MATHS FORENSICS
CASE FILE WORKSHEET · GCSE

MF-CF-GEO-SIMILAR
GCSE HIGHER · ABOUT 50 MINUTES

CASE FILE SERIES · SHAPE

SIMILAR SHAPES

Same shape, different size. Secure the scale factor for lengths, extend to triangles inside triangles and to area and volume, then master problems that switch between all three.

SECURING · GRADES 4–5 | EXTENDING · GRADES 6–7 | MASTERY · GRADES 8–9

Name _____ Class _____ Date _____

CASE BRIEFING

WHAT YOU NEED TO KNOW

Similar shapes have equal angles and every length multiplied by the same **scale factor** k. Find k from a pair of **corresponding** sides: new ÷ old.

Areas scale by k^2, and volumes by k^3. To go back from areas or volumes to lengths, take the square root or the cube root.

1. Match up corresponding sides. Redraw the shapes the same way round if it helps.
2. Find the length scale factor k from one matching pair.
3. Multiply lengths by k, areas by k^2, volumes by k^3.
4. Check: the bigger shape should have the bigger answers.

WORKED EXAMPLE **Two similar evidence boxes have heights 10 cm and 15 cm. The smaller box has a volume of 400 cm³. Find the volume of the larger box.**

SOLUTION

1 Length scale factor: k = 15 ÷ 10 = 1.5.
2 Volume scale factor: $k^3 = 1.5^3 = 3.375$.
3 Larger volume = 400 × 3.375.
4 = 1350 cm³. Check: bigger box, bigger volume ✓

✓ **1350 cm³**

KNOWLEDGE CHECK

Use your investigative skills to solve each case. Show full working: the method marks are where most students lose out.

Securing
Scale factors and missing lengths in similar shapes.
Secured ☐

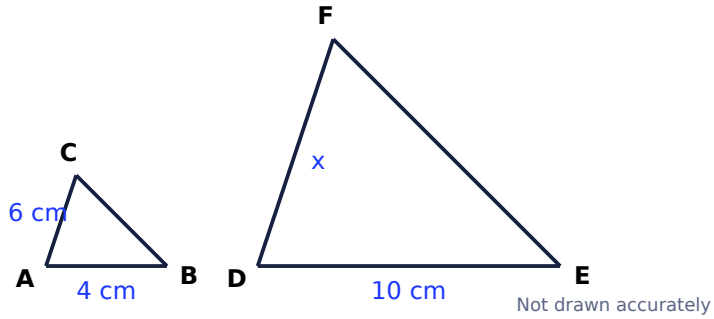
Extending
Triangles inside triangles, area and volume scale factors, and tampered evidence.
Secured ☐

Mastery
Switching between length, area and volume, maps, and proving similarity.
Secured ☐

SECURING

The method, step by step. Show every line.

1 The two triangles are similar. Find the length x. [2]



Not drawn accurately

cm _____

2 A rectangle measures 3 cm by 5 cm. A similar rectangle measures 9 cm by 15 cm. Write down the scale factor. [1]

Answer _____

3 Two shapes are similar. A side of 8 cm in the small shape matches a side of 12 cm in the large one. Another side of the small shape is 10 cm. Find the matching side in the large shape. [2]

cm _____

4 A photo 15 cm wide and 10 cm tall is enlarged to 24 cm wide. How tall is the enlargement? [2]

cm _____

FORENSIC TIP Work out the scale factor by **multiplying**, not adding. Adding 9 cm to the height would distort the photo.

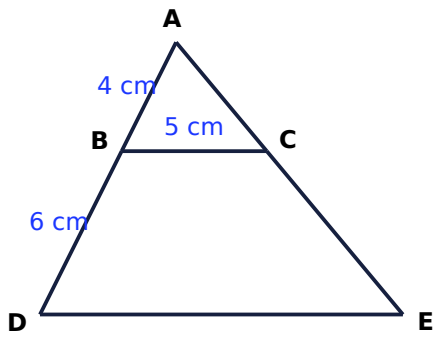
5 Are triangles with sides 3, 4, 5 and 6, 8, 10 similar? Give a reason. [2]

Yes / No _____

EXTENDING

A step is hidden, or there's a context to unpick. One piece of tampered evidence.

6 BC is parallel to DE. Find the length DE. [3]



Not drawn accurately

cm _____

FORENSIC TIP Use the **whole** side AD = 4 + 6 = 10, not BD = 6. The triangles share the corner A.

7 Two similar shapes have lengths in the ratio 2 : 3. The smaller has an area of 20 cm². Find the area of the larger. [2]

cm² _____

8 Two similar cylinders have heights 6 cm and 9 cm. The smaller has a volume of 80 cm³. Find the volume of the larger. [2]

cm³ _____

9 Two similar cones have surface areas of 50 cm² and 200 cm². Find the ratio of their heights. [2]

Ratio _____

10 Ella enlarged a shape of area 12 cm² by scale factor 3. Find her mistake. [2]

TAMPERED EVIDENCE · FIND THE MISTAKE

Lengths × 3, so area × 3
12 × 3 = 36 cm²

cm² _____

MASTERY

No hints. Plan before you calculate.

11 Two similar bottles have volumes of 250 cm³ and 2000 cm³. The small bottle is 12 cm tall and has a surface area of 300 cm². Find the height and the surface area of the large bottle. [4]

___ cm ___ cm² _____

12 Two similar solids have surface areas of 64 cm² and 100 cm². The smaller has a volume of 256 cm³. Find the volume of the larger. [4]

cm³ _____

FORENSIC TIP Go back to the **length** scale factor first. You can't get from an area factor to a volume factor directly.

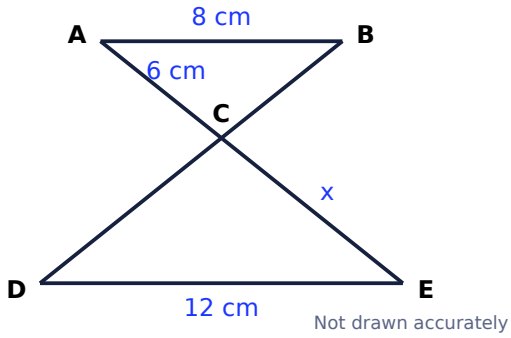
13 In triangle ABC, D is on AB and E is on AC, with angle ADE = angle ACB. AD = 4 cm, AE = 6 cm and AC = 8 cm. Find AB. [3]

cm _____

14 A map has a scale of 1 : 25 000. A lake has an area of 6 cm² on the map. Find its real area in m². [3]

m² _____

15 AB is parallel to DE. Explain why triangles ABC and EDC are similar, then find x. [3]



Not drawn accurately

cm _____

KNOWLEDGE CHECK: SOLUTIONS

Check your method as well as your answer. In the exam, an answer with no working usually earns the final mark at most.

Q1 SECURING

Scale factor 10 ÷ 4 = 2.5. 6 × 2.5.

✓ **15 cm**

Q2 SECURING

✓ **3**

Q3 SECURING

k = 1.5.

✓ **15 cm**

Q4 SECURING

k = 24 ÷ 15 = 1.6.

✓ **16 cm**

Q5 SECURING

✓ **Yes: every side is multiplied by 2.**

Q6 EXTENDING

Triangles ABC and ADE are similar. AD = 10, so k = 10 ÷ 4 = 2.5. 5 × 2.5.

✓ **12.5 cm**

Q7 EXTENDING

Area factor $(3/2)^2 = 2.25$.

✓ **45 cm²**

Q8 EXTENDING

$(1.5)^3 = 3.375$.

✓ **270 cm³**

Q9 EXTENDING

Area factor 4, so length factor √4.

✓ **1 : 2**

Q10 EXTENDING

Areas scale by $3^2 = 9$, not 3.

✓ **108 cm²**

Mastery solutions are in the Lab. Grades 8 and 9 are won on method, so a bare answer won't tell you much. Photograph or write your Mastery working in **Forensic Marking** and get it marked mark by mark, with the full solution and the mistake behind every lost mark. Your first marked question is free.

lab.mathsforensics.com/written/?sheet=CF-GEO-SIMILAR

Mark your evidence

Level	Marks	My score	Secured? (every mark)
Securing	9		☐
Extending	11		☐
Mastery	17		☐

R · Reading
Misread or missed part of the question

M · Method
Didn't know how to do it

A · Accuracy
Knew how, slipped in the working

Write R, M or A next to every mark you lost. Mostly R or A? The fix is technique, not more practice of the topic.

CASE CLOSED: SIMILAR SHAPES

In this case file you've learned to:

- Find a scale factor from corresponding sides.
- Find missing lengths, including triangles inside triangles.
- Use k^2 for areas and k^3 for volumes.
- Work back from an area or volume factor to a length factor.
- Give geometric reasons for similarity.

Because every case comes down to one principle: numbers don't lie.

YOUR NEXT ASSIGNMENT

Practise every GCSE topic in the Lab

New numbers every time, feedback that names the mistake behind each wrong answer, and handwritten working marked like an examiner. Start free.

https://www.mathsforensics.com/the-lab