Test answers - Area, volume, surface area, arcs and sectors

Year: Year 10 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. $\frac{1}{2}(8+14)\times 6 = 66$ **cm²** (1 for the formula, 1 for the answer) Add the parallel sides, halve, then multiply by the height: $\frac{1}{2}\times 22\times 6 = 66$.
b. Circumference $= 2\pi\times 7 =$ **44.0 cm** (1). Area $= \pi\times 49 =$ **153.9 cm²** (1). The circumference uses $2\pi r$ and the area uses πr^2. So the circumference is 44.0 cm and the area is 153.9 cm².

In (a), a common slip is to forget the half and give 132 cm². In (b), using $\pi \approx 3.14$ gives 43.96 and 153.86, which round to the same answers; a diameter of 14 cm also gives $\pi d = 44.0$ cm.

Answer to Question 2 (4 marks)

a. Area of triangle $= \frac{1}{2}\times 6\times 8 = 24$ (1). Volume $= 24\times 15 =$ **360 cm³** (1) A prism's volume is the area of its cross-section times its length. The volume is 360 cm³.
b. Triangles $2\times 24 = 48$ (1). Rectangles $15\times(6+8+10) = 360$. Total $=$ **408 cm²** (1) The surface is two triangles and three rectangles, one for each side of the triangle. The total surface area is 408 cm².

In (b), the three rectangles have different widths (6, 8 and 10 cm), so do not use $3\times$ one rectangle. Check the units: volume is in cm³ and area in cm².

Answer to Question 3 (4 marks)

a. $\frac{120}{360}\times 2\pi\times 9 = 6\pi =$ **18.8 cm** (1 for method, 1 for the answer) The sector is $\frac{120}{360} = \frac{1}{3}$ of the circle, and the full circumference is 18π. The arc length is 6π cm, about 18.8 cm.
b. $\frac{120}{360}\times \pi\times 81 = 27\pi =$ **84.8 cm²** (1, 1) Take $\frac{1}{3}$ of the full area 81π. The area of the sector is 27π cm², about 84.8 cm².

Exact answers in terms of π are also accepted, 6π cm and 27π cm². A useful check: arc length times radius divided by 2 gives the sector area, $6\pi\times 9\div 2 = 27\pi$.

Answer to Question 4 (4 marks)

a. Radius $= 0.6$ m. $V = \pi \times 0.36 \times 2 = 0.72\pi = 2.262$ m³ (1) $= 2262$ litres (1) Halve the diameter to get the radius, use $V = \pi r^2 h$, then multiply by 1000 because 1 m³ is 1000 litres. The tank holds about 2262 litres, as required.
b. $2262 \times 0.68 = 1538.2$, so **£1538** (1 for multiplying, 1 for the answer) Change 68p into £0.68 before multiplying. It costs about £1538 to fill the tank.

Answer to Question 5 (4 marks)

a. $\sqrt{36 + 64} =$ **10 cm** (1) The radius, the height and the slant height form a right-angled triangle, so the slant height is 10 cm.
b. $\frac{1}{3}\pi \times 36 \times 8 = 96\pi$ **cm³** (1) Use $V = \frac{1}{3}\pi r^2 h$ with $r = 6$ and $h = 8$. The volume is 96π cm³.
c. $\frac{4}{3}\pi \times 27 = 36\pi$ **cm³** (1) Use $V = \frac{4}{3}\pi r^3$ with $r^3 = 27$. The volume is 36π cm³.
d. $96\pi : 36\pi = 96 : 36 =$ **8 : 3** (1) The π cancels, then divide both numbers by their HCF, 12. The ratio is 8 : 3.