Unit 10 · Perimeter, Area and Volume

STUDY NOTES

Key terms

Perimeter: the total length of a flat shape's edges, the distance all the way round; a length (cm, m, ft).

Area: the flat space a shape covers, counted in **unit squares**: 1 cm^2 is a square 1 cm on each side; cm^2, m^2, ft^2.

Volume: the space a solid takes up, counted in **unit cubes**: 1 cm^3 is a cube with 1 cm edges; cm^3, m^3, ft^3.

Regular shape: edges along the grid lines (rectangle, square): whole squares.

Irregular shape: a curved edge cuts through squares (a leaf).

Cuboid: a box shape; a **cube** has length, breadth and height equal.

Formulas

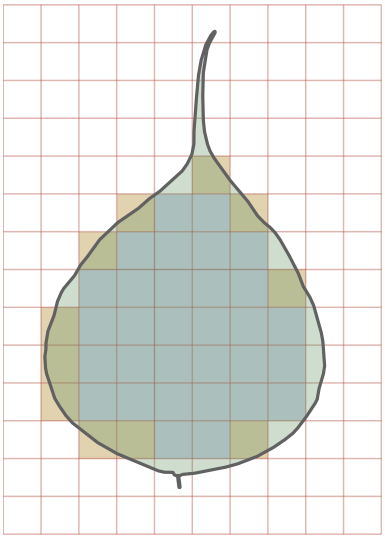
$P = 2(l + b)$	l length, b breadth **Use:** perimeter of a rectangle
$P = 4l$	l side **Use:** perimeter of a square
$A = l \times b$	in square units **Use:** area of a rectangle
$A = l^2$	$l \times l$ **Use:** area of a square
$V = l \times b \times h$	h height; cubic units **Use:** volume of a cuboid
$V = l^3$	$l \times l \times l$ **Use:** volume of a cube

Perimeter

- a rectangle has two lengths and two breadths: $4 + 3 + 4 + 3 = 2 \times (4 + 3) = 14$ ft
- 6 cm by 4 cm: $2(6 + 4) =$ **20 cm**; square photo, side 15 cm: $4 \times 15 =$ **60 cm**
- **backwards**: $P = 18$ cm, $b = 4$ cm: $18 = 2(l + 4) \rightarrow 2l = 10 \rightarrow l =$ **5 cm**
- model drawing: a bar of length, breadth, length, breadth = 18 cm; take away 2 breadths (8), 10 left for 2 lengths
- half the perimeter = one length + one breadth: fence 26 m, breadth 3 m $\rightarrow l + 3 = 13 \rightarrow l =$ **10 m**
- square handkerchief: $120 = 4l \rightarrow l =$ **30 cm**
- twice as long as broad, $P = 42$ m: breadth x, length $2x$: $2(2x + x) = 6x = 42 \rightarrow$ **7 m** and **14 m**
- 340 trees equally on the 4 sides of a square: $340 \div 4 =$ **85** a side (86 if each corner tree is counted on both its sides)
- 6 by 4 and 7 by 3: both perimeter 20, areas 24 and 21

Area by counting squares

1. count the **whole** squares inside
2. a square **more than half** covered counts as one
3. leave out squares **less than half** covered



Peepal leaf on 1 cm squares: 31 whole squares + 11 more than half covered $\rightarrow$ **about 42 cm^2** (true 43.75 cm^2).

- an estimate: write “about”; finer squares (½ cm) usually give a closer count
- squares cut exactly in half by a straight edge: two halves make one: arrow 16 + 6 halves = **19 square units**; parallelogram 30 + 4 + 2 = **36**
- units: cm^2 on 1 cm squares; squares of no stated size $\rightarrow$ **square units**

Area of rectangle and square

- each row as many squares as the length; as many rows as the breadth: 6 cm by 4 cm → 4 rows of 6 = **24 cm²**
- 20 cm by 8 cm: **160 cm²**; tile of side 20 cm: 20 × 20 = **400 cm²**
- from area and one side: other side = area ÷ known side: carpet 12 m², 3 m broad → **4 m**; 36 m², 9 m long → **4 m** broad
- square from its area: side = **square root**: 100 ft² → 10 ft
- twice as long as broad, 50 cm²: two squares of 25 cm², side 5 cm → **10 cm by 5 cm**
- equal areas ≠ equal perimeters: 6 by 4 and 8 by 3 both 24; perimeters 20 and 22
- 5 cm by 3 cm: perimeter 16 cm, area 15 cm²
- **shaded part** = whole − the part cut out: 6 × 4 rectangle with a 3 × 2 hole → 24 − 6 = **18 cm²**; a turned hole has the same area
- same area: square 16 m² (side 4 m) = rectangle 8 m long → breadth 16 ÷ 8 = **2 m**
- ropani: 5,476 ft² = a square 74 ft a side; 1 aana = 5,476 ÷ 16 = 342.25 ft² (18.5 ft a side)

Volume

- one layer has $l \times b$ cubes; h layers: 4 × 3 = 12 a layer, 2 layers → **24 cm³**
- a third layer adds another 4 × 3 = 12 → 36
- box of sweets 20 × 15 × 4 = **1,200 cm³** (300 a layer, 4 layers)
- cube of edge 4 cm: 4 × 4 × 4 = **64 cm³**; cube of 27 cm³: 3 × 3 × 3 → edge **3 cm**
- twice as long as broad, 5 m high, 250 m³: $2x \times x \times 5 = 250 \rightarrow x \times x = 25 \rightarrow$ **5 m** and **10 m**
- three measures multiplied → cubed units: 5 × 4 × 2 = 40 cm³
- 1 liter fills a cube 10 cm on each side: **1,000 cm³ = 1 liter**; a cube 1 m a side holds 1,000 liters

The storeroom (12 ft by 10 ft)

- wood strip round the walls: 2(12 + 10) = **44 ft** (less the doorway)
- tiles 1 ft²: 12 × 10 = 120 ft² → **120 tiles** (10 rows of 12), a few spare
- tiles 2 ft a side cover 4 ft² each: 120 ÷ 4 = **30 tiles**: doubling the side covers **four** times the floor
- tank 4 × 3 × 3 = **36 ft³**; 1 ft³ ≈ 28,317 cm³ ≈ 28.3 liters → about **1,019 liters**

Which measure?

Question	Measure
strip, fence, border, skirting **round** it	perimeter (cm, m, ft)
tiles, carpet, paint, land **covering** it	area (cm², m², ft²)
water, space **inside** a solid	volume (cm³, m³, ft³)

COMMON MISTAKES

✗ perimeter of 6 cm by 4 cm = 6 + 4 = 10 cm
✓ half the way round: 2(6 + 4) = 20 cm.

✗ area of a 15 cm square = 60 cm
✓ 60 cm is the perimeter; area 15 × 15 = 225 cm².

✗ area written in cm
✓ square units: cm².

✗ the count of a leaf given as exact
✓ an estimate: “about 42 cm²”.

✗ box 5 cm by 4 cm by 2 cm: 40 cm² or 11 cm
✓ three measures multiplied: 40 cm³.

✗ cube of edge 4 cm: 16 cm³
✓ 16 is one face; 4 × 4 × 4 = 64 cm³.

✗ tiles twice as wide: half as many
✓ 4 times the area: a quarter as many.