Unit 8 · Area and Volume

HARDER PRACTICE QUESTIONS · ANSWER KEY

Full marks 31

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 One triangle, three heights

ANSWER A · 3

i. $\frac{1}{2} \times 14 \times 12 = \mathbf{84\ cm^2}$.

ii. The area is the same from any side: $\frac{1}{2} \times 15 \times h = 84$, so $h = \frac{168}{15} = \mathbf{11.2\ cm}$.

iii. Base × height is 168 for every side, so the shortest side, **13 cm**, has the longest height.

MARKING SCHEME

- ✓ 84 cm^2.
- ✓ 11.2 cm.
- ✓ The height onto the shortest side, since base × height stays the same.

2 Work backwards

ANSWER A · 3

$\frac{1}{2} \times 10 \times h = 60$, so $h = \mathbf{12\ cm}$.

The height cuts the base into two parts of 5 cm, so each equal side is $\sqrt{5^2 + 12^2} = \sqrt{169} = \mathbf{13\ cm}$.

Perimeter: $13 + 13 + 10 = \mathbf{36\ cm}$.

Check: $\frac{10}{4}\sqrt{4 \times 169 - 100} = 2.5 \times \sqrt{576} = 2.5 \times 24 = 60\ cm^2$. ✓

MARKING SCHEME

- ✓ Height 12 cm.
- ✓ Equal side 13 cm and perimeter 36 cm.
- ✓ The check with the formula gives 60 cm^2.

3 Same perimeter, three shapes

ANSWER HA · 4

Triangle: side 8 cm, area $\frac{\sqrt{3}}{4} \times 8^2 = 16 \times 1.73 \approx \mathbf{27.7\ cm^2}$.

Square: side 6 cm, area $\mathbf{36\ cm^2}$.

Circle: $2\pi r = 24$, so $r = \frac{24 \times 7}{44} = \frac{42}{11} \approx 3.82$ cm, and the area is $\frac{22}{7} \times \frac{42}{11} \times \frac{42}{11} = \frac{504}{11} \approx \mathbf{45.8\ cm^2}$.

The more round the shape, the more area the same perimeter holds. The circle holds the most.

MARKING SCHEME

- ✓ Triangle about 27.7 cm^2.
- ✓ Square 36 cm^2.
- ✓ Circle about 45.8 cm^2.
- ✓ The circle has the greatest area for the same perimeter.

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4 A rhombus from a side

ANSWER A · 3

Half of 24 is 12. Half of the other diagonal is $\sqrt{13^2 - 12^2} = \sqrt{25} = 5$, so the diagonal is **10 cm**.

Area: $\frac{1}{2} \times 24 \times 10 = \mathbf{120\ cm^2}$.

A rhombus is a parallelogram, so $13 \times h = 120$ and $h = \frac{120}{13} \approx \mathbf{9.2\ cm}$.

MARKING SCHEME

- ✓ The other diagonal is 10 cm.
- ✓ Area 120 cm^2.
- ✓ Height about 9.2 cm.

5 A path round a pond

ANSWER A · 3

i. Inner radius 14 m, outer radius 17.5 m.

Area $= \pi(17.5^2 - 14^2) = \frac{22}{7} \times (306.25 - 196) = \frac{22}{7} \times 110.25 = \mathbf{346.5\ m^2}$.

ii. $346.5 \times 200 = \mathbf{Rs\ 69{,}300}$.

MARKING SCHEME

- ✓ Radii 14 m and 17.5 m.
- ✓ 346.5 m^2.
- ✓ Rs 69,300.

6 Spot the error

ANSWER U · 3

Small: $\frac{22}{7} \times 7^2 = 154\ cm^2$. Big: $\frac{22}{7} \times 14^2 = 616\ cm^2$.

$616 \div 154 = 4$. Doubling the radius makes the area **4 times** as big, because the radius is squared. So she should have said **four** small rotis.

MARKING SCHEME

- ✓ Areas 154 cm^2 and 616 cm^2.
- ✓ The mistake: the area doesn't double, since the radius is squared.
- ✓ Four small rotis.

7 One inside the other

ANSWER HA · 4

i. Side 14 cm: **196 cm^2**.

ii. Its diagonals are both 14 cm, and a square is a rhombus: $\frac{1}{2} \times 14 \times 14 = \mathbf{98\ cm^2}$.

iii. Circle: $\frac{22}{7} \times 49 = \mathbf{154\ cm^2}$. Outside the small square: $154 - 98 = \mathbf{56\ cm^2}$.

iv. $196 : 98 = \mathbf{2 : 1}$.

MARKING SCHEME

- ✓ 196 cm^2.
- ✓ 98 cm^2, from the diagonals.
- ✓ 154 cm^2 and 56 cm^2.
- ✓ 2 : 1.

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8 In a real setting

ANSWER A · 4

i. A quarter circle: $\frac{1}{4} \times \frac{22}{7} \times 49 = \mathbf{38.5\ m^2}$. Out of reach: $300 - 38.5 = \mathbf{261.5\ m^2}$.

ii. A half circle: $\mathbf{77\ m^2}$, twice as much.

iii. r^2 must double, from 49 to 98, so $r = \sqrt{98} \approx \mathbf{9.9\ m}$, not 14 m.

MARKING SCHEME

- ✓ 38.5 m^2.
- ✓ 261.5 m^2.
- ✓ 77 m^2.
- ✓ About 9.9 m, from $r^2 = 98$.

9 Think

ANSWER HA · 2

The **area doesn't change**: the base stays the same, and the height, the distance between the two parallel lines, stays the same.

The **perimeter does change**: as A moves away, the sides AB and AC get longer overall.

MARKING SCHEME

- ✓ The area stays the same, since the base and the height do.
- ✓ The perimeter changes.

10 Make your own

ANSWER HA · 2

For example, height 6 cm: a parallelogram with base 10 cm has an area of 60 cm^2, and a trapezium with parallel sides 8 cm and 12 cm has an area of $\frac{1}{2} \times 6 \times 20 = 60\ cm^2$.

The two parallel sides must add up to **twice the base**: their average must equal it.

MARKING SCHEME

- ✓ Two shapes with equal areas, shown by working.
- ✓ The parallel sides add up to twice the base.

See it at Science Playground

Exhibits and plants at the center, Bhaktapur, that go with this unit. Book a class visit at science-playground.com/booking.

- **Tangram Puzzle** (exhibit): Each large triangle's longest side is the whole square's side, and its height is half of that, so ½ × b × h makes it a quarter of the square.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	3	16	12	**31**

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