

Similar shapes and matching lengths

G19, R12 · Geometry and measures · revision notes

Similar shapes have equal corresponding angles and matching lengths in the same ratio. Find a length scale factor and use it to calculate a missing side. This includes triangles formed by parallel lines.

Key facts

- Similar: equal angles and sides in the same ratio
- Length scale factor $k = \text{new length} \div \text{corresponding original length}$
- Two pairs of equal angles $\rightarrow$ similar triangles
- A line parallel to a side of a triangle makes a similar triangle

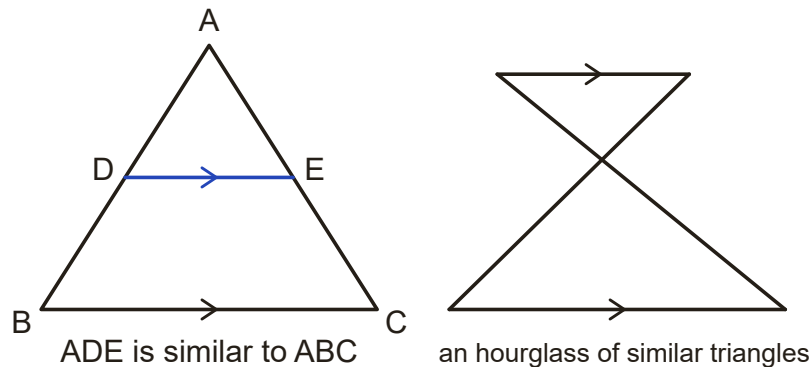
Notes

Similar shapes

- Two shapes are **similar** if one is an enlargement of the other: corresponding angles are equal and corresponding sides are in the same ratio.
- Length scale factor $k = \frac{\text{length on the new shape}}{\text{corresponding length on the original}}$
- Match corresponding sides carefully. If one shape is turned or flipped, redraw them the same way round.
- Two triangles are similar if their angles are equal. Two pairs of equal angles is enough, as the third angles must then be equal too.

Missing lengths

- Find k from a pair of corresponding sides you know. Multiply by k to go from the small shape to the large one; divide by k to go back.
- A line parallel to one side of a triangle cuts off a smaller, similar triangle (the corresponding angles are equal).
- Two parallel lines crossed by two straight lines that meet between them make an 'hourglass' of two similar triangles (alternate angles and vertically opposite angles are equal).



Parallel lines make similar triangles.

- Use whole sides: if $AD = 4$ cm and $DB = 6$ cm on the same line, the full side AB is 10 cm.

How to answer each type of question

M = method mark, A = answer mark, B = a mark on its own.

Find missing lengths in similar shapes

2 marks each

Grade 5

- Find a pair of corresponding sides you know both of.
- Work out the scale factor (keep it as a fraction if it is not exact).
- Multiply to go small to large; divide to go large to small.

Example. Triangle ABC is similar to triangle PQR. AB corresponds to PQ, BC to QR and AC to PR. $AB = 6$ cm, $BC = 9$ cm and $PQ = 10$ cm.

- (a) Work out the length of QR. (2 marks)
(b) $PR = 12.5$ cm. Work out the length of AC. (2 marks)

Model answer. (a) Scale factor $= 10 \div 6 = \frac{5}{3}$, so $QR = 9 \times \frac{5}{3}$ (M1) $= 15$ cm (A1)

(b) $AC = 12.5 \div \frac{5}{3}$ (M1) $= 7.5$ cm (A1)

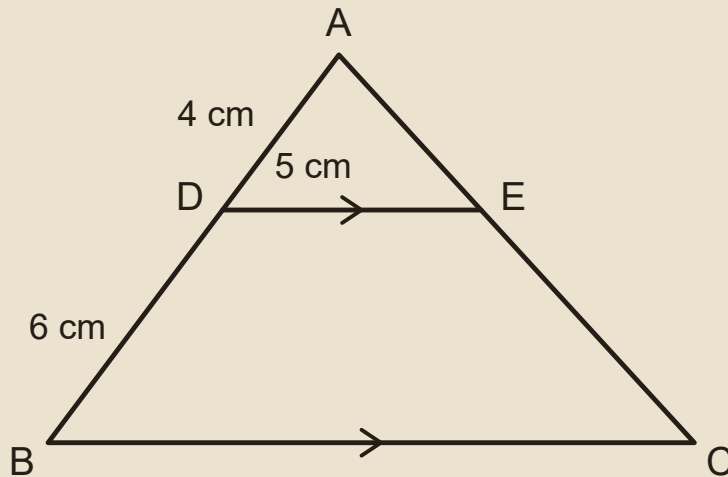
Similar triangles from parallel lines

3 marks

Grade 5

1. Redraw the small triangle and the large triangle separately, the same way round.
2. Use whole side lengths for the large triangle.
3. Find the scale factor and use it.

Example. In triangle ABC, D is a point on AB and E is a point on AC so that DE is parallel to BC. AD = 4 cm, DB = 6 cm and DE = 5 cm.



Work out the length of BC.

Model answer. $AB = 4 + 6 = 10$ cm (M1)

Scale factor = $10 \div 4 = 2.5$ (M1)

$BC = 5 \times 2.5 = 12.5$ cm (A1)

Don't lose marks

- ✗ Using the short piece DB instead of the whole side AB when a small triangle sits inside a large one.
- ✗ Adding the difference in lengths instead of multiplying by the scale factor.
- ✗ Matching the wrong sides when one triangle is turned or flipped.

More tips

Memory tricks

- Redraw overlapping triangles as two separate triangles, the same way round, and label matching vertices.
- Sense check: if the new shape is bigger, your answer must be bigger than the original length.
- Keep scale factors as fractions (e.g. $\frac{5}{3}$) to avoid rounding errors.

Exam technique

- Write the scale factor clearly (e.g. $k = 18 \div 12 = 1.5$); it is usually the first method mark.
- To show triangles are similar, show that the angles are equal, giving a reason for each (e.g. corresponding angles are equal).
- Check which way you are going: small to large, multiply; large to small, divide.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 4

Recognise similar shapes and find scale factors

Check that corresponding sides are all in the same ratio; scale factor = new length $\div$ original length.

Grade 5

Find missing lengths in similar shapes

Multiply or divide a length by the scale factor.

Grade 5

Use similar triangles made by parallel lines

Parallel lines give equal corresponding or alternate angles, so the triangles are similar.

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