MATHS FIELD GUIDE · GRADE 7

Congruence and similarity compare whole shapes

OPENING PROBLEM

Can all three matching side lengths establish congruence?

Triangle	Side 1	Side 2	Side 3
ABC	3	4	5
PQR	3	4	5

02 Decide whether the evidence fixes a triangle
03 Rules and worked cases
04 Two triangular signs
05 Match the sides before scaling
06 Check your reasoning

ILLUSTRATED PROBLEM SHEET

Decide whether the evidence fixes a triangle

Correspondence records which vertex matches which. The included angle sits between the named sides.

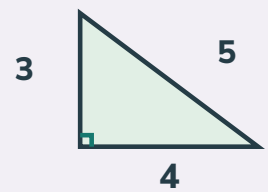
1

Triangle	Side 1	Side 2	Side 3
ABC	3	4	5
PQR	3	4	5

Can all three matching side lengths establish congruence?

Yes, by SSS. Match the vertex opposite each corresponding side.

2



Two triangles each have legs 3 and 4 meeting at 90°. Is that enough?

Yes. Two corresponding sides and their included right angle give SAS.

3

Equal angles: 40°, 60°, 80°

↓

Same shape

↓

Size still free

Do three equal angle pairs prove congruence?

They give similarity. One triangle may be an enlargement of the other.

4

Third side	3	7	11
Other sides	4 and 7	4 and 7	4 and 7
Triangle?	no	yes	no

Why do endpoints fail?

The third side must be strictly between 3 and 11. Equality collapses the triangle into a straight line.

AAA
shape determined, size free.

SSS with fixed lengths
shape and size determined if the triangle exists.

CHAPTER PROBLEM

Why do three equal corresponding angles not prove triangle congruence?

The triangles can have the same shape at different sizes. Their side lengths need not match.

MATHS REFERENCE · GRADE 7

Congruence and similarity compare whole shapes

Congruent figures have the same shape and size. Corresponding sides and angles match. Similar figures have the same shape, with equal corresponding angles and one scale factor for corresponding lengths.

Correspondence tells us which parts are being compared. It must be consistent around each figure.

Four cases to recognise

Situation	What to do and why
Triangles with sides 5, 6, 8 and 8, 5, 6	All three matched sides agree. SSS gives congruence.
Sides 4, 5, 6 and 8, 10, 12	Ratios all equal two. SSS similarity applies.
Two triangles have three equal corresponding angles	Shape is fixed. Size still can vary.
Length scale three	Perimeter scales by three, while area scales by nine.

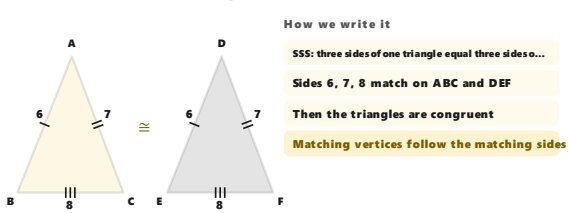
Read the model

Build the idea

Move, rotate or reflect a triangle without changing its measurements. Its image remains congruent.

Enlarge a triangle by a factor of two. Every side length doubles while its angles stay unchanged. The image is similar but generally not congruent.

Congruence SSS



Side, side, side

Why it works

Triangle congruence tests identify enough fixed information to determine the same triangle: SSS, SAS with the included angle, ASA/AAS, and RHS for right triangles.

Three matching angles only determine shape. They allow triangles of different sizes, so AAA establishes similarity rather than congruence.

congruent Same shape and size.
similar Same shape with proportional corresponding lengths.
included angle The angle between two specified sides.



4 equal

Is this both a rectangle and a rhombus?

Yes. It has four right angles and four equal sides.

WORKED INVESTIGATION

Two triangular signs

One sign has side lengths 3, 4 and 5 cm. A second has sides 6, 8 and 10 cm. Pair shortest with shortest and compare each ratio.

Look at this part	What it tells you
6 ÷ 3	2
8 ÷ 4	2
10 ÷ 5	2

Work it through

All three side ratios match, so the signs are similar by SSS similarity. Their sizes differ, so they are not congruent.

Catch the mistake

Equal angles can fix the shape of a triangle without fixing its size. A copy enlarged on a photocopier illustrates this.

Compare the cases

Follow an example

Two triangles have matching side lengths 6, 7 and 8. SSS guarantees congruence even if their orientations differ.

Triangles with sides 3, 4, 5 and 6, 8, 10 are similar: every corresponding side has scale factor two.

What changes? What stays true?

Two matching sides and a non-included angle do not generally determine one triangle. The placement of the angle matters.

Use the same scale factor for every corresponding length. Mixing up the correspondence can falsely suggest that a similar pair does not match.

Change one condition

A third triangle with sides 5, 3 and 4 cm is congruent to the first by SSS. Reordering the side list does not change the triangle.



right angles

Does a rectangle need four equal sides?

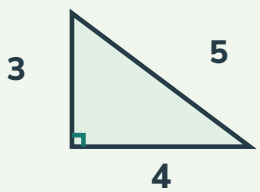
No. It needs four right angles. Opposite sides have matching lengths.

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.

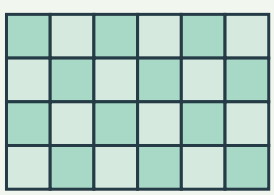
2

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

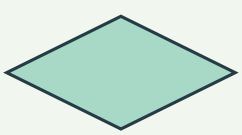
Two rectangles measure 3 by 5 and 6 by 10. Are they similar? Are they congruent?

They are similar: all angles are right angles and corresponding lengths scale by 2. Their sizes differ, so they are not congruent.

QUESTION BANK · FOLD OR COVER THE RIGHT COLUMN

Check your reasoning

Try the problem	Solution and reasoning
01 If ABC is congruent to PQR in that order, which side equals AC?	PR. The first and third vertices correspond in both names.
02 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.
03 A proposed copy has sides 9, 12 and 14 cm. Is it similar to the first sign?	The first two ratios are three, but the longest side would need to be 15 cm. A third unequal ratio rules out similarity.
04 Two similar triangles have area ratio 1:16. Their smaller side is 3 cm. Corresponding larger side?	Length scale is $\sqrt{16} = 4$, so the side is 12 cm.
05 Can one pair of equal sides and one pair of equal angles prove congruence?	No. For instance, two triangles can share a base and a base angle yet have different third vertices along the same ray.



Must a rhombus have four right angles?

No. Equal sides do not fix a right angle.

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