

Similarity

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Name: _____

Date: _____

At a glance

Similar shapes, scale factors for lengths, areas and volumes, and nested triangles.

1. Similar shapes and lengths
2. Nested triangles
3. Areas and volumes of similar shapes

1. Similar shapes and lengths

☐ I revised this

- Similar shapes have equal angles and sides in the same ratio.
- Length scale factor $k = \text{a length on the new shape} \div \text{the matching length on the old one}$.
- Two triangles are similar if two pairs of angles are equal (the third then matches too).

How to do it

1. Identify matching sides (opposite equal angles).
2. Find k from a pair of known matching sides.
3. Multiply (or divide) to find the missing length.

Worked example

Two similar triangles have matching sides 4 cm and 10 cm. A side of 6 cm on the small one matches which length?

1. $k = 10 \div 4 = 2.5$.
2. 6×2.5 .

15 cm

2. Nested triangles

☐ I revised this

- A line parallel to one side of a triangle cuts off a smaller similar triangle.
- Use the **whole** sides of the big triangle, not just the extra piece.
- Redraw the two triangles separately the same way round.

Worked example

In triangle ABC, $DE \parallel BC$ with D on AB, E on AC. $AD = 3$, $DB = 6$, $DE = 4$. Find BC.

1. $AB = 3 + 6 = 9$.
2. $k = 9 \div 3 = 3$.
3. $BC = 4 \times 3$.

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3. Areas and volumes of similar shapes

☐ I revised this

- Length factor $k \rightarrow$ area factor $k^2 \rightarrow$ volume factor k^3 .
- Surface area scales like area (k^2); mass and capacity scale like volume (k^3).
- Work backwards with roots: area ratio $\rightarrow k = \sqrt{\text{area ratio}}$; volume ratio $\rightarrow k = \sqrt[3]{\text{volume ratio}}$.

Formulas

area factor = k^2

volume factor = k^3

$k = \sqrt{\text{(area ratio)}} = \sqrt[3]{\text{(volume ratio)}}$

Worked example

Two similar jugs have surface areas 180 cm^2 and 405 cm^2 . The small one holds 0.8 litres. How much does the large one hold?

1. Area factor = $405 \div 180 = 2.25$, so $k = 1.5$.

2. Volume factor = $1.5^3 = 3.375$.

3. 0.8×3.375 .

2.7 litres

Common mistakes

Don't write	Write instead
✗ Area doubles when the lengths double	✓ Area $\times 4$ ($k^2 = 2^2$)
✗ Using DB instead of AB for the big triangle	✓ Use the whole side AB
✗ Cubing the volume ratio to get a length	✓ Take the cube root
✗ Showing similarity with one pair of equal angles	✓ You need two pairs of equal angles

In the exam

- Write k clearly as a fraction or decimal before using it.
- For area or volume questions, find the length factor first.
- To prove similarity, state the equal angles with reasons.

My notes

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