CLASS 10 — MATHEMATICS

Chapter: Areas Related to Circles

Answer Key with Step-by-Step Solutions

Maximum Marks: 40 **Time Allowed: 1 hour 30 minutes**

Results used: for a circle of radius r and central angle θ (in degrees): length of arc = $\frac{\theta}{360} \times 2\pi r$; area of sector = $\frac{\theta}{360} \times \pi r^2$; area of minor segment = area of sector − area of the corresponding triangle; area of major segment = πr^2 − area of minor segment. Area of an equilateral triangle of side $a = \frac{\sqrt{3}}{4}a^2$.

SECTION A — MCQ Answer Key

Q	Option	Answer	Explanation / calculation
Q1	**(A)**	38.5 cm²	$\frac{90}{360} \times \frac{22}{7} \times 49 = \frac{1}{4} \times 154 = 38.5$ cm^2.
Q2	**(B)**	22 cm	$\frac{60}{360} \times 2 \times \frac{22}{7} \times 21 = \frac{1}{6} \times 132 = 22$ cm.
Q3	**(C)**	154 cm²	$2\pi r = 88 \Rightarrow r = 14$ cm. Quadrant = $\frac{1}{4} \times \frac{22}{7} \times 196 = 154$ cm^2.
Q4	**(C)**	60°	$\frac{\theta}{360} = \frac{1}{6} \Rightarrow \theta = 60°$.
Q5	**(A)**	12π cm²	In 20 minutes the hand turns $\frac{20}{60} \times 360° = 120°$. Area = $\frac{120}{360} \times \pi \times 36 = 12\pi$ cm^2.
Q6	**(B)**	4 times	Area $\propto r^2$ for a fixed angle; $(2r)^2 = 4r^2$.
Q7	**(D)**	56 cm²	Sector = $\frac{1}{4} \times \frac{22}{7} \times 196 = 154$; $\triangle OAB = \frac{1}{2} \times 14 \times 14 = 98$. Segment = 154 − 98 = 56 cm^2.
Q8	**(D)**	38.5 cm²	Arc = 25 − 2 × 7 = 11 cm. Area = $\frac{1}{2} \times$ arc $\times r = \frac{1}{2} \times 11 \times 7 = 38.5$ cm^2. (Or: $\theta = 90°$, quadrant of radius 7.)
Q9	**(A)**	Both true; R explains A	A sector of angle θ is the fraction θ/360 of the full circle, so its area is that fraction of πr². R is exactly the reason.
Q10	**(D)**	A false, R true	30 minutes ⇒ 180°, so the area is $\frac{1}{2} \times \frac{22}{7} \times 49 = 77$ cm^2, not 154 cm^2. A is false; R is true.

Marking: 1 mark for each correct option; no part marks in Section A.

SECTION B — Very Short Answer

Q11. Minor and major sectors [2 marks]

Minor sector = $\frac{120}{360} \times \frac{22}{7} \times 21 \times 21 = \frac{1}{3} \times 1386 = 462$ cm^2.

Area of circle = $\frac{22}{7} \times 441 = 1386$ cm^2. Major sector = $1386 - 462 = 924$ cm^2.

Answer: 462 cm^2 and 924 cm^2

> **Marking scheme:**
> Minor sector 462 cm²: 1 mark
> Major sector 924 cm²: 1 mark

Q12. Arc length and perimeter [2 marks]

Arc = $\frac{45}{360} \times 2 \times \frac{22}{7} \times 28 = \frac{1}{8} \times 176 = 22$ cm.

Perimeter of sector = arc + $2r = 22 + 56 = 78$ cm.

Answer: 22 cm; 78 cm

> **Marking scheme:**
> Arc 22 cm: 1 mark
> Perimeter 78 cm: 1 mark

Q13. Length of the pendulum [2 marks]

Arc = $\frac{72}{360} \times 2\pi r \Rightarrow 22 = \frac{1}{5} \times 2 \times \frac{22}{7} \times r = \frac{44}{35} r$.

$r = 22 \times \frac{35}{44} = 17.5$ cm.

Answer: 17.5 cm

> **Marking scheme:**
> Correct arc equation: 1 mark
> $r = 17.5$ cm: 1 mark

Q14. Central angle [2 marks]

$\frac{\theta}{360} \times \frac{22}{7} \times 10.5 \times 10.5 = 69.3 \Rightarrow \frac{\theta}{360} \times 346.5 = 69.3$.

$\theta = \frac{69.3 \times 360}{346.5} = 0.2 \times 360 = 72°$.

Answer: 72°

> **Marking scheme:**
> Correct equation: 1 mark
> θ = 72°: 1 mark

Q15. Sector of a circle of area 616 cm² [2 marks]

Sector area = $\frac{45}{360} \times$ (area of circle) = $\frac{1}{8} \times 616 = 77$ cm^2.

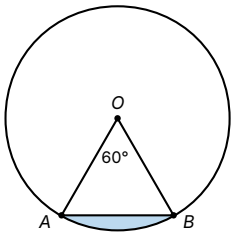
(Radius check: $\frac{22}{7} r^2 = 616 \Rightarrow r = 14$ cm.)

Answer: 77 cm^2

> **Marking scheme:**
> Using fraction 45/360 of the circle: 1 mark
> 77 cm²: 1 mark

SECTION C — Short Answer

Q16. Segments for a 60° chord, r = 21 cm [3 marks]



Sector OAB = $\frac{60}{360} \times \frac{22}{7} \times 441 = 231$ cm^2.

OA = OB and ∠AOB = 60°, so △OAB is equilateral with side 21 cm: area = $\frac{\sqrt{3}}{4} \times 441 = \frac{1.73 \times 441}{4} = 190.73$ cm^2 (190.7325).

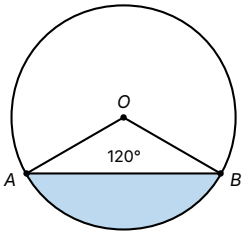
Minor segment = $231 - 190.73 = 40.27$ cm^2.

Major segment = $\frac{22}{7} \times 441 - 40.27 = 1386 - 40.27 = 1345.73$ cm^2.

Answer: Minor ≈ 40.27 cm^2; major ≈ 1345.73 cm^2

> **Marking scheme:**
> Sector 231 cm² and equilateral triangle area: 1 mark
> Minor segment ≈ 40.27 cm²: 1 mark
> Major segment ≈ 1345.73 cm²: 1 mark

Q17. Segment for a 120° chord, r = 6 cm [3 marks]



Sector = $\frac{120}{360} \times 3.14 \times 36 = 37.68$ cm^2.

Area of △OAB: draw OM ⊥ AB. ∠AOM = 60°, so OM = 6 cos 60° = 3 cm and AM = 6 sin 60° = $3\sqrt{3}$ cm, AB = $6\sqrt{3}$ cm.

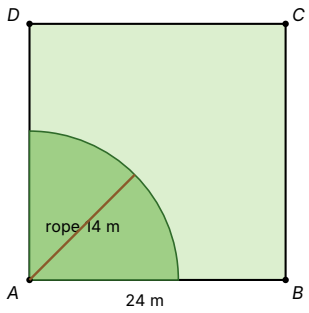
Area of △OAB = $\frac{1}{2} \times 6\sqrt{3} \times 3 = 9\sqrt{3} = 9 \times 1.73 = 15.57$ cm^2.

Minor segment = $37.68 - 15.57 = 22.11$ cm^2.

Answer: 22.11 cm^2

> **Marking scheme:**
> Sector 37.68 cm²: 1 mark
> Triangle $9\sqrt{3} \approx 15.57$ cm²: 1 mark
> Segment 22.11 cm²: 1 mark

Q18. Cow tied to a corner [3 marks]



The cow grazes a quadrant (angle 90°) of radius 14 m: $\frac{1}{4} \times \frac{22}{7} \times 196 = 154$ m^2.

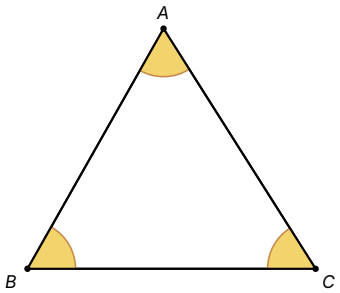
Area not grazed = $24 \times 24 - 154 = 576 - 154 = 422$ m^2.

A 21 m rope is still shorter than the 24 m side, so the cow again grazes a quadrant: $\frac{1}{4} \times \frac{22}{7} \times 441 = 346.5$ m^2. Increase = $346.5 - 154 = 192.5$ m^2.

Answer: 154 m^2; 422 m^2; 192.5 m^2 more

> **Marking scheme:**
> Grazed area 154 m²: 1 mark
> Not grazed 422 m²: 1 mark
> Increase 192.5 m²: 1 mark

Q19. Three sectors inside a triangle [3 marks]



The three sectors have the same radius 7 cm and angles ∠A, ∠B, ∠C.

Total area = $\frac{\angle A}{360}\pi r^2 + \frac{\angle B}{360}\pi r^2 + \frac{\angle C}{360}\pi r^2 = \frac{\angle A + \angle B + \angle C}{360} \times \pi r^2$.

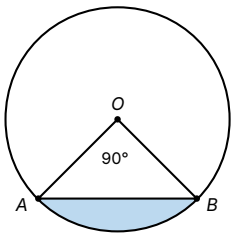
$\angle A + \angle B + \angle C = 180°$, so total = $\frac{180}{360} \times \frac{22}{7} \times 49 = 77$ cm^2.

Answer: 77 cm^2

> **Marking scheme:**
> Expressing each sector area: 1 mark
> Using the angle sum 180°: 1 mark
> 77 cm²: 1 mark

SECTION D — Long Answer

Q20. Segment for a 90° chord, r = 21 cm [4 marks]



Sector OAB = $\frac{90}{360} \times \frac{22}{7} \times 441 = 346.5$ cm^2. △OAB is right-angled at O: area = $\frac{1}{2} \times 21 \times 21 = 220.5$ cm^2.

(i) Minor segment = 346.5 − 220.5 = **126 cm^2**.

(ii) Circle = $\frac{22}{7} \times 441 = 1386$ cm^2. Major segment = 1386 − 126 = **1260 cm^2**.

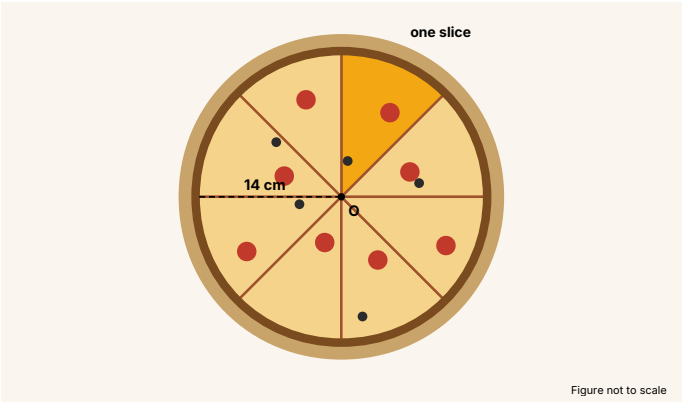
(iii) Arc AB = $\frac{90}{360} \times 2 \times \frac{22}{7} \times 21 = 33$ cm. Chord AB = $\sqrt{21^2 + 21^2} = 21\sqrt{2} = 21 \times 1.414 = 29.694$ cm.

Perimeter of minor segment = 33 + 29.694 = **62.694 cm** ≈ 62.69 cm.

Answer: (i) 126 cm^2 (ii) 1260 cm^2 (iii) ≈ 62.69 cm

> **Marking scheme:**
> Sector 346.5 and triangle 220.5: 1 mark
> (i) 126 cm²: 1 mark
> (ii) 1260 cm²: 1 mark
> (iii) arc 33 + chord 29.69 = 62.69 cm: 1 mark

SECTION E — Case Study



Q21. Pizza slices [4 marks]

Radius = 28 ÷ 2 = 14 cm.

(i) Central angle = $\frac{360}{8}$ = **45°**.

(ii) Area of one slice = $\frac{45}{360} \times \frac{22}{7} \times 196 = \frac{616}{8}$ = **77 cm^2**.

(iii) Crust = $\frac{45}{360} \times 2 \times \frac{22}{7} \times 14 = \frac{88}{8}$ = **11 cm**. Perimeter of a slice = 11 + 14 + 14 = **39 cm**.

Area left after 3 slices are eaten = $5 \times 77 = \mathbf{385\ cm^2}$.

Answer: (i) 45° (ii) 77 $\mathbf{cm^2}$ (iii) 11 cm; 39 cm; 385 $\mathbf{cm^2}$

> **Marking scheme:**
> (i) 45°: 1 mark
> (ii) 77 cm^2: 1 mark
> (iii) crust 11 cm and perimeter 39 cm: 1 mark; 385 cm^2 left: 1 mark

Final Answer Summary

Q	Final answer	Q	Final answer
Q1	(A) 38.5 cm²	**Q12**	22 cm; 78 cm
Q2	(B) 22 cm	**Q13**	17.5 cm
Q3	(C) 154 cm²	**Q14**	72°
Q4	(C) 60°	**Q15**	77 cm²
Q5	(A) 12π cm²	**Q16**	≈ 40.27 cm²; ≈ 1345.73 cm²
Q6	(B) 4 times	**Q17**	22.11 cm²
Q7	(D) 56 cm²	**Q18**	154 m²; 422 m²; 192.5 m²
Q8	(D) 38.5 cm²	**Q19**	77 cm²
Q9	(A)	**Q20**	126 cm²; 1260 cm²; ≈ 62.69 cm
Q10	(D)	**Q21**	45°; 77 cm²; 11 cm, 39 cm; 385 cm²
Q11	462 cm², 924 cm²		

Marks: Section A 10 + Section B 10 + Section C 12 + Section D 4 + Section E 4 = **40**

— End of Solutions —