CLASS IX – MATHEMATICS

Chapter Test: Measuring Space: Perimeter and Area

Step-by-Step Solutions and Marking Scheme | M. M.: 40

Formulas used

Circle: $C = 2\pi r$, $A = \pi r^2$. **Arc:** $l = 2\pi r \times \theta/360$. **Sector:** $A = \pi r^2 \times \theta/360$. **Rectangle:** $P = 2(l + b)$, $A = lb$. **Parallelogram:** A = base × height.

Triangle: A = ½ × base × height. **Heron:** $s = (a + b + c)/2$, $A = \sqrt{(s(s - a)(s - b)(s - c))}$. **Trapezium:** $A = \frac{1}{2}(a + b)h$. **Rhombus/kite:** $A = \frac{1}{2} d_1 d_2$. Where needed, $\pi = 22/7$.

Section A (1 mark each)

Q	Ans	Reason
1	(B)	$2\pi r = 88 \Rightarrow 2 \times 22/7 \times r = 88 \Rightarrow r = 88 \times 7 \div 44 =$ **14 cm**.
2	(C)	$l = 2\pi r \times 45/360 = 2 \times 22/7 \times 14 \times 1/8 = 88 \times 1/8 =$ **11 cm**.
3	(D)	r = 7 cm. $A = \pi r^2 = 22/7 \times 49 =$ **154 cm²**.
4	(B)	$5^2 + 12^2 = 13^2$, so it is right-angled. Area = ½ × 5 × 12 = **30 cm²**.
5	(C)	$A = \pi r^2 \times 60/360 = 22/7 \times 441 \times 1/6 = 1386 \div 6 =$ **231 cm²**.
6	(A)	A = base × height = 12 × 7.5 = **90 cm²**.
7	(D)	Distance per turn = $\pi d = 22/7 \times 70 = 220$ cm. For 100 turns: 22000 cm = **220 m**.
8	(B)	A median divides a triangle into two triangles of equal area, so area (ΔABD) = 48 ÷ 2 = **24 cm²**.
9	(C)	Perimeters $2\pi r_1 : 2\pi r_2 = 5 : 4$, so $r_1 : r_2 = 5 : 4$. Areas $= r_1^2 : r_2^2 =$ **25 : 16**.
10	(D)	π cannot be written as a ratio of two integers; 22/7 and 3.14 are only approximations. π is **irrational**.
11	(A)	$C = 2\pi r$ is proportional to r, so doubling r doubles C. R is true and explains A. → **(A)**.
12	(D)	A is false: 6 × 4 and 7 × 3 both have perimeter 20 cm, but areas 24 cm² and 21 cm². R is true. → **(D)**.

Section B (2 marks each)

Q.13 (2 marks)

Circumference = $2\pi r = 2 \times 22/7 \times 14 =$ **88 cm**. [1]

Ans. Area = $\pi r^2 = 22/7 \times 14 \times 14 = 616$ cm². [1]

Q.14 (2 marks)

(A) Distance in one turn = circumference = $2\pi r = 2 \times 22/7 \times 35 =$ **220 cm**. [1]

Ans. 2.2 km = 220000 cm. Number of turns = 220000 ÷ 220 = 1000. [1]

OR (B) Arc length = $2\pi r \times 60/360 = 2 \times 22/7 \times 21 \times 1/6 =$ **22 cm**. [1]

Ans. Perimeter of sector = arc + 2 radii = 22 + 21 + 21 = 64 cm. [1]

Q.15 (2 marks)

Third side = 56 − 7 − 24 = **25 cm**. Semi-perimeter s = 56 ÷ 2 = 28 cm. [1]

Ans. Area = $\sqrt{(28 \times 21 \times 4 \times 3)} = \sqrt{7056} = 84$ cm². [1] (Check: $7^2 + 24^2 = 25^2$, right-angled, ½ × 7 × 24 = 84.)

Q.16 (2 marks)

(A) Let the shorter diagonal be *d*; the other is 2*d*. Area = ½ × d × 2d = d^2. [1]

Ans. $d^2 = 144 \Rightarrow d = 12$. The diagonals are 12 cm and 24 cm. [1]

OR (B) Area = base × height = 15 × 8 = **120 cm²**. [1]

Ans. Using the 10 cm side as base: 10 × h = 120 ⇒ altitude = 12 cm. [1]

Section C (3 marks each)

Q.17 (3 marks)

(A) Draw perpendiculars from the ends of the shorter side to the longer side. Each cuts off (40 − 20) ÷ 2 = 10 cm. [1]

Height h = √(26² − 10²) = √(676 − 100) = √576 = 24 cm. [1]

Ans. Area = ½ × (40 + 20) × 24 = 720 cm². [1]

OR (B) Ratio sum = 5 + 12 + 13 = 30, so each part = 150 ÷ 30 = 5. Sides = 25 m, 60 m, 65 m. [1]

s = 150 ÷ 2 = 75 m. [1]

Ans. Area = √(75 × 50 × 15 × 10) = √562500 = 750 m². [1]

Q.18 (3 marks)

(A) Given: ΔABC, D is the midpoint of BC (BD = DC), AH ⊥ BC. Let AH = h. [½]

Area (ΔABD) = ½ × BD × h. [1]

Area (ΔACD) = ½ × DC × h. [1]

Since BD = DC, both areas are equal. So the median AD divides ΔABC into two triangles of equal area. [½]

OR (B) AD is a median of ΔABC, so area (ΔABD) = area (ΔACD). [1] PD is a median of ΔPBC (D is the midpoint of BC), so area (ΔPBD) = area (ΔPCD). [1]

Ans. Subtract: area (ΔABD) − area (ΔPBD) = area (ΔACD) − area (ΔPCD), i.e. area (ΔABP) = area (ΔACP). [1]

Section D (5 marks each)

Q.19 (5 marks)

(A) (i) AB = AC = BC = 21 cm, as each circle passes through the centre of the other (the radius of each circle is 21 cm). So ΔABC is equilateral. [1] Hence ∠CAB = 60°. Similarly ∠BAD = 60°, so ∠CAD = 60° + 60° = **120°**. [1]

(ii) The red arc of circle A is the major arc, making 360° − 120° = 240° at A. Length = 2π × 21 × 240/360 = 132 × 2/3 = **88 cm**. [1]

(iii) The two red arcs are equal, so the perimeter = 2 × 88 = **176 cm** (= 8πr/3). [1]

Ans. (iv) Sector area = πr² × 120/360 = 22/7 × 441 × 1/3 = 1386 ÷ 3 = 462 cm². [1]

OR (B) (i) Inner boundary = 2 × 90 + 2π × 35 = 180 + 220 = **400 m**. [1]

(ii) Outer radius of the curved ends = 35 + 3.5 = 38.5 m. [1] Outer boundary = 2 × 90 + 2π × 38.5 = 180 + 242 = **422 m**. [1]

Ans. (iii) Extra distance = 422 − 400 = 22 m (= 2π × 3.5). The straight sections are equal on both boundaries (90 m each); only the semicircular ends have a bigger radius on the outside, so the whole difference comes from the curves. [2]

Q.20 (5 marks)

(A) (i) s = (13 + 14 + 15) ÷ 2 = **21 m**. [1]

(ii) Area = √(21 × 8 × 7 × 6) = √7056 = **84 m²**. [2]

(iii) ½ × 14 × h = 84 ⇒ h = **12 m**. [1]

Ans. (iv) Cost = 84 × 20 = ₹1680. [1]

OR (B) (i) Area of the square = 14 × 14 = **196 cm²**. [1]

(ii) The four quarter circles together make one full circle of radius 7 cm: area = 22/7 × 7 × 7 = **154 cm²**. [2]

(iii) Shaded area = 196 − 154 = **42 cm²**. [1]

Ans. (iv) The sides of the square are fully used by the quarter circles (7 + 7 = 14), so the boundary is four quarter arcs, i.e. one circle: 2π × 7 = 44 cm. [1]

Section E (4 marks)

Q.21 (4 marks)

(i) Area of park = πr^2 = 22/7 × 21 × 21 = **1386 m²**. **[1]**

(ii) Flower bed = sector of 120°: 1386 × 120/360 = **462 m²**. **[1]**

(iii) (A) Arc length = 2π × 21 × 120/360 = 132 ÷ 3 = 44 m. [1]

Fencing = arc + 2 radii = 44 + 21 + 21 = **86 m**. [1]

OR (iii) (B) Area of lawn = 1386 − 462 = **924 m²**. [1]

Cost = 924 × 15 = **₹13,860**. [1]

— End of Solutions —