Similarity.

You should be able to: Find the ratio of sides of similar shapes.
Find the ratio of areas of similar shapes.

Shapes are **congruent** when they are exactly identical.

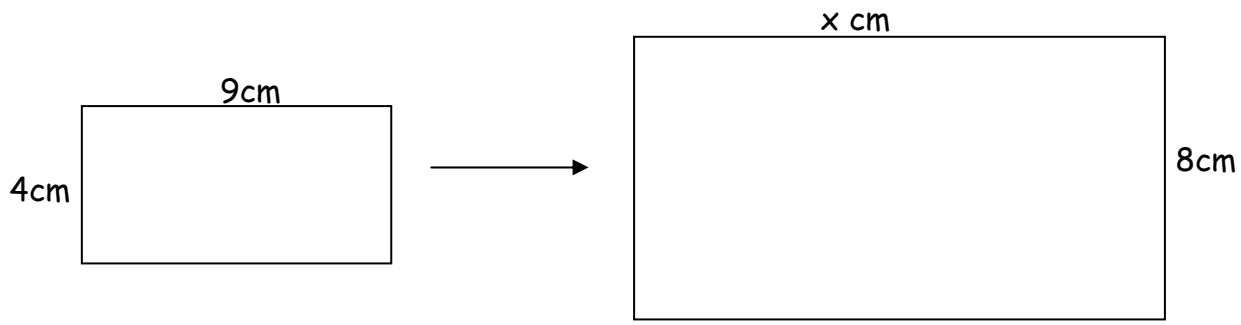
These two shapes are congruent.

Shapes are **similar** when they have the same general shape, but one is smaller than the other and the dimensions are different by the exact same scale factor.

These two shapes are similar, because the one on the right its dimensions multiplied by the exact same scale factor.

These two shapes are not similar since the dimensions have been multiplied by different values, therefore giving a distorted shape.

Example 1. Find the length of side **x**.



Here we have a mathematical **enlargement**. To first of all find out the scale factor that has been used in this example we must use the ratio →

$$\text{Enlargement SF} = \frac{\text{Bigger Value}}{\text{Smaller Value}}$$

We now look at the corresponding sides that we know, i.e. the 4cm and the 8cm and apply it to this formula

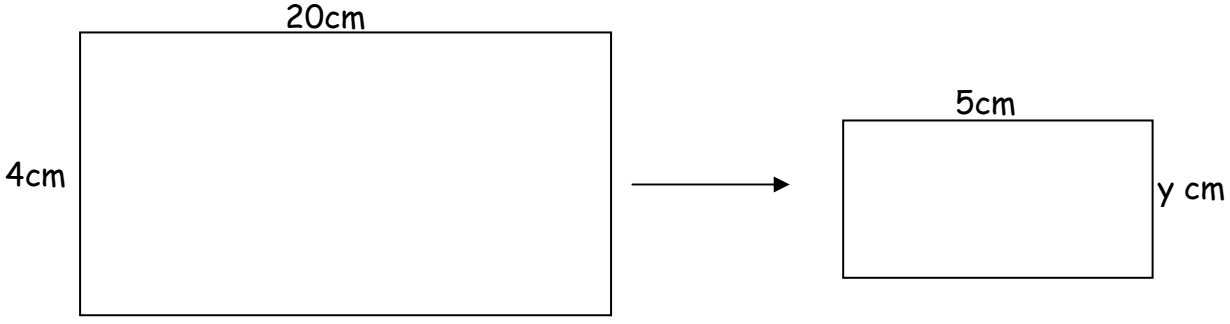
$$\text{Scale Factor} = \frac{8}{4}$$
$$\text{Scale Factor} = 2$$

This means there has been a multiplication of 2 in the enlargement. So if 4 x 2 = 8. Then we can work out what x is.

9 x 2 = **18cm**

x = 18cm

Example 2. Find the length of side y.



Here we have a mathematical **reduction**. To first of all find out the scale factor that has been used in this example we must use the ratio →

$$\text{Reduction SF} = \frac{\text{Smaller Value}}{\text{Bigger Value}}$$

We now look at the corresponding sides that we know, i.e. the 20cm and the 5cm and apply it to this formula

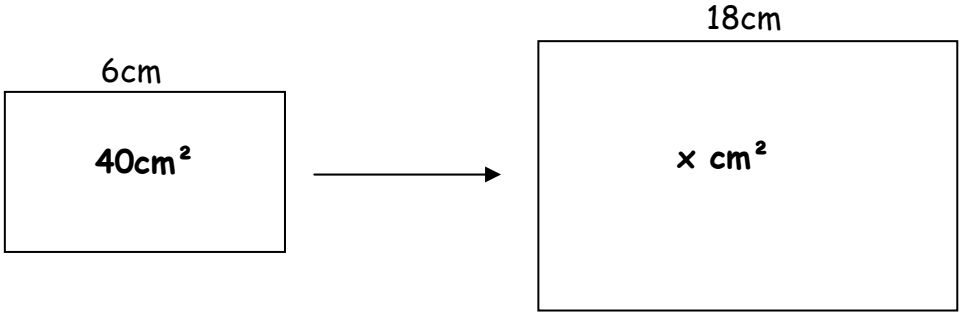
$$\text{Scale Factor} = \frac{5}{20}$$
$$\text{Scale Factor} = \frac{1}{4}$$

This means there has been a multiplication of $\frac{1}{4}$ in the reduction. So if 20 x $\frac{1}{4}$ = 5. Then we can work out what y is.

$4 \times \frac{1}{4} = \mathbf{1cm}$

y = 1cm

Example 3. Find the area marked as x in the following similar shape



To find the **area** of a similar shape is the same as finding a dimension, except all you need to do is square your scale factor once you find it since area is measured in square units ². It is an enlargement, therefore we use the enlargement ratio.

$$\text{Enlargement SF} = \frac{\text{Bigger Value}}{\text{Smaller Value}}$$

$$\text{Scale Factor} = \frac{18}{6}$$

$$\text{Scale Factor} = 3$$

We have now found the scale factor. Since it is an area we are finding, we must now square the number and then multiply it by the smaller area

$3^2 \times 40$
$= 9 \times 40$
$= \mathbf{360cm^2}$

x = 360cm²

When we have similar **triangles** it is important to remember that for triangles to be similar the sides must be multiplied by the same scale factor, just like the examples above, **and** the angles within the triangle **must** remain exactly the same.