

Solutions

2.1

Use Pythagoras because the given sides meet at a right angle.

$$c = \sqrt{a^2 + b^2} = \sqrt{5^2 + 12^2} = 13 \text{ cm}$$

Hypotenuse 13 cm.

2.2

Use half the rectangle area.

$$A = \frac{1}{2}bh = \frac{1}{2}(8)(6) = 24 \text{ cm}^2$$

Area 24 square centimetres.

2.3

The larger-to-smaller length factor is $k = 10/4 = 2.5$. Areas scale by the square of the length factor.

$$A_L = k^2 A_S = (2.5)^2(12) = 75 \text{ cm}^2$$

Larger area 75 square centimetres.

2.4

Use circular area times height.

$$V = \pi r^2 h = \pi(3)^2(8) = 72\pi \text{ cm}^3$$

Exact answer.

$$V = 72\pi \text{ cm}^3 \approx 226 \text{ cm}^3$$

Correct 3 significant figures.

3.1

Volume uses all three perpendicular lengths.

$$V = lwh = 8(5)(3) = 120 \text{ cm}^3$$

Volume. Sum the three pairs of opposite faces.

$$S = 2(lw + lh + wh)$$

$$S = 2(8(5) + 8(3) + 5(3)) = 158 \text{ cm}^2$$

Surface area.

$$V_L = k^3 V_S = 2^3(120) = 960 \text{ cm}^3$$

Larger volume. Each of the three dimensions doubles, so the product grows eightfold.

3.2

Capacity is internal rectangular volume.

$$V_T = lwh = 80(50)(40) = 160000 \text{ cm}^3$$

$$C = \frac{V_T}{1000} = \frac{160000}{1000} = 160 \text{ litres}$$

Capacity 160 litres.

$$V_W = lwh_W = 80(50)(25) = 100000 \text{ cm}^3 = 100 \text{ litres}$$

Initial water volume 100 litres. The submerged block displaces its own volume.

$$V_B = l_B w_B h_B = 20(10)(10) = 2000 \text{ cm}^3$$

Block volume.

$$\Delta h = \frac{V_B}{lw} = \frac{2000}{80(50)} = 0.5 \text{ cm}$$

Correct rise.

$$h_{new} = h_W + \Delta h = 25 + 0.5 = 25.5 \text{ cm}$$

New depth.

$$h_{gap} = h_T - h_{new} = 40 - 25.5 = 14.5 \text{ cm}$$

Remaining gap 14.5 cm. The initial depth already exceeds the block's height, so complete submersion is possible.