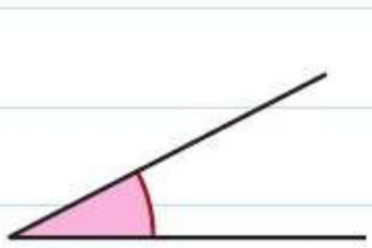
Had a look ☐ Nearly there ☐ Nailed it! ☐

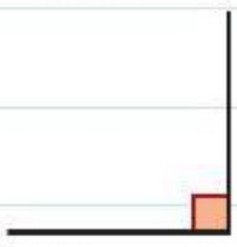
Angles 1

Types of angle

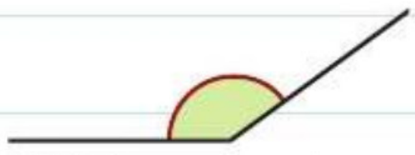
You need to know the names of the different types of angles.



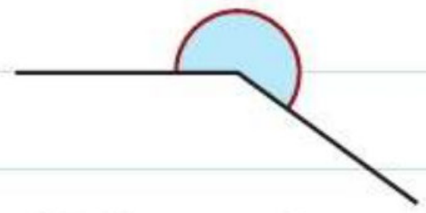
Acute angle:
Less than 90°



Right angle:
90°



Obtuse angle:
Between 90° and 180°



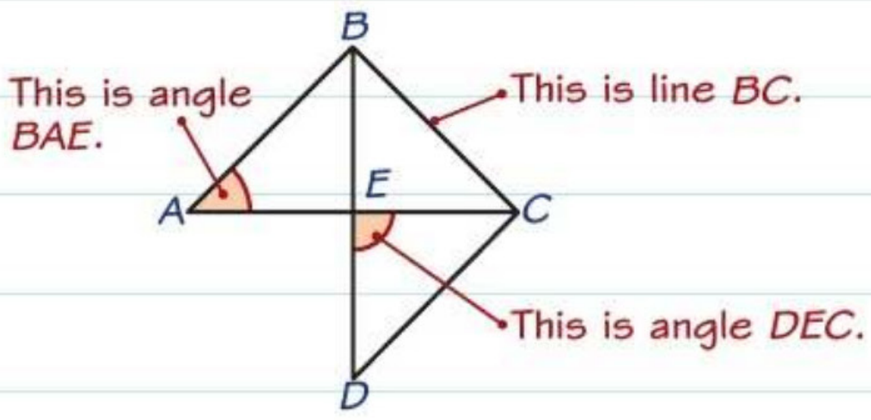
Reflex angle:
More than 180°

You can use these angle types to help you estimate the size of angles.

To revise measuring and drawing angles, have a look at page 95.

Naming angles

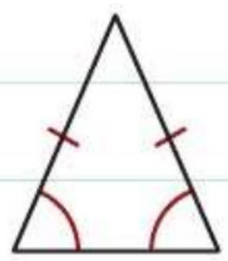
You can use letters to name angles.



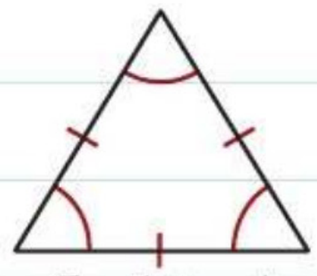
Angles are named using the three letters of the lines that make the angle. The angle is always at the middle letter.

Special triangles

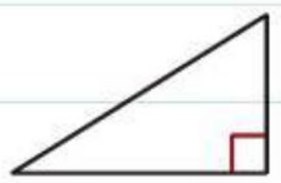
Here are three special types of triangle.



Isosceles
Two equal sides
Two equal angles



Equilateral
Three equal sides
All angles 60°



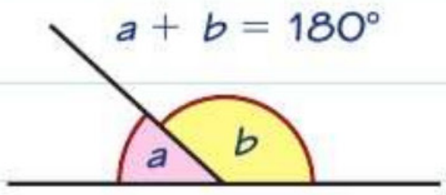
Right-angled
One angle 90°

In a **scalene** triangle none of the sides or angles are equal.

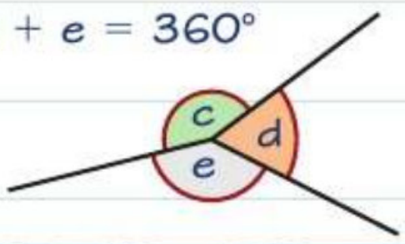
Angle facts

You can use these angle facts to work out missing angles.

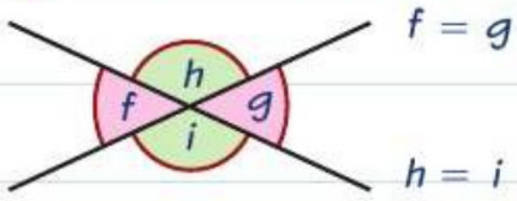
1 Angles on a straight line add up to 180°.



2 Angles around a point add up to 360°.



3 Vertically opposite angles are equal.



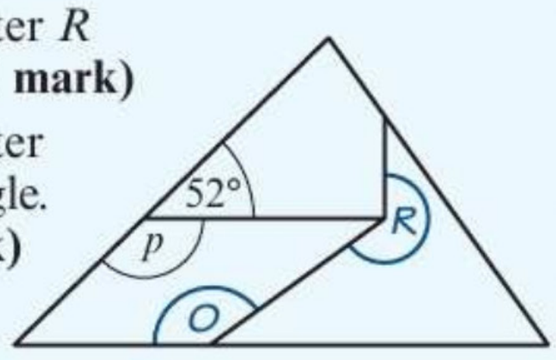
Worked example

Target grade 1

(a) Mark with a letter R a reflex angle. **(1 mark)**

(b) Mark with a letter O an obtuse angle. **(1 mark)**

(c) Work out the size of angle p. Give a reason for your answer. **(2 marks)**



$p + 52° = 180°$

$180 - 52 = 128$

$p = 128°$

Angles on a straight line add up to 180°.

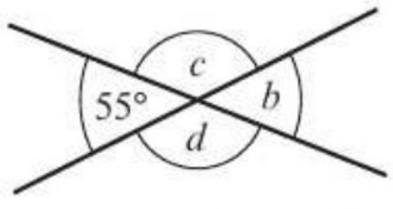
Everything in blue is part of the answer.

Now try this

Target grade 1

Work out the sizes of the angles marked with letters in this diagram. Give reasons for your answers. **(3 marks)**

Worked solution video



You could start by using angle fact 1 or angle fact 3 from the blue box above.

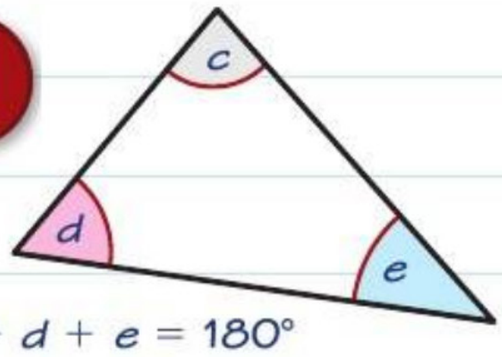
Had a look ☐ Nearly there ☐ Nailed it! ☐

Angles 2

Triangles and quadrilaterals

These are useful facts for triangles and quadrilaterals.

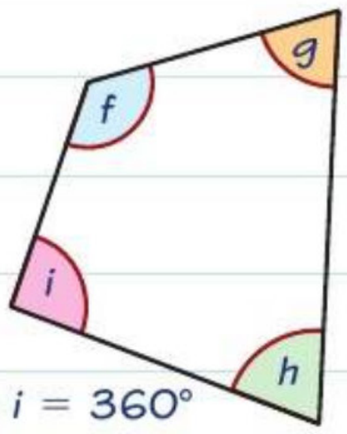
1



$c + d + e = 180°$

Angles in a triangle add up to 180°.

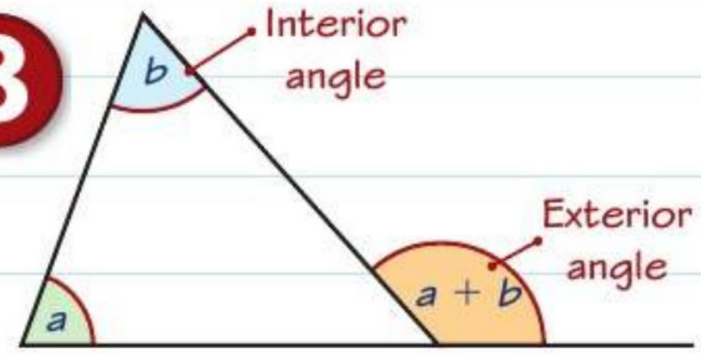
2



$f + g + h + i = 360°$

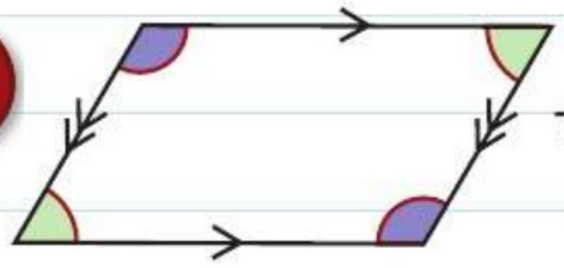
Angles in a quadrilateral add up to 360°.

3



The exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices.

4



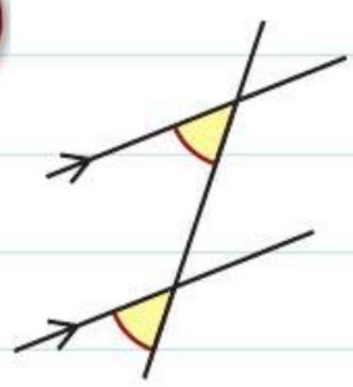
The opposite angles of a parallelogram are equal.

Parallel and perpendicular lines

Perpendicular lines meet at 90°.

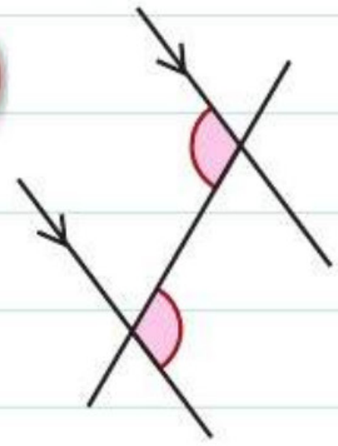
Lines that remain the same distance apart are **parallel**.
Parallel lines are marked with arrows.
You need to remember these angle facts about parallel lines and their correct names:

1



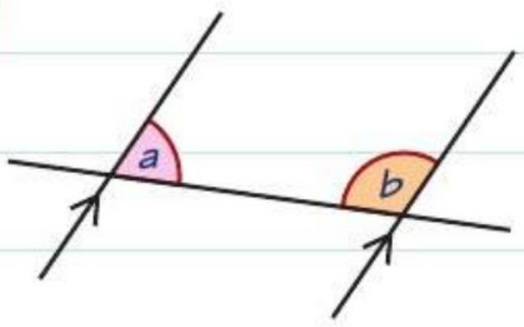
Corresponding angles are equal.

2



Alternate angles are equal.

3



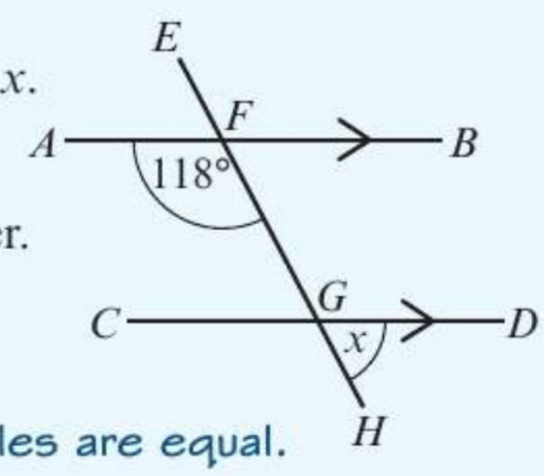
$a + b = 180°$

Co-interior or **allied** angles add up to 180°.

Worked example

Target grade 3

Work out the size of the angle marked x. Show clearly, giving reasons, how you work out your answer. **(3 marks)**



Angle $CGH = 118°$

Corresponding angles are equal.

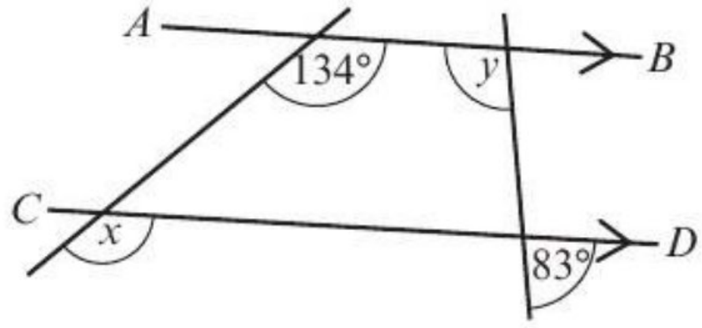
$180 - 118 = 62$

Angle $x = 62°$

Angles on a straight line add up to 180°.

Now try this

Target grade 3



(a) Write down the size of angle x. Give a reason for your answer. **(2 marks)**

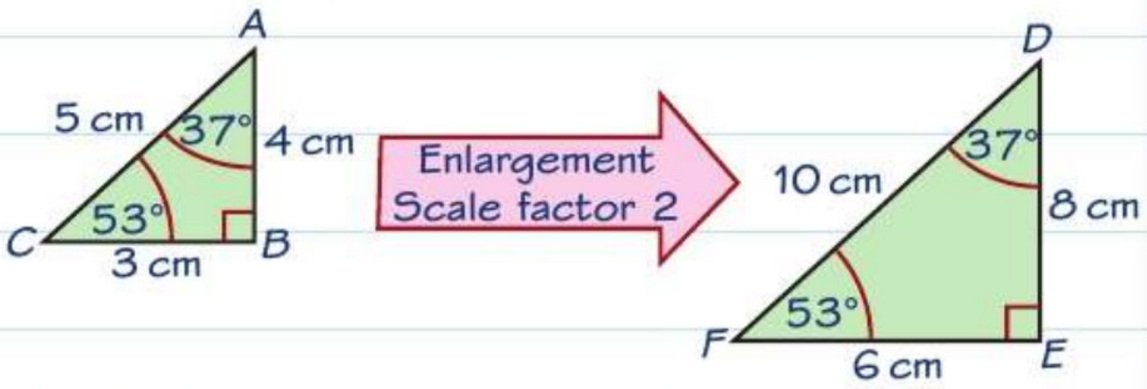
(b) Work out the size of angle y. **(2 marks)**

Write any angles you have worked out on the diagram.

Similarity and congruence

If one shape is an enlargement of another, the shapes are **similar**.

These triangles are similar.



The angles in similar shapes are the same.

Congruent shapes are exactly the same shape and size. They have the same area and the same perimeter.

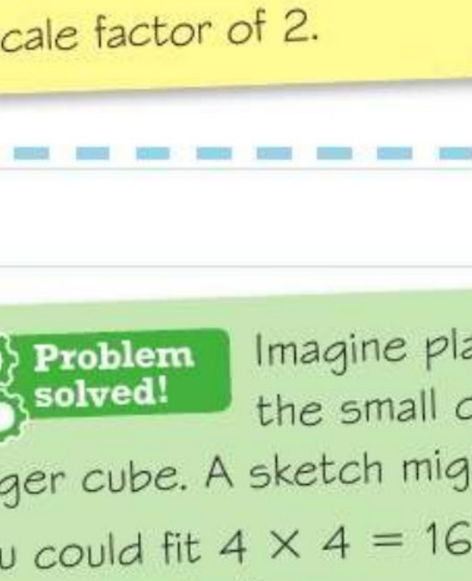
Rotations and reflections give congruent shapes.

Enlargements are a different size so they are not congruent shapes.

Worked example

Target grade 1

Here is a large triangle made from 16 equilateral triangles.



Everything in blue is part of the answer.

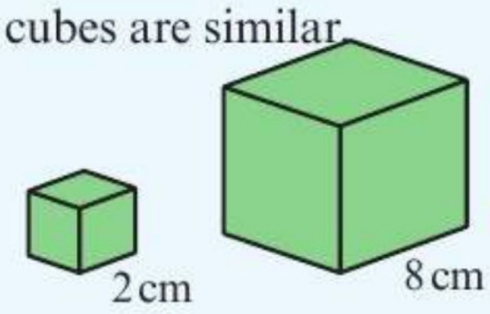
Shade a shape which is **similar** to the shaded shape but **not** congruent. **(2 marks)**

Congruent shapes are exactly the same shape and size. Similar shapes can be enlargements. You can shade in a rhombus which is an enlargement of the grey shape with a scale factor of 2.

Worked example

Target grade 2

These two cubes are similar.



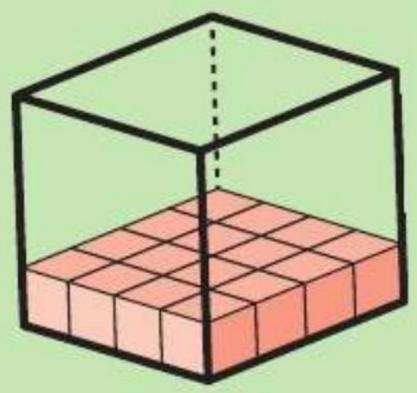
How many times will the 2 cm cube fit inside the 8 cm cube? **(2 marks)**

$4 \times 4 \times 4 = 64$

Problem solved! Imagine placing copies of the small cube inside the larger cube. A sketch might help.

You could fit $4 \times 4 = 16$ across the bottom.

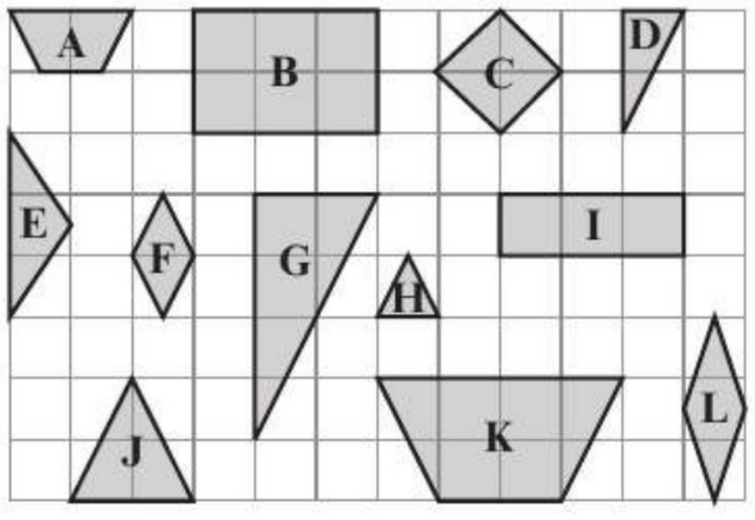
You can fit 4 layers like this, so in total you can fit $4 \times 4 \times 4$ copies of the small cube inside the larger cube.



Now try this

Target grade 1

Here are some shapes on a grid.
Write down three pairs of similar shapes. **(3 marks)**



If one shape is an enlargement of another, the shapes are similar. Similar shapes are not necessarily congruent.

Had a look ☐ Nearly there ☐ Nailed it! ☐

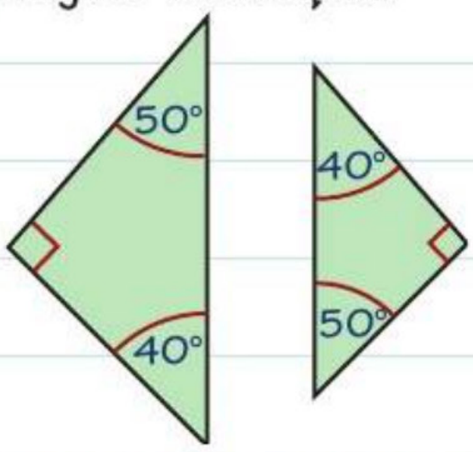
Hot Topic

Similar shapes

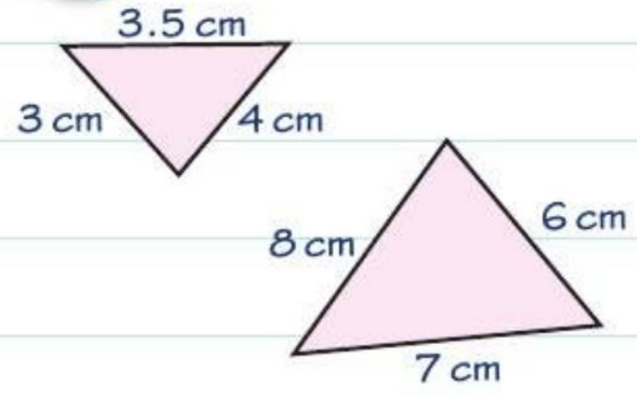
You need to recognise similar triangles and find missing lengths and angles in similar shapes.

Similar triangles satisfy one of these three conditions:

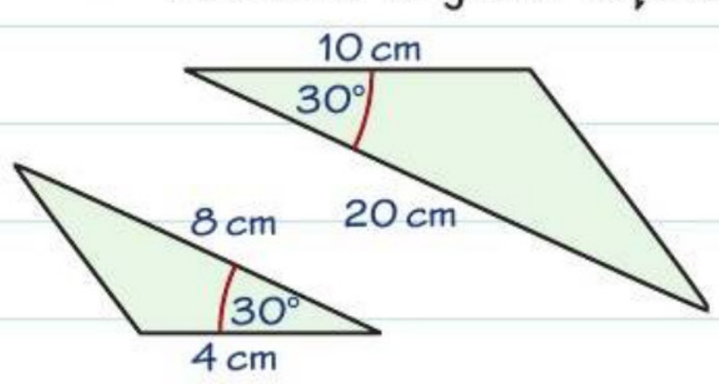
1. All three pairs of angles are equal.



2. All three pairs of sides are in the same ratio.



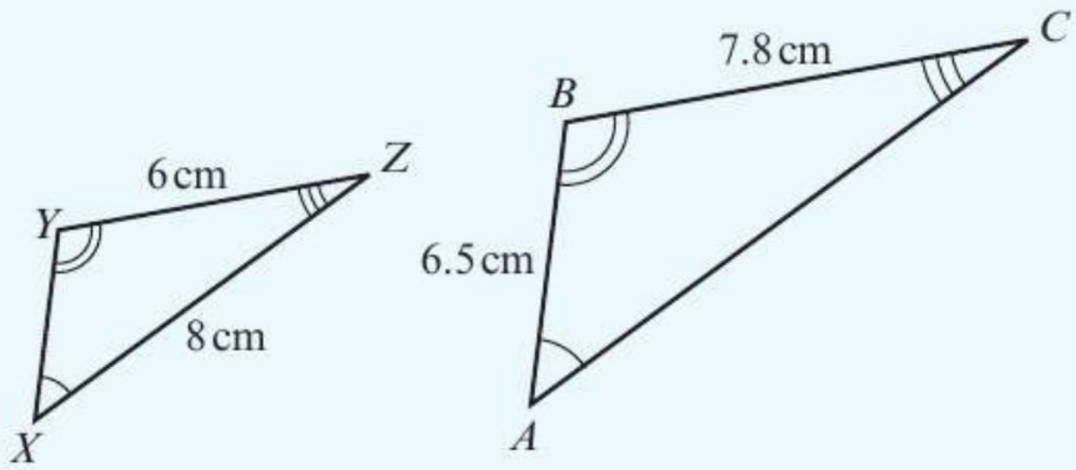
3. Two sides are in the same ratio and the included angle is equal.



Worked example

Target grade 5

XYZ and ABC are similar triangles.



(a) Work out the length of AC. **(2 marks)**

$$\frac{AC}{XZ} = \frac{BC}{YZ}$$

$$\frac{AC}{8} = \frac{7.8}{6}$$

$$AC = \frac{7.8 \times 8}{6}$$

$$= 10.4 \text{ cm}$$

(b) Work out the length of XY. **(2 marks)**

$$\frac{XY}{AB} = \frac{YZ}{BC}$$

$$\frac{XY}{6.5} = \frac{6}{7.8}$$

$$XY = \frac{6 \times 6.5}{7.8}$$

$$= 5 \text{ cm}$$

Start with the unknown length on top of a fraction. Make sure you write your ratios in the correct order.

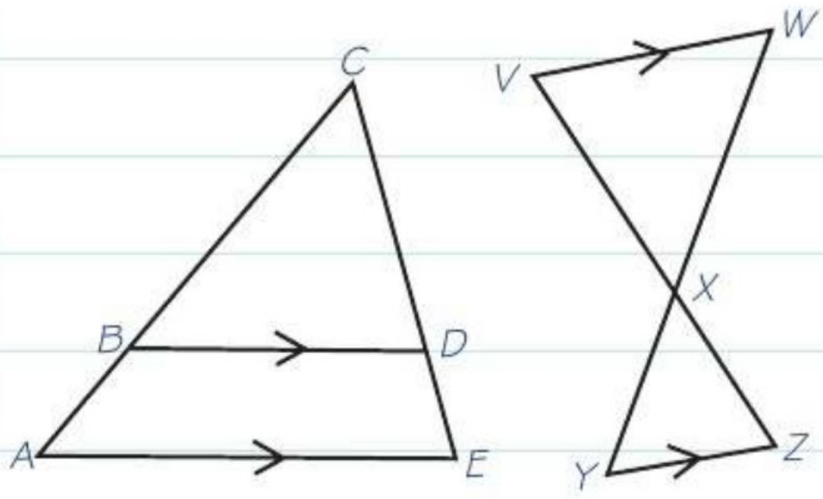
Similar shapes checklist

Use these facts to solve similar shapes problems:

- ✓ Corresponding angles are equal.
- ✓ Corresponding sides are in the same ratio.

Spotting similar triangles

Here are some similar triangles:



Triangle ACE is similar to triangle BCD.

Triangle VWX is similar to triangle ZYX.

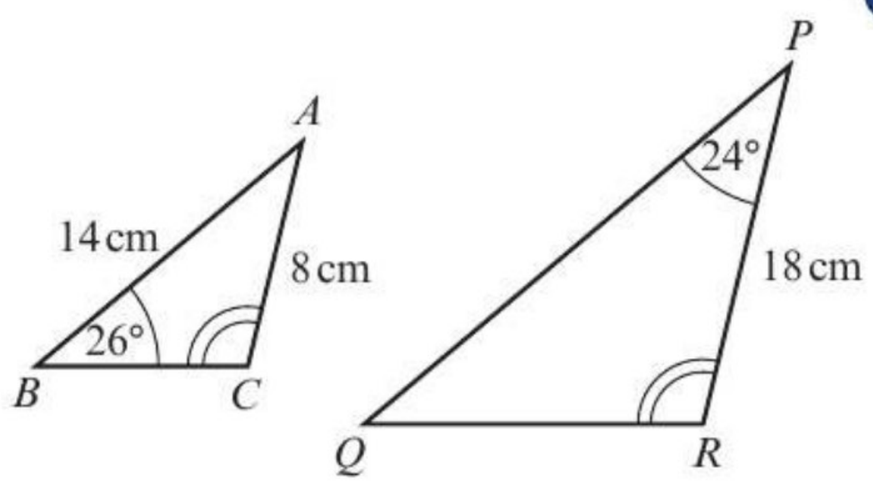
Now try this

Target grade 5

Triangles ABC and PQR are similar.
Angle ACB = angle PRQ.

(a) Work out the size of angle PRQ. **(2 marks)**

(b) Work out the length of PQ. **(2 marks)**



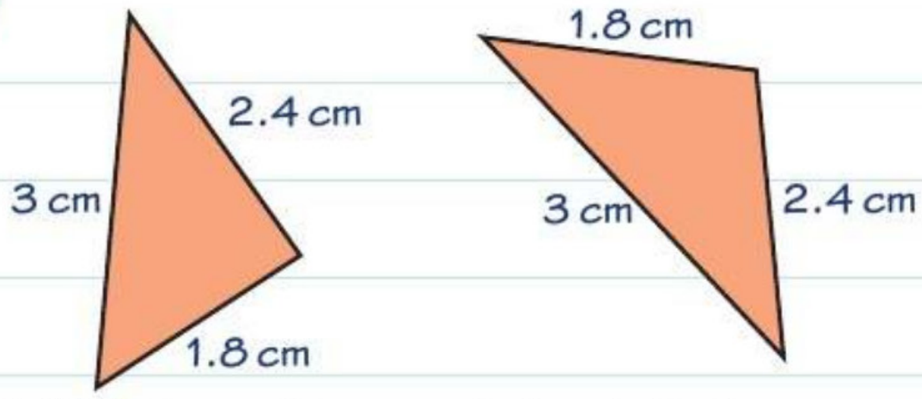
Had a look ☐ Nearly there ☐ Nailed it! ☐

Tricky Topic

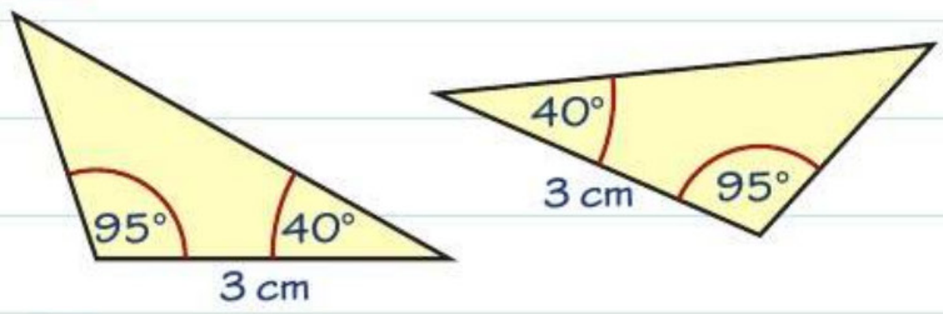
Congruent triangles

Triangles are **congruent** if **any one** of these four conditions is true.

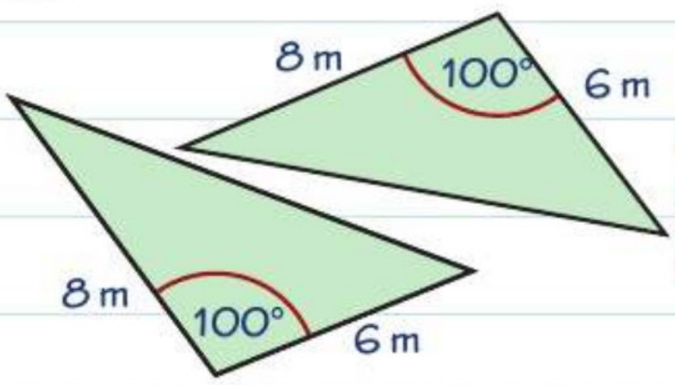
1 **SSS** (three sides are equal)



2 **AAS** (two angles and a corresponding side are equal)

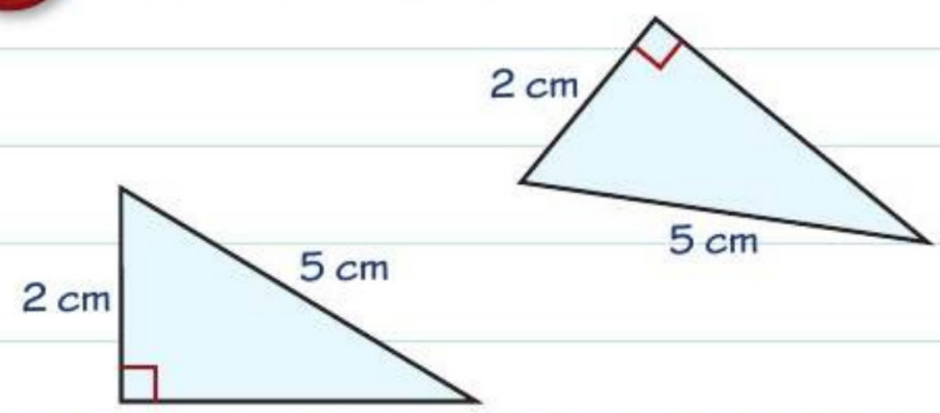


3 **SAS** (two sides and the included angle are equal)



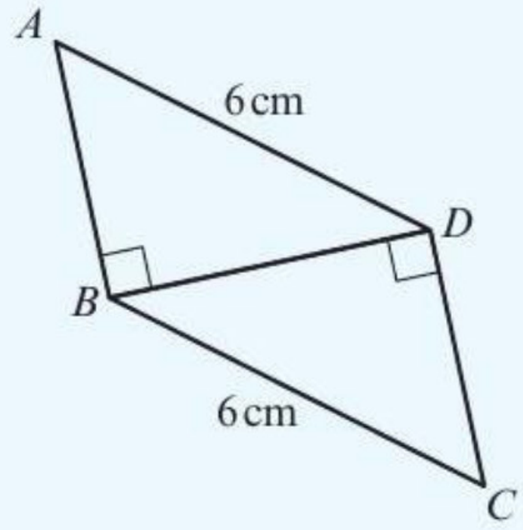
The angle must be **between** the two sides for SAS.

4 **RHS** (right angle, hypotenuse and a side are equal)



Worked example

Target grade 5



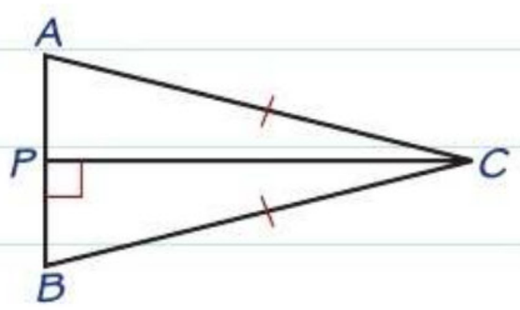
Triangle ABD and triangle BDC are congruent. Explain which information in the diagram supports this statement. **(3 marks)**

ABD and BDC are both right-angled triangles. The hypotenuse of both triangles is 6 cm. Side BD is common to both triangles so is equal. Therefore the triangles satisfy the RHS condition and are congruent.

Problem solved! To explain why the two triangles are congruent, you need to show that **one** of the conditions above is satisfied. Once you have decided which one, explain which lengths or angles are the same and why. Then write down **which condition** is satisfied. It's OK to use the abbreviations above.

Common sides

If two triangles have a side in **common** then those two sides are equal.



Now try this

Target grade 5

In the quadrilateral $ABCD$, $BC = CD$ and the angles at B and D are right angles.

Show that triangle ABC is congruent to triangle ADC. **(3 marks)**