Test answers - Volume and surface area of prisms

Year: Year 8 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. Volume of a cuboid = length × width × height $= 9 \times 6 \times 5 =$ **270 cm³**. (1 mark)
b. For any prism, volume = area of cross-section × length. The cross-section is a triangle: $\frac{1}{2} \times 10 \times 6 = 30$ cm² (1 mark). Volume $= 30 \times 15 =$ **450 cm³** (1 mark).
c. Each cubic metre holds 1 000 litres, so $2.4 \times 1000 =$ **2 400 litres**. (1 mark)

Forgetting the half in the triangle area gives 900 cm³, twice the correct volume. Volumes are in cubic units, so always write cm³ or m³. A tank of 2.4 m³ could be, for example, 2 m long, 1.2 m wide and 1 m deep.

Answer to Question 2 (4 marks)

a. The cuboid has three pairs of equal faces: $7 \times 4 = 28$, $7 \times 3 = 21$ and $4 \times 3 = 12$ cm² (1 mark). Total surface area $= 2(28 + 21 + 12) = 2 \times 61 =$ **122 cm²** (1 mark).
b. A cube has 6 identical square faces, so $6a^2 = 122$ (1 mark). Then $a^2 = 122 \div 6 = 20.33\ldots$ and $a = \sqrt{20.33\ldots} = 4.509\ldots$, which is **4.5 cm** to 1 decimal place (1 mark).

Check (b): $6 \times 4.509^2 \approx 122$. The cube has a volume of about 91.7 cm³, more than the 84 cm³ of the cuboid, since a cube encloses the most volume for a given surface area.

Answer to Question 3 (4 marks)

a. A cylinder is a prism with a circular cross-section, so $V = \pi r^2 h$ (1 mark). With $r = 6$ and $h = 10$: $V = \pi \times 36 \times 10 = 360\pi = 1130.97\ldots$, which is **1 131.0 cm³** (1 mark).
b. The curved surface unrolls into a rectangle whose width is the circumference $2\pi r$ and whose height is h, so the area is $2\pi rh$ (1 mark).
$2 \times \pi \times 6 \times 10 = 120\pi = 376.99\ldots$, which is **377.0 cm²** (1 mark).

The two circular ends add $2 \times \pi \times 36 = 72\pi \approx 226.2$ cm² for the total surface area. The question asks only for the curved part, so those ends are not included here.

Answer to Question 4 (4 marks)

a. The pool is a cuboid: $15 \times 8 \times 1.4 = 120 \times 1.4 =$ **168 m³**. (1 mark)
b. Change to litres: 1 m³ = 1 000 litres, so the pool holds 168 000 litres (1 mark).

Divide by the rate: $168\,000 \div 3\,000 = 56$ (1 mark). The rate is per minute, so it takes 56 minutes, which is **0 hours 56 minutes** (1 mark for the answer with correct units).

Check with cubic metres: the pump delivers 3 m³ each minute, and $168 \div 3 = 56$. The pool fills in just under an hour. If the units were left mixed, dividing 168 by 3 000 would give a meaningless answer, so always convert first.

Answer to Question 5 (4 marks)

a. The cross-section is a trapezium: area $= \frac{1}{2}(6 + 10) \times 4 = \frac{1}{2} \times 16 \times 4 = 32$ cm² (1 mark). Volume = cross-section × length $= 32 \times 25 =$ **800 cm³** (1 mark).
b. The two trapezium ends give $2 \times 32 = 64$ cm². The four rectangular faces all have length 25 cm, and their widths are the four sides of the trapezium, 6, 10, 4.5 and 4.5 cm, which add to 25 cm (1 mark). So the rectangles give $25 \times 25 = 625$ cm². Total paper $= 64 + 625 =$ **689 cm²** (1 mark).

The 4 cm height of the trapezium is not a face of the box; the sloping sides of 4.5 cm are.