Marking guide | Measurement

Measurement topic test 5

10 questions | 52 marks | 75 minutes

Planning and validation. Use a scientific calculator, show working and include units. Sketches are not to scale.

Equivalent correct methods earn the corresponding marks.

1. A student writes three conversions. Correct each one. [6 marks]

(a) The student writes $4\,\text{mm} = 0.4\,\text{m}$. [2 marks]

Divide millimetres by 1000.

Answer: $4\,\text{mm} = 0.004\,\text{m}$.

(b) The student writes $3.2\,\text{m}^2 = 320\,\text{cm}^2$. [2 marks]

Multiply by $100^2 = 10\,000$.

Answer: 32,000 cm^2.

(c) The student writes $0.8\,\text{m}^3 = 80\,\text{L}$. [2 marks]

Multiply cubic metres by 1000.

Answer: 800 L.

2. A line on a 1:25,000 walking map is 6.4 cm long. The route takes 24 minutes. [4 marks]

(a) Find the real route length in kilometres. [2 marks]

$6.4 \times 25\,000 = 160\,000$ cm $= 1.6$ km.

Answer: 1.6 km.

(b) Find average speed in km/h. [2 marks]

24 min is 0.4 h; $\frac{1.6}{0.4} = 4$ km/h.

Answer: 4 km/h.

3. A running-track outline consists of a 12 m by 6 m rectangle with one semicircle of radius 3 m attached to each 6 m end. [6 marks]

(a) Find the enclosed area to two decimal places. [3 marks]

The semicircles make one circle: $A = 12 \times 6 + 9\pi \approx 100.27$.

Answer: 100.27 m^2.

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

Two straight lengths give 24 m; the arcs total 6π m. $P = 24 + 6\pi \approx 42.85$.

Answer: 42.85 m.

4. A rectangular enclosure is 15 m by 10 m. A 3 m gate leaves one continuous open fence line. Posts must be at both ends of that line and no more than 2 m apart. [5 marks]

(a) Find the fence-line length. [2 marks]

$2(15 + 10) - 3 = 47$ m.

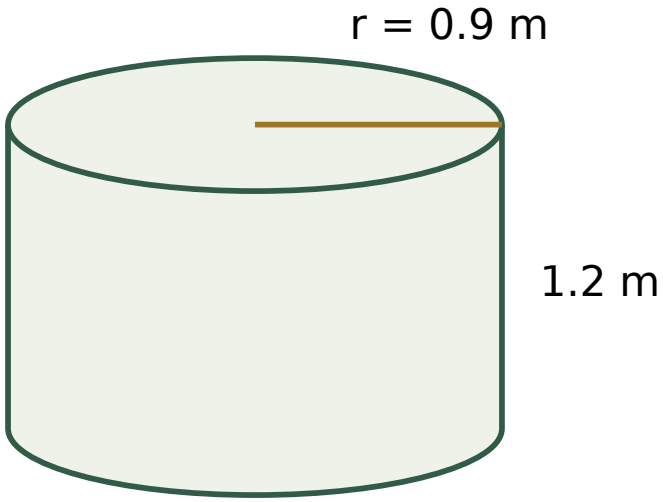
Answer: 47 m.

(b) Find the minimum number of posts for this line, ignoring extra corner-post requirements. [3 marks]

At least $\lceil \frac{47}{2} \rceil = 24$ intervals are needed; an open line with 24 intervals has 25 posts.

Answer: 25 posts.

5. An internal cylindrical tank has diameter 1.8 m and height 1.2 m. [5 marks]



Sketch not to scale

(a) Find its capacity to the nearest litre. [3 marks]

Radius is 0.9 m; $V = \pi(0.9)^2(1.2) = 0.972\pi$ m^3, or $972\pi \approx 3053.63$ L.

Answer: 3054 L.

(b) Can it hold 3000 L with at least 60 L of empty capacity? Explain. [2 marks]

Unrounded spare capacity is $972\pi - 3000 \approx 53.63$ L, less than 60 L.

Answer: No.

6. A drink has density 1.05 kg/L. A batch contains 18 L. It is packed into 750 mL bottles, each empty bottle having mass 0.3 kg. [5 marks]

(a) Find the number of completely filled bottles. [2 marks]

$\frac{18}{0.75} = 24$.

Answer: 24 bottles.

(b) Find the total mass of drink and bottles. [3 marks]

Drink mass $= 1.05 \times 18 = 18.9$ kg; bottle mass $= 24 \times 0.3 = 7.2$ kg; total $= 26.1$ kg.

Answer: 26.1 kg.

7. A redesign changes every length of a package to 80% of its former value. [5 marks]

(a) Find the new surface-area percentage. [2 marks]

Area factor $= 0.8^2 = 0.64$.

Answer: 64% of the original.

(b) Find the percentage reduction in volume. [3 marks]

Volume factor $= 0.8^3 = 0.512$, so reduction is $1 - 0.512 = 0.488 = 48.8\%$.

Answer: 48.8%.

8. A vehicle uses 8 L per 100 km. It starts a 210 km trip with 20 L. A reserve of at least 3 L is required on arrival. The steady travelling speed is 90 km/h. [5 marks]

(a) Check whether the planned fuel amount meets the reserve condition. [3 marks]

Fuel use $= 8 \times 2.1 = 16.8$ L. Remaining $= 20 - 16.8 = 3.2$ L, exceeding the 3 L reserve under the constant-use model.

Answer: Yes; 3.2 L remains.

(b) Find travel time with no stops. [2 marks]

$\frac{210}{90} = \frac{7}{3}$ h; the fractional hour is 20 minutes.

Answer: 2 hours 20 minutes.

9. A flooring report says: “The floor is 8 by 5, so order 40.” [5 marks]

(a) Identify two missing pieces of information needed before making a reliable order. [2 marks]

40 might describe area, not a count of packages. Units and package coverage are necessary.

Answer: For example, units of the dimensions and the coverage supplied per package.

(b) If the dimensions are metres and boxes cover 2.5 m^2, find the number of boxes with 15% extra area. [3 marks]

Area $= 40$ m^2; allowance $= 46$ m^2; $\frac{46}{2.5} = 18.4$, so buy 19.

Answer: 19 boxes.

10. A 120 m^2 surface needs two coats. Paint A costs AUD 55 per 5 L tin and covers 10 m^2/L. Paint B costs AUD 100 per 10 L tin and covers 8 m^2/L. Assume both are otherwise suitable. [6 marks]

(a) Find each whole-tin order. [3 marks]

Coverage requirement is 240 m^2. A needs 24 L, so 5 tins. B needs 30 L, so 3 tins.

Answer: A: 5 tins; B: 3 tins.

(b) Recommend the cheaper order, calculate the saving and state a model limitation. [3 marks]

Cost A $= 5 \times 55 = 275$; B $= 3 \times 100 = 300$. Coverage may vary with surface preparation or application.

Answer: A costs AUD 275 versus B at AUD 300; saving AUD 25.