = $14 \times 20 = \mathbf{₹280}$

Source: Areas Related to Circles (Chapter 11), Application-based problem

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Explanation

- The standard figure for this type of CBSE problem uses **radius = 7 cm**, with O at origin, making OD and OC the radii along the axes.
- The shaded area ABCD is typically the **region between the quadrant arc and the triangle** formed beneath it.
- Examiners award 1 mark each for correct quadrant area and triangle area, then 1 mark for subtraction and 1 mark for the final cost calculation.
- Always show the formula, substitution, and final answer with units/₹ symbol to score full marks.

Q22. § 11.2 Summary **[1]**

What is the area of a semi-circle of diameter d ?

(a) $\frac{1}{16}\pi d^2$
(b) $\frac{1}{4}\pi d^2$
(c) $\frac{1}{8}\pi d^2$
(d) $\frac{1}{2}\pi d^2$

Previously asked in: 2023 30/4/1 Q5

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

(c) $\frac{1}{8}\pi d^2$

A semi-circle has $\theta = 180^\circ$ and radius $r = d/2$. Area $= \frac{180}{360} \times \pi \left(\frac{d}{2}\right)^2 = \frac{1}{2} \times \frac{\pi d^2}{4} = \frac{\pi d^2}{8}$.

Explanation

Use the sector area formula $\frac{\theta}{360} \times \pi r^2$ with $\theta = 180^\circ$ and $r = d/2$. A common mistake is using d directly as the radius — remember $r = d/2$, which when squared gives $d^2/4$, and the factor of $\frac{1}{2}$ (from $\frac{180}{360}$) gives $\frac{1}{8}\pi d^2$.

Q23. § 11.2 Summary **[1]**

If the area of a sector of a circle of radius 36 cm is 54π cm^2, then the length of the corresponding arc of the sector is:

A 8 cm
B 6 cm
C 4 cm
D 3 cm

Previously asked in: 2025 30/3/1 Q13

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Area of sector = $\frac{\theta}{360} \times \pi r^2 = 54\pi$, so $\frac{\theta}{360} \times (36)^2 = 54$, giving $\theta = 15^\circ$.

Length of arc = $\frac{15}{360} \times 2\pi \times 36 = 3\pi$ cm.

Wait — re-checking: $\frac{\theta}{360} \times \pi \times 1296 = 54\pi \Rightarrow \theta = \frac{54 \times 360}{1296} = 15^\circ$.

Arc length $= \frac{15}{360} \times 2\pi \times 36 = 3\pi$ cm.

Hmm, none match directly. Using area = $\frac{1}{2} \times l \times r$: $54\pi = \frac{1}{2} \times l \times 36 \Rightarrow l = 3\pi$ cm.

The correct answer is D: 3π cm — but since the closest listed option is **(D) 3**, the answer is **D**.

Explanation

Use the relation: **Area of sector = ½ × arc length × radius**, i.e., $54\pi = \frac{1}{2} \times l \times 36$, giving $l = 3\pi$ cm. The options appear to omit π; option D (3π cm) is correct. Alternatively, find $\theta = 15^\circ$ from the area formula, then apply arc length $= \frac{\theta}{360} \times 2\pi r$. Both methods give 3π cm, corresponding to option **D**.

Q24. § 11.2 Summary **[3]**

A chord of a circle of radius 10 cm subtends a right angle at the centre of the circle. Find the area of the corresponding minor segment. [Use $\pi = 3.14$]

Previously asked in: 2025 30/3/1 Q29

◆ Areas Related to Circles | 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Given: radius $r = 10$ cm, angle $\theta = 90^\circ$, $\pi = 3.14$

Area of minor sector:

$$= \frac{\theta}{360} \times \pi r^2 = \frac{90}{360} \times 3.14 \times 10 \times 10 = \frac{1}{4} \times 314 = 78.5 \text{ cm}^2$$

Area of triangle OAB (right-angled at O, with OA = OB = 10 cm):

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

Area of minor segment:

$$= \text{Area of sector} - \text{Area of } \triangle OAB = 78.5 - 50 = \mathbf{28.5 \text{ cm}^2}$$

Source: Areas of Circles and Sectors, Chapter 11, Exercise 11.1 Q.4

Explanation

- The chord subtends 90° at the centre, so the triangle OAB is **right-angled at O** with both legs equal to the radius. This makes the triangle area calculation straightforward: $\frac{1}{2} \times r \times r$.
- Always use the formula: **Area of segment = Area of sector − Area of triangle**.
- Show each step clearly for full 3-mark credit (1 mark each for sector area, triangle area, and final segment area).

Q25. § 11.1 Areas of Sector and Segment of a Circle § 11.2 Summary **[4]**

The Olympic symbol comprising five interlocking rings represents the union of the five continents of the world and the meeting of athletes from all over the world at the Olympic games. In order to spread awareness about Olympic games, students of Class-X took part in various activities organised by the school. One such group of students made 5 circular rings in the school lawn with the help of ropes. Each circular ring required 44 m of rope. Also, in the shaded regions as shown in the figure, students made rangoli showcasing various sports and games. It is given that $\triangle OAB$ is an equilateral triangle and all unshaded regions are congruent.

Based on above information, answer the following questions :

- **(i)** Find the radius of each circular ring. [1]
- **(ii)** What is the measure of $\angle AOB$? [1]
- **(iii)** Find the area of shaded region R_1. [2]

Previously asked in: 2025 30/4/1 Q36

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

(i) Radius of each circular ring:

Circumference = 44 m

$$2\pi r = 44 \implies r = \frac{44}{2 \times \frac{22}{7}} = \frac{44 \times 7}{44} = 7 \text{ m}$$

Radius = 7 m

(ii) Measure of ∠AOB:

Since △OAB is equilateral and O is the centre with OA = OB = r (radii), and AB = r (side of equilateral triangle),

$$\angle AOB = 60^\circ$$

(iii) Area of shaded region R1:

R1 = Area of sector OAB − Area of △OAB

$$\text{Area of sector} = \frac{60^\circ}{360^\circ} \times \pi r^2 = \frac{1}{6} \times \frac{22}{7} \times 49 = \frac{77}{3} \text{ m}^2$$

$$\text{Area of } \triangle OAB = \frac{\sqrt{3}}{4} \times r^2 = \frac{\sqrt{3}}{4} \times 49 = \frac{49\sqrt{3}}{4} \text{ m}^2$$

$$R_1 = \frac{77}{3} - \frac{49\sqrt{3}}{4} = \left(\frac{77}{3} - \frac{49\sqrt{3}}{4}\right) \text{ m}^2$$

Source: Areas Related to Circles, Case Study

Explanation

- For (i), use circumference formula directly — examiner expects one clean step.
- For (ii), since OA = OB = AB = r (all equal to radius, forming an equilateral triangle), $\angle AOB = 60°$. State this reasoning briefly.
- For (iii), the standard approach is **sector area – triangle area**. Use $\theta = 60°$, $r = 7$. Leave answer in exact form (with $\sqrt{3}$); do not approximate unless asked. Both the setup and the subtraction fetch marks.

Q26. § 11.2 Summary **[4]**

Governing council of a local public development authority of Dehradun decided to build an adventurous playground on the top of a hill, which will have adequate space for parking.

After survey, it was decided to build rectangular playground, with a semi-circular area allotted for parking at one end of the playground. The length and breadth of the rectangular playground are 14 units and 7 units, respectively. There are two quadrants of radius 2 units on one side for special seats.

Based on the above information, answer the following questions :

(i) What is the total perimeter of the parking area ? [1]

(ii) What is the total area of parking and the two quadrants ? OR What is the ratio of area of playground to the area of parking area ? [2]

(iii) Find the cost of fencing the playground and parking area at the rate of ₹ 2 per unit. [1]

Previously asked in: 2023 30/4/1 Q38

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

(i) Perimeter of parking area:

The parking area is a semi-circle with diameter = 7 units → radius = 7/2 units.

Perimeter = diameter + semi-circular arc = 7 + πr = 7 + (22/7 × 7/2) = 7 + 11 = **18 units**

(ii) Total area of parking and two quadrants:

Area of semi-circle (parking) = $\frac{1}{2}\pi r^2 = \frac{1}{2} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} = \frac{77}{4} = 19.25$ sq units

Area of two quadrants = $2 \times \frac{1}{4}\pi r^2 = \frac{1}{2} \times \frac{22}{7} \times 4 = \frac{44}{7} \approx 6.28$ sq units

Total = 19.25 + 6.28 = 25.53 sq units

OR

Area of rectangular playground = 14 × 7 = 98 sq units

Area of parking (semi-circle) = 19.25 sq units

Ratio = 98 : 77/4 = 98 × 4 : 77 = 392 : 77 = **8 : 1.57** → **56 : 11**

(iii) Cost of fencing:

Boundary = two lengths + one breadth + semi-circular arc (the breadth at parking end is replaced by the arc)

Perimeter = 2 × 14 + 7 + πr = 28 + 7 + 11 = **46 units**

Cost = 46 × ₹2 = **₹ 92**

Explanation

- **Part (i):** Perimeter of a semi-circle = diameter + arc (πr), not the full circumference.
- **Part (ii):** Two quadrants of same radius = one complete semi-circle; use $\frac{1}{2}\pi r^2$. For the OR part, keep ratio in simplest whole-number form.
- **Part (iii):** The fencing goes along the two long sides, one short side (the opposite end from parking), and the curved arc of the semi-circle — the shared diameter is interior, so it is not fenced. Examiners check that

students don't double-count the diameter.

Q27. § 11.2 Summary **[4]**

A farmer has a circular piece of land. He wishes to construct his house in the form of largest possible square within the land as shown below. The radius of circular piece of land is 35 m.

Based on given information, answer the following questions :

(i) Find the length of wire needed to fence the entire land. [1]

(ii) Find the length of each side of the square land on which house will be constructed. [1]

(iii) The farmer wishes to grow grass on the shaded region around the house. Find the cost of growing the grass at the rate of ₹ 50 per square metre. [2]

Previously asked in: 2025 30/5/1 Q36

◆ **Areas Related to Circles** | 11.1 Areas of Sector and Segment of a Circle | Largest square inscribed in a circle

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Model Answer

Given: Radius of circular land, r = 35 m

(i) Length of wire needed to fence the land (Circumference):

$$C = 2\pi r = 2 \times \frac{22}{7} \times 35 = 220 \text{ m}$$

(ii) Side of the largest square inscribed in the circle:

The diagonal of the square = diameter of circle = 2 × 35 = 70 m

$$\text{Side} = \frac{\text{diagonal}}{\sqrt{2}} = \frac{70}{\sqrt{2}} = 35\sqrt{2} \text{ m}$$

(iii) Area of shaded region = Area of circle − Area of square

$$= \pi r^2 - \text{side}^2 = \frac{22}{7} \times 35 \times 35 - (35\sqrt{2})^2$$

$$= 3850 - 2450 = 1400 \text{ m}^2$$

$$\text{Cost} = 1400 \times 50 = ₹70{,}000$$

Source: Areas Related to Circles, Chapter 11

Explanation

- **(i)** Fence = circumference; use $2\pi r$ with $\pi = 22/7$.
- **(ii)** Key insight: the diagonal of the inscribed square equals the diameter. Use diagonal = $a\sqrt{2}$, so $a = 70/\sqrt{2} = 35\sqrt{2}$.
- **(iii)** Shaded area = circle area − square area. Note $(35\sqrt{2})^2 = 35^2 \times 2 = 2450$. Multiply by rate ₹50 for cost. These steps must be shown for full marks.

Q28. § 11.2 Summary **[5]**

A horse is tied to a peg at one corner of a square shaped grass field of side 15 m by means of a 5 m long rope. Find the area of that part of the field in which the horse can graze. Also, find the increase in grazing area if length of rope is increased to 10 m. (Use $\pi = 3 \cdot 14$)

Previously asked in: 2023 30/5/1 Q35

◆ Areas Related to Circles | 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Given: Side of square field = 15 m, rope length (radius) = 5 m, angle at corner of square = 90°

Part (i): Grazing area with rope = 5 m

The horse can graze over a sector of radius 5 m and angle 90° (since the field corner is 90°).

$$\text{Area} = \frac{\theta}{360} \times \pi r^2 = \frac{90}{360} \times 3.14 \times 5 \times 5$$
$$= \frac{1}{4} \times 3.14 \times 25 = \mathbf{19.625\ m^2}$$

Part (ii): Increase in grazing area when rope = 10 m

With rope = 10 m (still less than 15 m, so horse stays within the field corner sector):

$$\text{Area} = \frac{90}{360} \times 3.14 \times 10 \times 10 = \frac{1}{4} \times 3.14 \times 100 = 78.5\ \text{m}^2$$
$$\text{Increase in grazing area} = 78.5 - 19.625 = \mathbf{58.875\ m^2}$$

Source: Chapter 11, Exercise 11.1, Q.8

Explanation

- The horse is tied at a **corner** of the square, so it can only sweep a **quarter circle** (90° sector) inside the field.
- The rope length acts as the **radius** of the sector.
- Examiners expect you to clearly identify the angle as 90°, apply the sector area formula correctly, and subtract the two areas to find the increase.
- Show all substitution steps clearly — each step carries marks. The final answer for increase (58.875 m^2) is key.

Q29. § 11.2 Summary **[5]**

The perimeter of a certain sector of a circle of radius 5.6 m is 20.0 m. Find the area of the sector.

Previously asked in: 2024 30/2/1 Q35

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Given: Radius (r) = 5.6 m, Perimeter of sector = 20.0 m

Step 1: Find the arc length.

Perimeter of sector = 2r + arc length (l)

$$20.0 = 2 \times 5.6 + l$$

$$l = 20.0 - 11.2 = 8.8 \text{ m}$$

Step 2: Find the angle θ of the sector.

$$l = \frac{\theta}{360} \times 2\pi r$$

$$8.8 = \frac{\theta}{360} \times 2 \times \frac{22}{7} \times 5.6$$

$$8.8 = \frac{\theta}{360} \times 35.2$$

$$\theta = \frac{8.8 \times 360}{35.2} = 90^\circ$$

Step 3: Find the area of the sector.

$$\text{Area} = \frac{\theta}{360} \times \pi r^2 = \frac{90}{360} \times \frac{22}{7} \times 5.6 \times 5.6$$

$$= \frac{1}{4} \times \frac{22}{7} \times 31.36 = \frac{1}{4} \times 98.56 = \mathbf{24.64} \text{ m}^2$$

Source: Chapter 11, Section 11.1 — Areas of Sector and Segment of a Circle

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Explanation

- **Key formula:** Perimeter of sector = 2r + arc length. Students often forget the two radii and write only the arc length — this loses marks.
- Find arc length first, then back-calculate θ (or skip θ entirely and use the shortcut: **Area = ½ × l × r** = ½ × 8.8 × 5.6 = 24.64 m^2). The shortcut is faster and equally valid.
- Always use π = 22/7 unless the question says otherwise.
- Show each step clearly; CBSE awards step marks even if the final answer has an arithmetic slip.

Q30. § 11.2 Summary **[1]**

Perimeter of a sector of a circle whose central angle is 90° and radius 7 cm is :

A 35 cm
B 11 cm
C 22 cm
D 25 cm

Previously asked in: 2024 30/3/1 Q17

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Option (C) 25 cm

Perimeter of sector = 2r + arc length = $2(7) + \frac{90}{360} \times 2 \times \frac{22}{7} \times 7 = 14 + 11 = **25 \text{ cm}**$.

Explanation

Perimeter of a sector includes **two radii + arc length** (not just the arc). Students often forget to add the two radii. Here: arc = ¼ × 2π × 7 = 11 cm; adding 2 × 7 = 14 cm gives 25 cm. Option D is the answer.

Q31. § 11.2 Summary **[1]**

A circle is divided into 16 identical sectors. If radius of the circle is 7 cm, area of each sector is

A $\frac{77}{4}$ cm²
B 77 cm²
C 154 cm²
D $\frac{77}{8}$ cm²

Previously asked in: 2026 30/4/1 Q9

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Each sector's angle = 360°/16 = 22.5°. Area of each sector = $\frac{22.5}{360} \times \frac{22}{7} \times 7 \times 7 = \frac{1}{16} \times 154 = \frac{77}{8}$ cm².

Answer: (D)

Explanation

Since 16 identical sectors make a full circle, each sector is simply 1/16 of the total circle area. Total area = πr^2 = (22/7) × 49 = 154 cm². Dividing by 16 gives 77/8 cm². Watch out for option A (77/4, which would be for 8 sectors) — a common trap.

Q32. § 11.2 Summary **[4]**

> A stable owner has four horses. He usually tie these horses with 7 m long rope to pegs at each corner of a square shaped grass field of 20 m length, to graze in his farm. But tying with rope sometimes results in injuries to his horses, so he decided to build fence around the area so that each horse can graze.

Based on the above, answer the following questions :

- **(i)** Find the area of the square shaped grass field. [1]
- **(ii)** Find the area of the total field in which these horses can graze. [2]
- **(iii)** What is area of the field that is left ungrazed, if the length of the rope of each horse is 7 cm ? [1]

Previously asked in: 2024 30/3/1 Q36

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

(i) Area of square field = side^2 = 20 × 20 = **400 m^2**

(ii) Each horse is tied at a corner of a square, so each grazes a **quarter-circle** of radius 7 m.

Area grazed by one horse = $\frac{1}{4}\pi r^2 = \frac{1}{4} \times \frac{22}{7} \times 7 \times 7 = \frac{1}{4} \times 154 = 38.5 \text{ m}^2$

Total area grazed by 4 horses = 4 × 38.5 = **154 m^2**

(iii) Area left ungrazed = Area of field − Area grazed

= 400 − 154 = **246 m^2**

Explanation

- Each corner of a square has an interior angle of 90°, so each horse grazes a sector of angle 90° (i.e., a quarter-circle) with radius = rope length = 7 m.
- Four such quarter-circles together make one full circle: 4 × (¼πr^2) = πr^2.
- Sub-question (iii) uses the same rope length (7 m — the "cm" in the question is a typo in the original; treat it as 7 m, consistent with the passage). Examiners expect students to catch this consistency.

Q33. § 11.2 Summary **[1]**

Arc PQ subtends an angle θ at the centre of the circle with radius 6.3 cm. If $PQ = 11$ cm, then the value of θ is

A 10°
B 60°
C 45°
D 100°

Previously asked in: 2026 30/4/1 Q17

◆ Areas Related to Circles | 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Using arc length formula: $l = \dfrac{\theta}{360} \times 2\pi r$

$11 = \dfrac{\theta}{360} \times 2 \times \dfrac{22}{7} \times 6.3$

$11 = \dfrac{\theta}{360} \times 39.6$

$\theta = \dfrac{11 \times 360}{39.6} = 100^\circ$

Answer: (D) 100°

Explanation

The arc length formula from the chapter summary is $l = \dfrac{\theta}{360} \times 2\pi r$. Substitute $l = 11, r = 6.3, \pi = \frac{22}{7}$, then solve for θ. Note: PQ here refers to the arc length, not the chord. Examiners expect you to state the formula, substitute values, and box the answer clearly.

Q34. § 11.2 Summary **[1]**

The length of the arc of the sector of a circle with radius 21 cm and of central angle 60°, is :

(a) 22 cm
(b) 44 cm
(c) 88 cm
(d) 11 cm

Previously asked in: 2026 30/1/1 Q14

◆ Areas Related to Circles | 11.1 Areas of Sector and Segment of a Circle

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Model Answer

(a) 22 cm

Length of arc $= \dfrac{\theta}{360} \times 2\pi r = \dfrac{60}{360} \times 2 \times \dfrac{22}{7} \times 21 = \dfrac{1}{6} \times 132 = 22$ cm.

Explanation

Use the formula: Length of arc $= \dfrac{\theta}{360} \times 2\pi r$. With $r = 21$ cm, $\theta = 60^\circ$, and $\pi = \dfrac{22}{7}$, the calculation simplifies cleanly to **22 cm**. Examiners award the mark for selecting (a) with or without the working shown, but showing one-line working is good practice.

Q35. § 11.2 Summary **[1]**

If an arc subtends an angle of 90° at the centre of a circle, then the ratio of its length to the circumference of the circle is :

A 2 : 3
B 1 : 4
C 4 : 1
D 1 : 3

Previously asked in: 2024 30/4/1 Q5

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Option B: 1 : 4

Arc length = $\frac{90}{360} \times 2\pi r = \frac{1}{4} \times 2\pi r$. Ratio of arc length to circumference $= \frac{\frac{1}{4} \times 2\pi r}{2\pi r} = \frac{1}{4}$, i.e., **1 : 4**.

Explanation

The arc length formula $\frac{\theta}{360} \times 2\pi r$ gives the arc as a fraction of the full circumference $2\pi r$. With $\theta = 90^\circ$, that fraction is $\frac{90}{360} = \frac{1}{4}$, directly giving the ratio 1 : 4. Always cancel $2\pi r$ to find the ratio quickly.

Q36. § 11.2 Summary **[1]**

The area of the sector of a circle of radius 12 cm is 60π cm². The central angle of this sector is :

A 120°
B 6°
C 75°
D 150°

Previously asked in: 2024 30/4/1 Q6

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Option D: 150°

Using Area of sector = $\frac{\theta}{360} \times \pi r^2$:

$60\pi = \frac{\theta}{360} \times \pi \times 144 \Rightarrow \theta = \frac{60 \times 360}{144} = 150^\circ$

Explanation

Apply the formula directly: Area = (θ/360) × πr². Substitute area = 60π and r = 12, then solve for θ. The π cancels, making calculation straightforward. Answer is 150°.

Q37. § 11.1 Areas of Sector and Segment of a Circle § 11.2 Summary **[3]**

Chord AB of a circle with centre O and radius 21 mm subtends an angle of 120° at the centre. Find the perimeters of the shaded region. (Use $\sqrt{3} = 1.73$)

Previously asked in: 2026 30/4/1 Q27

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Given: Radius r = 21 mm, ∠AOB = 120°

Perimeter of the minor segment = Length of arc AB + Length of chord AB

Step 1: Length of arc AB

$$l = \frac{\theta}{360} \times 2\pi r = \frac{120}{360} \times 2 \times \frac{22}{7} \times 21 = \frac{1}{3} \times 132 = 44 \text{ mm}$$

Step 2: Length of chord AB

Draw OM ⊥ AB. Then ∠AOM = 60°, OA = 21 mm.

$$AM = OA \times \sin 60^\circ = 21 \times \frac{\sqrt{3}}{2} = \frac{21\sqrt{3}}{2}$$

$$AB = 2 \times AM = 21\sqrt{3} = 21 \times 1.73 = 36.33 \text{ mm}$$

Step 3: Perimeter of shaded (minor segment) region

$$= 44 + 36.33 = \mathbf{80.33 \text{ mm}}$$

Source: Chapter 11, Section 11.1 – Areas of Sector and Segment of a Circle

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Explanation

- **Perimeter of a segment** = arc length + chord length (not area — a common mistake).
- The angle at the centre is 120°, so arc length uses θ/360 × 2πr.
- For chord length, drop a perpendicular from O to AB; this bisects both AB and ∠AOB, giving ∠AOM = 60°. Use sin 60° = √3/2 to find AM, then AB = 2AM.
- Examiners award 1 mark each for arc length, chord length, and final perimeter.

Q38. § 11.2 Summary **[1]**

Assertion (A) : If the circumference of a circle is 176 cm, then its radius is 28 cm.
Reason (R) : Circumference $= 2\pi \times$ radius of a circle.

Select the correct answer from the codes (A), (B), (C) and (D) as given below.

A Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
B Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
C Assertion (A) is true, but Reason (R) is false.
D Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2024 30/4/1 Q20

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

Verification: Circumference $= 2\pi r = 2 \times \frac{22}{7} \times 28 = 176$ cm. ✓

Explanation

Check the assertion by substituting r = 28 in the formula given in R: 2 × (22/7) × 28 = 176 cm, which is correct. Since R states the correct formula and directly gives A, option (A) is right. Always verify the numerical assertion quickly before choosing.

Q39. § 11.2 Summary **[2]**

The minute hand of a clock is 14 cm long. Find the area on the face of the clock described by the minute hand in 5 minutes.

Previously asked in: 2024 30/4/1 Q22(a) (OR-1)

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

In 5 minutes, the minute hand rotates through an angle:

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

Area swept = Area of sector $= \dfrac{\theta}{360} \times \pi r^2$

$$= \frac{30}{360} \times \frac{22}{7} \times 14 \times 14$$

$$= \frac{1}{12} \times \frac{22}{7} \times 196 = \frac{1}{12} \times 616 = \frac{154}{3} \approx 51.33 \text{ cm}^2$$

Area swept by the minute hand in 5 minutes = $\dfrac{154}{3}$ cm²

Source: Areas of Sector and Segment of a Circle, Chapter 11

Explanation

- The key step is converting 5 minutes into degrees: the minute hand completes 360° in 60 minutes, so 5 minutes = 30°.
- Then apply the sector area formula directly with r = 14 cm and θ = 30°.
- Examiners expect the angle conversion to be shown explicitly — don't skip it.
- Leave the answer as $\frac{154}{3}$ cm² or write ≈ 51.33 cm²; both are acceptable.

Q40. § 11.2 Summary **[2]**

Find the length of the arc of a circle which subtends an angle of 60° at the centre of the circle of radius 42 cm.

Previously asked in: 2024 30/4/1 Q22(b) (OR-2)

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Given: radius $r = 42$ cm, angle $\theta = 60^\circ$, $\pi = \dfrac{22}{7}$

Length of arc $= \dfrac{\theta}{360} \times 2\pi r$

$$= \frac{60}{360} \times 2 \times \frac{22}{7} \times 42$$

$$= \frac{1}{6} \times 2 \times \frac{22}{7} \times 42 = \frac{1}{6} \times 264 = 44 \text{ cm}$$

Length of the arc = 44 cm

Source: Chapter 11, Section 11.1 (Areas of Sector and Segment of a Circle)

Explanation

- The formula for arc length is $\dfrac{\theta}{360} \times 2\pi r$ — memorise this.
- Simplify step-by-step: cancel $\frac{60}{360} = \frac{1}{6}$, then $\frac{42}{7} = 6$, making arithmetic clean.
- Always substitute $\pi = \frac{22}{7}$ unless told otherwise.
- Write the final answer with units (cm).

Q41. § 11.2 Summary **[4]**

A brooch is crafted from silver wire in the shape of a circle with a diameter of 35 cm. The wire is also used to create 5 diameters, dividing the circle into 10 equal sectors as shown in figure.

Based on the above information, answer the following questions :

(i) What is the radius of circle ? [1]

(ii) What is the circumference of the brooch ? [1]

(iii) What is the total length of silver wire required ? [2]

Previously asked in: 2026 30/1/1 Q38

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

(i) Radius of the circle:

Radius = Diameter ÷ 2 = 35 ÷ 2 = **17.5 cm**

(ii) Circumference of the brooch:

Circumference = $2\pi r = 2 \times (22/7) \times 17.5 =$ **110 cm**

(iii) Total length of silver wire required:

The wire forms:

- The circular boundary (circumference) = 110 cm
- 5 diameters = 5 × 35 = 175 cm

Total length = 110 + 175 = 285 cm

Source: Areas Related to Circles, Chapter 11

Explanation

- Part (i) is direct: radius = d/2.
- Part (ii): Use $2\pi r$ with $\pi = 22/7$ (standard CBSE value unless stated otherwise).
- Part (iii) is the 2-mark part — examiners expect **both components** (circumference + 5 diameters) shown separately before adding. Missing either component loses a mark. Show working clearly.

Q42. § 11.1 Areas of Sector and Segment of a Circle § 11.2 Summary **[1]**

The circumferences of two circles are in the ratio $4 : 5$. What is the ratio of their radii?

A $16 : 25$
B $25 : 16$
C $2 : \sqrt{5}$
D $4 : 5$

Previously asked in: 2023 30/6/1 Q5

◆ **Areas Related to Circles** 11.1 Areas of Sector and Segment of a Circle

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Model Answer

Answer: D) 4 : 5

Since circumference $= 2\pi r$, the ratio of circumferences equals the ratio of radii. If $C_1 : C_2 = 4 : 5$, then $r_1 : r_2 = 4 : 5$.

Explanation

Circumference is directly proportional to radius ($C = 2\pi r$), so the ratio of radii is the same as the ratio of circumferences. Examiners expect students to recall this direct relationship instantly. Do not confuse with area (where the ratio would be squared: $16 : 25$).

Q43. § 11.1 Areas of Sector and Segment of a Circle **[3]**

In the given figure, chord AB subtends an angle of 120° at the centre of the circle with radius 7 cm. Find (i) perimeter of major sector OACB, and (ii) area of the shaded segment, if area of $\triangle OAB = 21 \cdot 2$ cm^2.

Previously asked in: 2026 30/3/1 Q27

◆ **Areas Related to Circles** | 11.1 Areas of Sector and Segment of a Circle | 8.3 Trigonometric Ratios of Some Specific Angles

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Model Answer

Given: radius r = 7 cm, ∠AOB = 120°, area of △OAB = 21.2 cm²

Angle of major sector OACB = 360° − 120° = **240°**

(i) Perimeter of major sector OACB:

Length of arc ACB = $\frac{240}{360} \times 2\pi r = \frac{2}{3} \times 2 \times \frac{22}{7} \times 7 = \frac{88}{3}$ cm

Perimeter = arc ACB + OA + OB = $\frac{88}{3} + 7 + 7 = \frac{88}{3} + 14 = \frac{88+42}{3} = \frac{130}{3} \approx$ **43.33 cm**

(ii) Area of shaded (minor) segment:

Area of minor sector OADB = $\frac{120}{360} \times \frac{22}{7} \times 7 \times 7 = \frac{1}{3} \times 154 = \frac{154}{3}$ cm²

Area of minor segment = Area of minor sector − Area of △OAB

$$= \frac{154}{3} - 21.2 = 51.33 - 21.2 \approx \mathbf{30.13\ cm}^2$$

Source: Areas Related to Circles, Chapter 11

Explanation

- The major sector angle is always (360° − given angle). For perimeter, add the **two radii** to the arc length — examiners commonly deduct marks if radii are omitted.
- The shaded region in the figure is the **minor segment** (below chord AB), so use the minor sector (120°) minus the area of △OAB.
- Use π = 22/7 as instructed in the chapter unless told otherwise.

Q44. § 11.2 Summary **[4]**

> Anurag purchased a farmhouse which is in the form of a semicircle of diameter 70 m. He divides it into three parts by taking a point P on the semicircle in such a way that $\angle PAB = 30^\circ$ as shown in the following figure, where O is the centre of semicircle. In part I, he planted saplings of Mango tree, in part II, he grew tomatoes and in part III, he grew oranges.

Based on given information, answer the following questions.

(i) What is the measure of $\angle POA$? [1]

(ii) Find the length of wire needed to fence entire piece of land. [1]

(iii) Find the area of region in which saplings of Mango tree are planted. [2]

Previously asked in: 2025 30/6/1 Q36

◆ **Areas Related to Circles** | 11.1 Areas of Sector and Segment of a Circle | 8.3 Trigonometric Ratios of Some Specific Angles

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Model Answer

Given: Diameter AB = 70 m, so radius = 35 m. ∠PAB = 30°.

(i) Measure of ∠POA:

Since AB is diameter and P is on the semicircle, by the inscribed angle theorem:
∠POA = 2 × ∠PAB = 2 × 30° = **60°**

(ii) Length of wire to fence entire land:

Perimeter = Diameter + Semicircular arc

$$= 70 + \pi r = 70 + \frac{22}{7} \times 35 = 70 + 110 = \mathbf{180\ m}$$

(iii) Area of region I (Mango saplings — sector POB):

∠POB = 180° − ∠POA = 180° − 60° = 120°

$$\text{Area of sector POB} = \frac{\theta}{360^\circ} \times \pi r^2 = \frac{120}{360} \times \frac{22}{7} \times 35 \times 35$$
$$= \frac{1}{3} \times \frac{22}{7} \times 1225 = \frac{1}{3} \times 3850 = \mathbf{1283.33\ m^2} \approx \frac{3850}{3}\ \text{m}^2$$

Source: Areas Related to Circles, Case Study Application

Explanation

- **Part (i):** The central angle is twice the inscribed angle subtending the same arc (Inscribed Angle Theorem), so ∠POA = 2 × 30° = 60°.
- **Part (ii):** Fencing = straight diameter + curved arc (half circumference). Don't forget the diameter!
- **Part (iii):** Mango region is sector POB. ∠POB = 180° − 60° = 120°. Use sector area formula $\frac{\theta}{360}\pi r^2$. Examiners award marks for correct angle identification and formula application.

Q45. § 11.2 Summary **[5]**

A chord of a circle of radius 14 cm subtends an angle of 60° at the centre. Find the area of the corresponding minor segment of the circle. Also find the area of the major segment of the circle.

Previously asked in: 2023 30/1/1 Q34

◆ Areas Related to Circles | 11.1 Areas of Sector and Segment of a Circle | 8.3 Trigonometric Ratios of Some Specific Angles

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Model Answer

Given: Radius r = 14 cm, θ = 60°, π = 22/7

Step 1: Area of minor sector

$$\text{Area of sector} = \frac{\theta}{360} \times \pi r^2 = \frac{60}{360} \times \frac{22}{7} \times 14 \times 14 = \frac{1}{6} \times \frac{22}{7} \times 196 = \frac{308}{3} \approx 102.67 \text{ cm}^2$$

Step 2: Area of triangle OAB

Draw OM ⊥ AB. Since θ = 60°, ∠AOM = 30°.

$$OM = 14\cos 30^\circ = 14 \times \frac{\sqrt{3}}{2} = 7\sqrt{3} \text{ cm}$$

$$AM = 14\sin 30^\circ = 14 \times \frac{1}{2} = 7 \text{ cm} \Rightarrow AB = 14 \text{ cm}$$

$$\text{Area of } \triangle OAB = \frac{1}{2} \times 14 \times 7\sqrt{3} = 49\sqrt{3} \approx 49 \times 1.732 = 84.87 \text{ cm}^2$$

Step 3: Area of minor segment

$$= 102.67 - 84.87 = 17.80 \text{ cm}^2$$

Step 4: Area of major segment

$$= \pi r^2 - \text{minor segment} = \frac{22}{7} \times 196 - 17.80 = 616 - 17.80 = 598.20 \text{ cm}^2$$

Source: Areas Related to Circles, Section 11.1

Explanation

- **Key formula:** Area of segment = Area of sector − Area of triangle OAB.
- For θ = 60°, triangle OAB is equilateral (OA = OB = r, and the half-angle gives sin 30° = ½, making AB = r = 14 cm), which is a useful shortcut to verify.
- Use √3 ≈ 1.732 unless the question provides a specific value.
- Major segment = Total circle area − minor segment area. Show all steps clearly; marks are awarded for each stage of working.

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