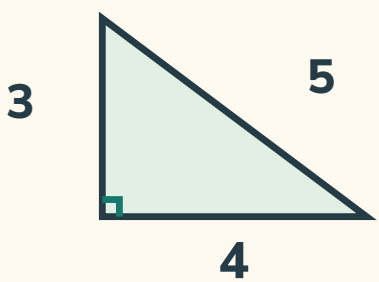
MATHS FIELD GUIDE · GRADE 8

Similarity links length, area and scale

OPENING PROBLEM

Scale every side by two. Which lengths result?



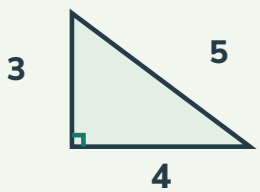
02 Match the sides before scaling
03 Rules and worked cases
04 Read an architect’s plan
05 Keep corresponding parts together
06 Check your reasoning

ILLUSTRATED PROBLEM SHEET

Match the sides before scaling

For similar figures one length scale k governs every corresponding side. Areas scale by k^2.

1



Scale every side by two. Which lengths result?

6, 8 and 10. The angles stay fixed, and the perimeter doubles.

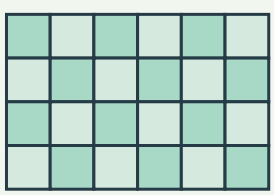
2

Length	Small	Large
AB ↔ PQ	4	10
BC ↔ QR	6	?

If ABC and PQR are similar in that order, find QR.

The length scale is 10/4 = 2.5, so QR = 15.

3



This rectangle is a twofold enlargement of a 3 by 2 rectangle. How do the areas compare?

Twenty-four squares versus six. Doubling both directions multiplies area by four.

4

Area ratio = 25:9

↓

Length ratio = 5:3

Why take a square root?

A two-dimensional area uses the length scale twice. Lengths are positive.

Length scale 3
area scale 9.

Area scale 9
positive length scale 3.

CHAPTER PROBLEM

A similar shape has sides twice as long. Why is its area four times as large?

Both length directions double, giving 2 × 2 = 4 times as many square units.

MATHS REFERENCE · GRADE 8

Similarity links length, area and scale

Similar shapes have equal corresponding angles and proportional corresponding lengths. A positive scale factor k multiplies every corresponding length by k.

An enlargement requires a centre as well as a scale factor to determine the new position.

Four cases to recognise

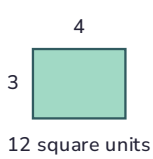
Situation	What to do and why
1:50 plan, a length of 7 cm	Actual length 350 cm or 3.5 m.
Actual length 12 m on a 1:300 plan	1,200 cm ÷ 300 = 4 cm on paper.
Enlarge a rectangle by length factor 1.5	Its area factor is $1.5^2 = 2.25$.
A solid's volume grows 27-fold under uniform enlargement	All lengths were multiplied by the cube root of 27, or 3.

Read the model

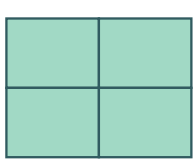
Build the idea

Enlarge a rectangle of length 4 and width 3 by factor two. Its new dimensions are 8 and 6.

The original area is twelve square units. The enlarged area is forty-eight: four copies of the original area.



12 square units

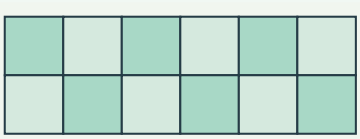

8 × 6 = 48 square units

Why it works

Area uses two independent length directions. Scaling both by k multiplies area by k × k, or k^2.

For similar solids, three directions scale, so volume scales by k^3. The exponent comes from the number of length dimensions.

scale factor Multiplier of corresponding lengths.
similar Matching angles and proportional lengths.
enlargement centre The point from which scaled positions are measured.



Twelve square tiles in two rows. What are the measurements?

Area 12 square units. Boundary 6 + 2 + 6 + 2 = 16 units.

WORKED INVESTIGATION

Read an architect's plan

On a 1:200 plan, each centimetre stands for 200 cm or 2 m. A room drawn 3 cm by 4 cm measures 6 m by 8 m.

Look at this part	What it tells you
Plan length 3 cm	real length 6 m
Plan width 4 cm	real width 8 m
Real floor	48 m²

Work it through

The plan area is 12 cm². Comparing both areas in square centimetres gives 480,000 ÷ 12 = 40,000, which is 200².

Catch the mistake

Multiplying plan area by 200 applies the length scale only once. Both perpendicular dimensions grow by 200.

Compare the cases

Follow an example

With k = 3, a five-unit side becomes fifteen. A ten-square-unit area becomes ninety square units.

With k = 1/2, lengths halve and areas become one quarter. An enlargement operation can produce a smaller image.

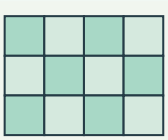
What changes? What stays true?

Preserved angles alone are sufficient for triangle similarity, but arbitrary polygons need matching side ratios too.

Surface area and volume follow different scale rules. Do not apply the length factor directly to either.

Change one condition

At scale 1:100, the same room is drawn 6 cm by 8 cm. Its plan area becomes four times as large as before.



Rearrange the same twelve tiles into three rows. What changes?

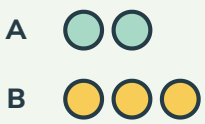
Area stays 12. Perimeter falls to 14 because more tile edges meet inside.

ILLUSTRATED PROBLEM SHEET

Keep corresponding parts together

Multiply or divide both counts by the same factor to preserve a ratio.

1



The mix is two parts A to three parts B. How many parts in all?

Five. A is two fifths of the whole mixture.

2

A	B
2	3
4	6
6	9

What changes across batches?

The totals change, while the amount of B for each unit of A stays at 3/2.

3

Total 35 g
↓
35 ÷ 5 = 7 g
↓
A = 14 g

How much A is in 35 g of this mix?

One part is 7 g. Two parts give 14 g and the remaining 21 g is B.

4

A	B
2	3
3	4

Does adding one to both counts preserve this recipe?

No. Cross-products 2 × 4 and 3 × 3 differ.

1:4 by parts
first share is 1/5 of the total.

1:4 by parts
first amount is 1/4 of the second.

CHAPTER PROBLEM

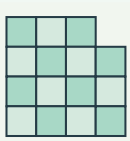
A similar enlargement triples each side of a 12 cm² triangle. Find the new area.

Both base and perpendicular height are tripled. Area scales by $3^2 = 9$, so the new area is 108 cm².

QUESTION BANK · FOLD OR COVER THE RIGHT COLUMN

Check your reasoning

Try the problem	Solution and reasoning
01 Can rectangles 2 by 6 and 3 by 4 be similar just because both have area 12?	No. Their long-to-short ratios are 3 and 4/3.
02 In the same mix B weighs 18 g. How much does A weigh?	Three parts weigh 18 g, so one weighs 6 g and A weighs 12 g.
03 A walkway is 9 m long. How long is it on the 1:200 plan?	Convert to 900 cm and divide by 200 to get 4.5 cm. Multiplying 4.5 by 200 recovers 900 cm.
04 A map shows 15 cm for 3 km. What is its scale?	3 km = 300,000 cm. Divide both parts of 15:300,000 by 15 to get 1:20,000.
05 Drawn area quadruples. By what factor did the lengths change in a uniform enlargement?	Length factor $\sqrt{4} = 2$.



Remove the corner tile from a four-by-four square. What changes?

Area falls from 16 to 15. Two lost outer edges are replaced by two exposed ones, so perimeter stays 16.

BANANALEARN LEARNING LIBRARY

Where will your maths take you next?

GRADE 8 MATHS

Choose your next problem.

Explore more illustrated guides and practise a related topic.

Browse Grade 8 guides →

Keep exploring

GRADE 8 · TOPIC GUIDE

Functions connect inputs, tables and graphs

Open guide →

GRADE 8 · TOPIC GUIDE

Pythagoras relates square areas

Open guide →

Visit bananalearn.com →