Answers - Perimeter, area and volume

Year: Year 7

Answer to Question 1

For a rectangle, perimeter = 2 × (length + width) and area = length × width. Check that both lengths are in the same unit before you calculate.

a. Perimeter $2(9+5) =$**28 cm**. Area $9 \times 5 =$**45 cm²**.
b. Perimeter $4 \times 7.5 =$**30 cm**. Area $7.5^2 =$**56.25 cm²**.
c. 85 cm = 0.85 m. Perimeter $2(2.4+0.85) =$**6.5 m**. Area $2.4 \times 0.85 =$**2.04 m²**.

Answer to Question 2

a. Area of a triangle = $\frac{1}{2}$ × base × height: $\frac{1}{2} \times 12 \times 7 =$**42 cm²**.
b. $\frac{1}{2} \times 9.6 \times 5 = 4.8 \times 5 =$**24 m²**.
c. Area of a parallelogram = base × perpendicular height: $15 \times 8 =$**120 cm²**. Do not use the slanting side.
d. Work backwards: $12 \times h = 96$, so $h = 96 \div 12 =$**8 cm**.

Answer to Question 3

a. $\frac{1}{2}(6+10) \times 4 =$**32 cm²**.
b. $\frac{1}{2}(8.5+11.5) \times 6 =$**60 m²**.
c. $60 - 12 =$**48 cm²**.
d. Cutting a corner does not change the perimeter of the rectangle: $2(10+6) =$**32 cm**.

In part (d) the two cut edges (4 cm and 3 cm) replace exactly the two pieces of the rectangle's edge that were removed, which is why the perimeter stays 32 cm even though the area is smaller.

Answer to Question 4

Volume of a cuboid = length × width × height. Surface area = 2 × (lw + lh + wh), the total area of the six faces.

a. Volume $8 \times 5 \times 3 =$**120 cm³**. Surface area $2(40+24+15) =$**158 cm²**.
b. Volume $4^3 =$**64 cm³**. Surface area $6 \times 16 =$**96 cm²**.
c. Volume $2.5 \times 1.2 \times 0.8 =$**2.4 m³**.

d. $120 \div 24 =$**5 cm**.

Answer to Question 5

a. 1 m² = 100 cm × 100 cm = 10 000 cm², so $3.5 \times 10000 =$**35 000 cm²**.
b. Divide by 10 000: $45000 \div 10000 =$**4.5 m²**.
c. 1 litre = 1 000 cm³, so $2.4 \times 1000 =$**2 400 cm³**.
d. Divide by 1 000: $5000 \div 1000 =$**5 litres**.
e. 1 m³ = 100 × 100 × 100 = 1 000 000 cm³, and $1000000 \div 1000 =$**1 000 litres**.

Answer to Question 6

In each part, write the formula, put in the values you know and use inverse operations to find the missing length.

a. Width $84 \div 12 =$**7 cm**. Perimeter $2(12 + 7) =$**38 cm**.
b. Side 9 cm. Area **81 cm²**.
c. $\frac{1}{2} \times 12 \times h = 30$, $6h = 30$, $h =$**5 cm**.
d. Width $17 - 10 =$**7 cm**. Area $10 \times 7 =$**70 cm²**.

Answer to Question 7

a. Area of the whole wall = length × height: $6.5 \times 2.8 =$**18.2 m²**.
b. Window $1.5 \times 1.2 = 1.8$ m² and door $2 \times 0.9 = 1.8$ m². Subtract both: $18.2 - 1.8 - 1.8 =$**14.6 m²**.
c. $14.6 \div 12 \approx 1.22$. One tin is not enough, and you cannot buy part of a tin, so round up to **2 tins**.
d. $2 \times 16.50 =$**£33**.

Answer to Question 8

a. Perimeter = 2 × (length + width) = $2(90 + 60) =$**300 m**.
b. The outside line is 300 m and the centre line goes across the width (60 m): $300 + 60 =$**360 m**.
c. Area = length × width: $90 \times 60 =$**5 400 m²**.
d. $5400 \div 150 = 36$ exactly, so **36 bags** of seed are needed.

Answer to Question 9

a. Change to centimetres first: 2.4 m = 240 cm and 1.8 m = 180 cm. Area $240 \times 180 =$**43 200 cm²**.

b. Each tile is a square: $30 \times 30 =$**900 cm²**.
c. $43200 \div 900 =$**48 tiles**. Check: 8 tiles fit along 240 cm and 6 along 180 cm, and $8 \times 6 = 48$.
d. 48 tiles need 5 boxes (4 boxes only hold 40). Cost $5 \times 14 =$**£70**.

Answer to Question 10

a. Volume = length × width × depth: $12 \times 6 \times 1.5 =$**108 m³**.
b. 1 m³ = 1 000 litres, so $108 \times 1000 =$**108 000 litres**.
c. $108000 \div 4500 =$**24 hours**, a whole day.
d. No top. Floor $12 \times 6 = 72$ m², long walls $2 \times 12 \times 1.5 = 36$ m², short walls $2 \times 6 \times 1.5 = 18$ m². Total **126 m²**.

Answer to Question 11

a. $30 \times 20 \times 10 =$**6 000 cm³**.
b. Three pairs of faces: $30 \times 20 = 600$, $30 \times 10 = 300$, $20 \times 10 = 200$. Surface area $2(600 + 300 + 200) =$**2 200 cm²**.
c. Add 10% by multiplying by 1.1: $2200 \times 1.1 =$**2 420 cm²**.
d. 2 420 cm² is 2.42 lots of 1 000 cm²: $2.42 \times 0.60 = 1.452$, so about **£1.45**.

Answer to Question 12

a. Area = $14 \times 9 =$**126 m²**.
b. The patio is $5 \times 4 = 20$ m², so the lawn is $126 - 20 =$**106 m²**.
c. $\frac{106}{126}$; divide top and bottom by 2: $\frac{53}{63}$, about 84% of the garden.
d. Perimeter $2(14 + 9) = 46$ m. Cost $46 \times 2.30 =$**£105.80**.

Answer to Question 13

a. $60 \times 30 \times 40 =$**72 000 cm³**.
b. 1 litre = 1 000 cm³, so $72000 \div 1000 =$**72 litres**.
c. Use the water depth as the height: $60 \times 30 \times 32 = 57600$ cm³, which is **57.6 litres**.
d. The base area is $60 \times 30 = 1800$ cm². The rock pushes up 1 800 cm³ of water, so the rise is $1800 \div 1800 =$**1 cm**.

Answer to Question 14

a. $90 \times 60 \times 100 = 540000$ cm³. Divide by 1 000: **540 litres**.

b. $540000 \div 600 =$**900 bottles**.
c. 80% of 900: $900 \times 0.8 =$**720 bottles**.
d. Front and back $2 \times 90 \times 100 = 18000$ cm², sides $2 \times 60 \times 100 = 12000$ cm², top $90 \times 60 = 5400$ cm². Total **35 400 cm²**.

Answer to Question 15

a. Volume = $3 \times 2 \times 0.6 =$**3.6 m³** (3 600 litres).
b. Path = outer rectangle − pond: $4 \times 3 - 3 \times 2 = 12 - 6 =$**6 m²**.
c. One slab is $0.5 \times 0.5 = 0.25$ m². $6 \div 0.25 =$**24 slabs**.
d. 24 slabs need 3 packs (2 packs only give 20). Cost $3 \times 18 =$**£54**.

Answer to Question 16

a. $20 \times 12 + 8 \times 5 = 240 + 40 =$**280 m²**.
b. Perimeter of the big rectangle $2(20 + 12) = 64$. The small rectangle adds two sides of 5 m and one side of 8 m but removes 8 m of the big rectangle, so perimeter = $64 + 5 + 5 =$**74 m**.
c. $280 \times 4.50 =$**£1 260**.
d. $\frac{40}{280} \times 100 = 14.3$, so about **14%**.

Answer to Question 17

a. Perimeter $2(5 + 4) = 18$ m, area $18 \times 2.5 =$**45 m²**.
b. $45 - 8 =$**37 m²**.
c. $37 \div 10 \times 2 =$**7.4 litres**.
d. Buy one 5 litre tin (£34) and one 2.5 litre tin (£19): 7.5 litres for **£53**. (Three 2.5 litre tins cost £57 and give 7.5 litres; two 5 litre tins cost £68.)

Answer to Question 18

a. Halve it: **30 cm²**.
b. Multiply: **24 cm³**.
c. 1 m² = 10 000 cm², so 2 m² = **20 000 cm²**.
d. Not necessarily. A 6 cm by 6 cm square has perimeter 24 cm, but a 9 cm by 4 cm rectangle also has area 36 cm² and perimeter 26 cm.

Answer to Question 19

a. Use the water depth: $50 \times 40 \times 20 = 40000$ cm³, which is **40 litres**.

b. $40 - 6 =$**34 litres**.
c. 34 litres = 34 000 cm³. Depth = volume ÷ base area: $34000 \div 2000 =$**17 cm**.
d. Full: $50 \times 40 \times 25 = 50000$ cm³ = 50 litres. Space left: $50 - 34 =$**16 litres**.

Answer to Question 20

a. The fence is two widths and one length: $2x + \text{length} = 40$, so the length is $40 - 2x$ m.
b. Area = width × length = $x(40 - 2x)$ m².
c. $x = 5$: $5 \times 30 = 150$. $x = 8$: $8 \times 24 = 192$. $x = 10$: $10 \times 20 = 200$. $x = 12$: $12 \times 16 = 192$. $x = 15$: $15 \times 10 = 150$.
d. The areas rise then fall symmetrically. The greatest is **200 m²** at $x = 10$ m (length 20 m).