**Lesson 5**

**GCSE Mathematics**
**Ratio and Similarity**

## 5.1 Congruent Shapes

Geometric figures with both the same ***shape*** and ***size*** are said to be **CONGRUENT**.

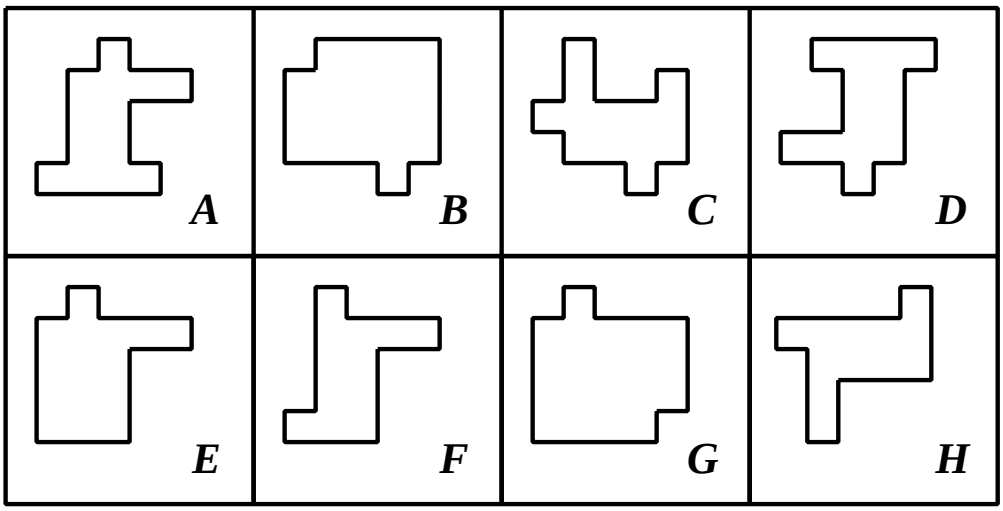
If two shapes are ***congruent*** then it will be possible to transform one on top of the other by means of translation, rotation and reflection.

If one copy of a shape can be translated (slid) across the page and then rotated as necessary to exactly cover another, the two shapes are **DIRECTLY *congruent***.

If a reflection (or flip) has to be used, the two shapes are **INDIRECTLY *congruent***.

**Example**

Consider the box of shapes.




**( i )** Which shape is ***directly congruent*** with *A* ?
Shade in this pair of shapes the same colour.

**[ 2 marks ]**

**( ii )** Which shape is ***indirectly congruent*** with *H* ?
Shade in this pair of shapes a different same colour.

**[ 2 marks ]**

**( iii )** Two other shapes are ***directly congruent.*** Which two ?
Shade in this pair of shapes, both in the same colour used in part **( i )**.

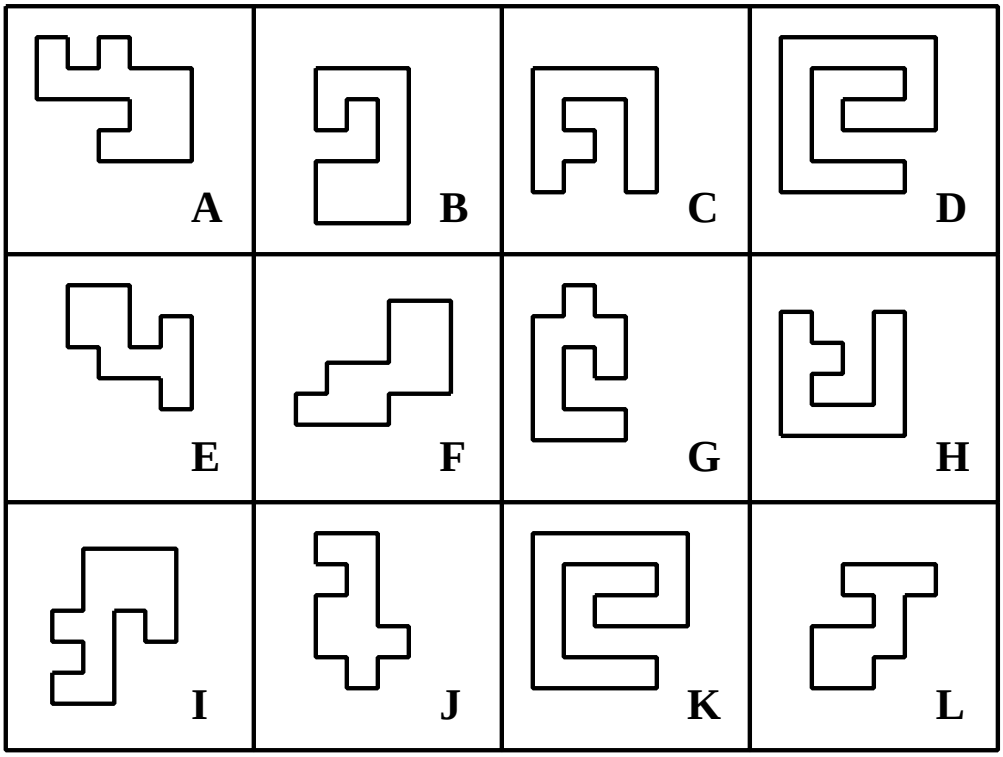
**[ 2 marks ]**

**5.2 Exercise**

Marks Available : 6

**Question 1**

For the following shapes, shade in those that are ***directly congruent*** in one colour and, in a different colour, those that are ***indirectly congruent.***




**[ 6 marks ]**

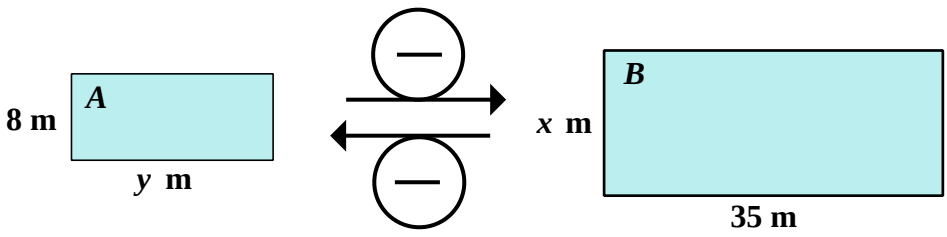
**5.3 Exercise : Test Revision**

Marks Available : 42

*You may use a calculator*

**Question 1**

For the similar rectangles *A* and *B*, shown below, find the lengths marked *x* and *y* given that the length scale factor (greater than 1) of the similarity is $\frac{7}{4}$




**[ 2 marks ]**

**Question 2**

An elastic band of length 15 cm is stretched with length scale factor $\frac{9}{3}$.
What is the length of the stretched band ?

**[ 2 marks ]**

**Question 3**

When made wet a 55 cm piece of string shrinks with length scale factor $\frac{3}{5}$
What is the length of the shrunk string ?

**[ 2 marks ]**

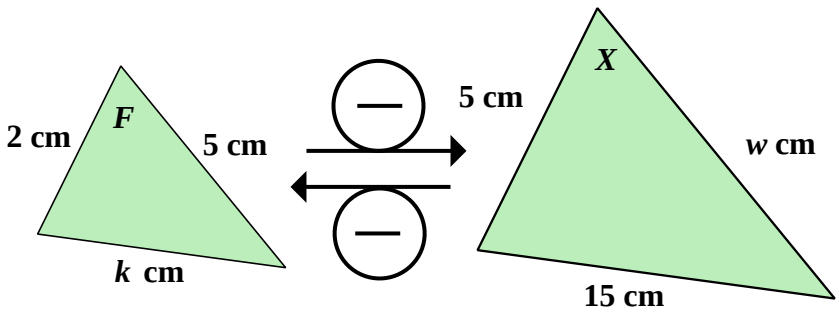
**Question 4**

Two rectangles are similar with length scale factor $\frac{13}{4}$
The smaller measures 8 cm by 12 cm.
What are the measurements of the larger ?

**[ 2 marks ]**

**Question 5**

For the similar triangles *F* and *X*, shown below, find the length scale factor (greater than 1) of the similarity and also the lengths marked *w* and *k*
(Your answers may involve decimals !)




**[ 3 marks ]**

**Question 6**

Cancel down these fractions as far as possible by repeated division of the numerator and denominator by 2, 3, 5 or 10.

**( i )** $\frac{14}{4}$

**( ii )** $\frac{35}{15}$

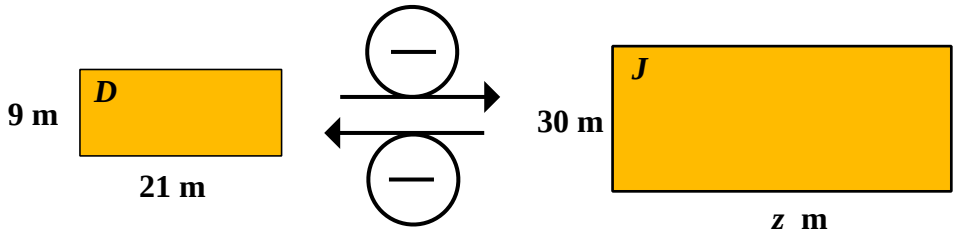
**( iii )** $\frac{21}{15}$

**( iv )** $\frac{28}{84}$

**[ 4 marks ]**

**Question 7**

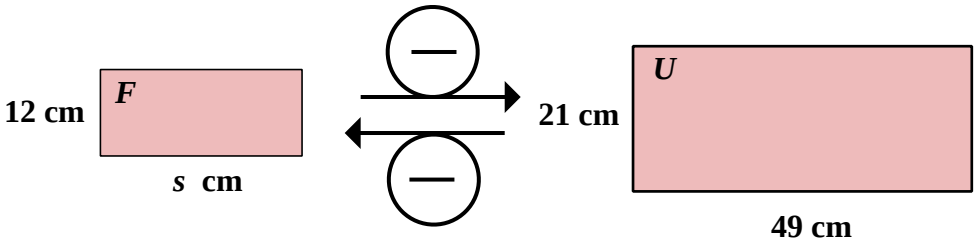
For the similar rectangles *D* and *J*, shown below, find the length scale factor (greater than 1) of the similarity (cancel down the fraction)
and also the length marked *z*




**[ 3 marks ]**

**Question 8**

For the similar rectangles *F* and *U*, shown below, find the length scale factor (greater than 1) of the similarity (cancel down the fraction)
and also the length marked *s*




**[ 3 marks ]**

**Question 9**

Simplify each of the following

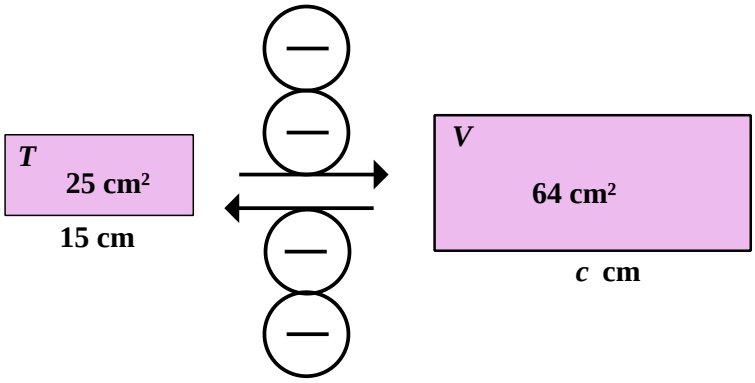
**( i )** $\left(\frac{7}{5}\right)^2 =$ ——

**( ii )** $\sqrt{\frac{100}{49}} =$ ——

**( iii )** $\left(\frac{9}{4}\right)^{0.5} =$ ——

**[ 3 marks ]**

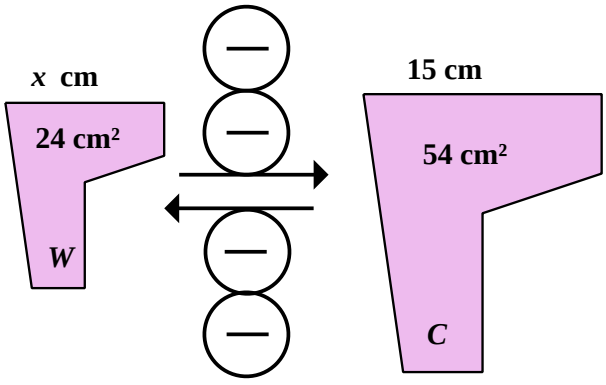
**Question 10**




Rectangles *T* and *V* are similar.
Find the length marked *c*

**[ 3 marks ]**

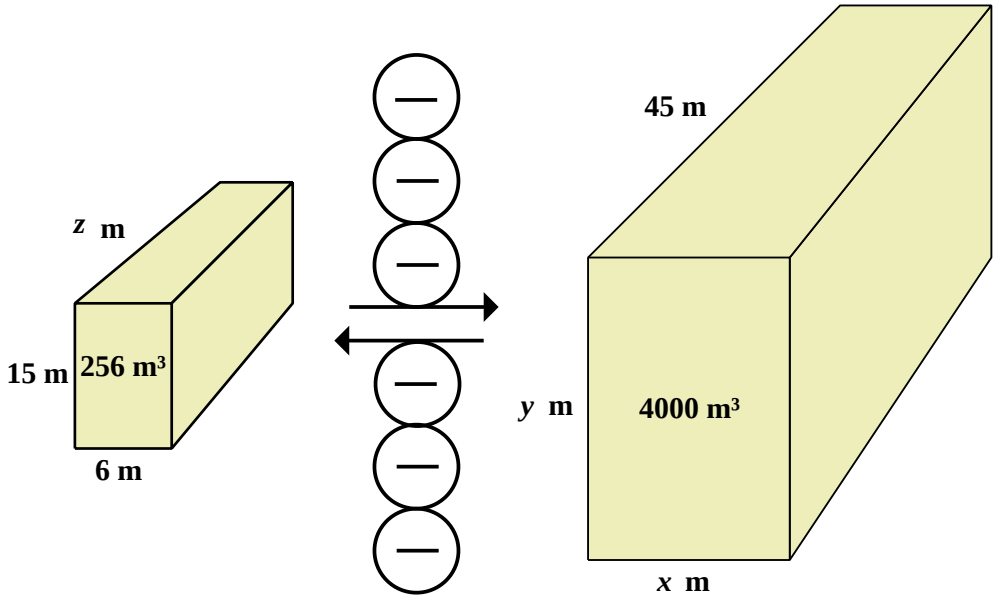
**Question 11**




The shapes *W* and *C* are similar.
Find the length marked *x*

**[ 3 marks ]**

**Question 12**




The above two similar cuboids are shown with the same orientation.

**( i )** Find the lengths marked *x*, *y* and *z*.

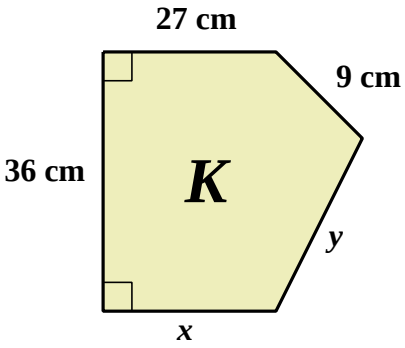
**[ 3 marks ]**

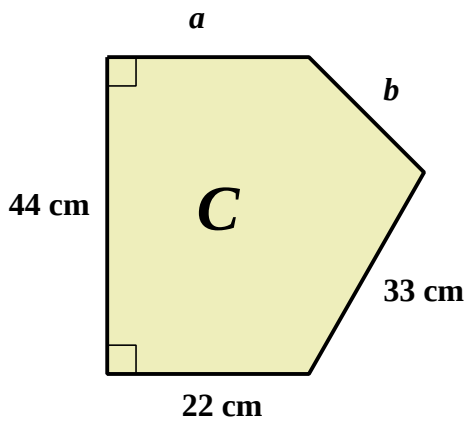
**( ii )** How many times more surface area has the larger cuboid than the smaller ?

**[ 1 mark ]**

**Question 13**

Pentagon *K* is mathematically similar to pentagon *C*.
Calculate the lengths of the sides marked *a*, *b*, *x*, and *y*.



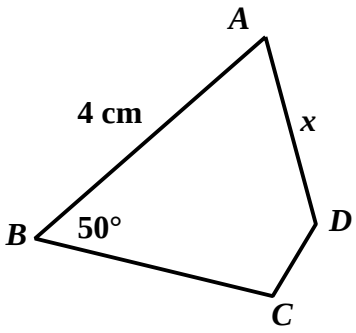



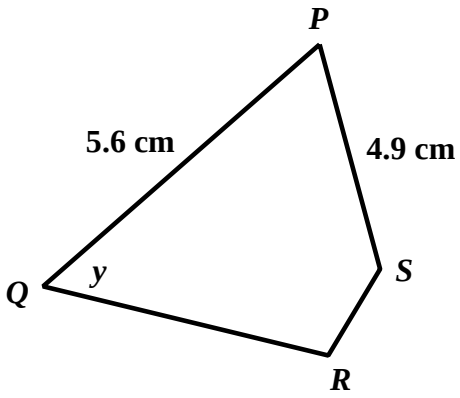

**[ 4 marks ]**

**Question 14**

Quadrilaterals *ABCD* and *PQRS* are similar.

**Diagram NOT accurately drawn**




*AB* corresponds to *PQ*.
*BC* corresponds to *QR*.
*CD* corresponds to *RS*.

Find the value of

**( a )** *x*,

**( b )** *y*,

**[ 3 marks ]**