Measurement topic test 2

10 questions | 52 marks | 65 minutes

Composite shapes and capacity. Use a scientific calculator, show working and include units. Sketches are not to scale.

Equivalent correct methods earn the corresponding marks.

1. A gardener compares different measurement descriptions. [4 marks]

(a) Explain why square metres, not metres, describe lawn coverage. [2 marks]

Two perpendicular lengths are multiplied, so the unit is squared.

Answer: Coverage is area.

(b) A device displays mass to 0.01 kg. State its displayed resolution in grams. [2 marks]

$0.01 \times 1000 = 10$ g.

Answer: 10 g.

2. An 8 m by 3.5 m rectangular pool has a water layer 200 mm deep. [5 marks]

(a) Find the water volume in litres. [3 marks]

Depth $= 0.2$ m; $8 \times 3.5 \times 0.2 = 5.6$ m$^3 = 5600$ L.

Answer: 5600 L.

(b) How many litres raise the water level by 1 mm? [2 marks]

$8 \times 3.5 \times 0.001 = 0.028$ m$^3 = 28$ L.

Answer: 28 L.

3. A semicircle of radius 3 m is attached externally along one 6 m side of a 10 m by 6 m rectangle. The shared diameter is internal. [6 marks]

(a) Find total area to 2 decimal places. [3 marks]

$A = 10 \times 6 + \frac{1}{2}\pi(3)^2 = 60 + 4.5\pi \approx 74.14$.

Answer: 74.14 m^2.

(b) Find outside perimeter to 2 decimal places. [3 marks]

Three uncovered rectangle edges total $10 + 10 + 6 = 26$ m. Add semicircle arc 3π: $26 + 3\pi \approx 35.42$.

Answer: 35.42 m.

4. A triangular prism has a right-triangle cross-section with sides 3 cm, 4 cm and 5 cm, and length 8 cm. [5 marks]

(a) Find its volume. [2 marks]

Triangle area $= \frac{1}{2}(3)(4) = 6$ cm^2; $V = 6 \times 8 = 48$.

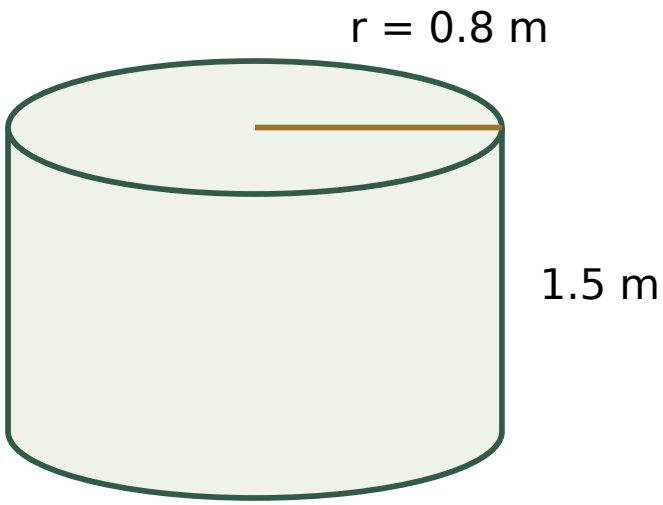
Answer: 48 cm^3.

(b) Find the total surface area. [3 marks]

Two triangles give 12 cm^2; rectangular faces give $8(3+4+5) = 96$ cm^2. Total $= 108$.

Answer: 108 cm^2.

5. An open cylindrical tank has radius 0.8 m and height 1.5 m. Its inner base and curved wall need coating. Coverage is 2 m^2/L, sold in 2.5 L tins. [5 marks]



Sketch not to scale

(a) Calculate the area to be coated, to 2 decimal places. [3 marks]

$A = \pi(0.8)^2 + 2\pi(0.8)(1.5) = 3.04\pi \approx 9.55$.

Answer: 9.55 m^2.

(b) Find the tin order using the unrounded area. [2 marks]

Volume $= \frac{3.04\pi}{2} \approx 4.7752$ L; $\frac{4.7752}{2.5} \approx 1.9101$, so buy 2 tins.

Answer: 2 tins.

6. A real room is 6 m by 4.2 m. A plan uses scale 1:80. [5 marks]

(a) Find its drawing dimensions in centimetres. [2 marks]

$\frac{600}{80} = 7.5$, $\frac{420}{80} = 5.25$.

Answer: 7.5 cm by 5.25 cm.

(b) Find drawing area and explain why dividing real area by 80 is wrong. [3 marks]

Drawing area $= 7.5 \times 5.25 = 39.375$. Area scale uses 80^2, not 80; units must also match.

Answer: 39.375 cm^2.

7. A cycle trip covers 14 km in 42 minutes. Separately, a car uses 6.8 L per 100 km and petrol costs AUD 1.95/L. [5 marks]

(a) Find average cycling speed. [2 marks]

42 min $= 0.7$ h; $\frac{14}{0.7} = 20$ km/h.

Answer: 20 km/h.

(b) Find the petrol cost for 250 km. [3 marks]

Fuel $= 6.8 \times 2.5 = 17$ L; cost $= 17 \times 1.95 = 33.15$.

Answer: AUD 33.15.

8. A rectangular tank has internal dimensions 2 m by 1.2 m by 0.9 m. A pump fills it at a constant 18 L/min. [6 marks]

(a) Find full capacity and filling time from empty. [3 marks]

$V = 2 \times 1.2 \times 0.9 = 2.16$ m^3; $\frac{2160}{18} = 120$ min.

Answer: 2160 L; 120 minutes.

(b) Find filling time if the initial water depth is 0.3 m. [3 marks]

Initial volume $= 2 \times 1.2 \times 0.3 = 0.72$ $m^3 = 720$ L. Remaining 1440 L takes $\frac{1440}{18} = 80$ min.

Answer: 80 minutes.

9. A rod measures 25.0 cm to the nearest 0.1 cm. A rigid gap is exactly 25.02 cm. [4 marks]

(a) State the measurement interval. [2 marks]

Half the rounding unit is 0.05 cm.

Answer: $24.95 \le L < 25.05$ cm.

(b) Can you guarantee that the rod fits? Explain. [2 marks]

Some possible lengths, such as 25.04 cm, exceed the gap; a more precise check is needed.

Answer: No.

10. Two closed boxes have dimensions A: 10 cm by 6 cm by 4 cm, and B: 8 cm by 6 cm by 5 cm. [7 marks]

(a) Show that their volumes are equal. [2 marks]

$10 \times 6 \times 4 = 240$ and $8 \times 6 \times 5 = 240$.

Answer: Both 240 cm^3.

(b) Compare surface areas and recommend the lower-material option, assuming either shape fits the product. [3 marks]

$SA_A = 2(60 + 40 + 24) = 248$. $SA_B = 2(48 + 40 + 30) = 236$. B saves 12 cm^2 per box.

Answer: A: 248 cm^2; B: 236 cm^2; choose B.

(c) Allow 5% waste on the recommended area. Find material needed per box. [2 marks]

$236 \times 1.05 = 247.8$.

Answer: 247.8 cm^2.