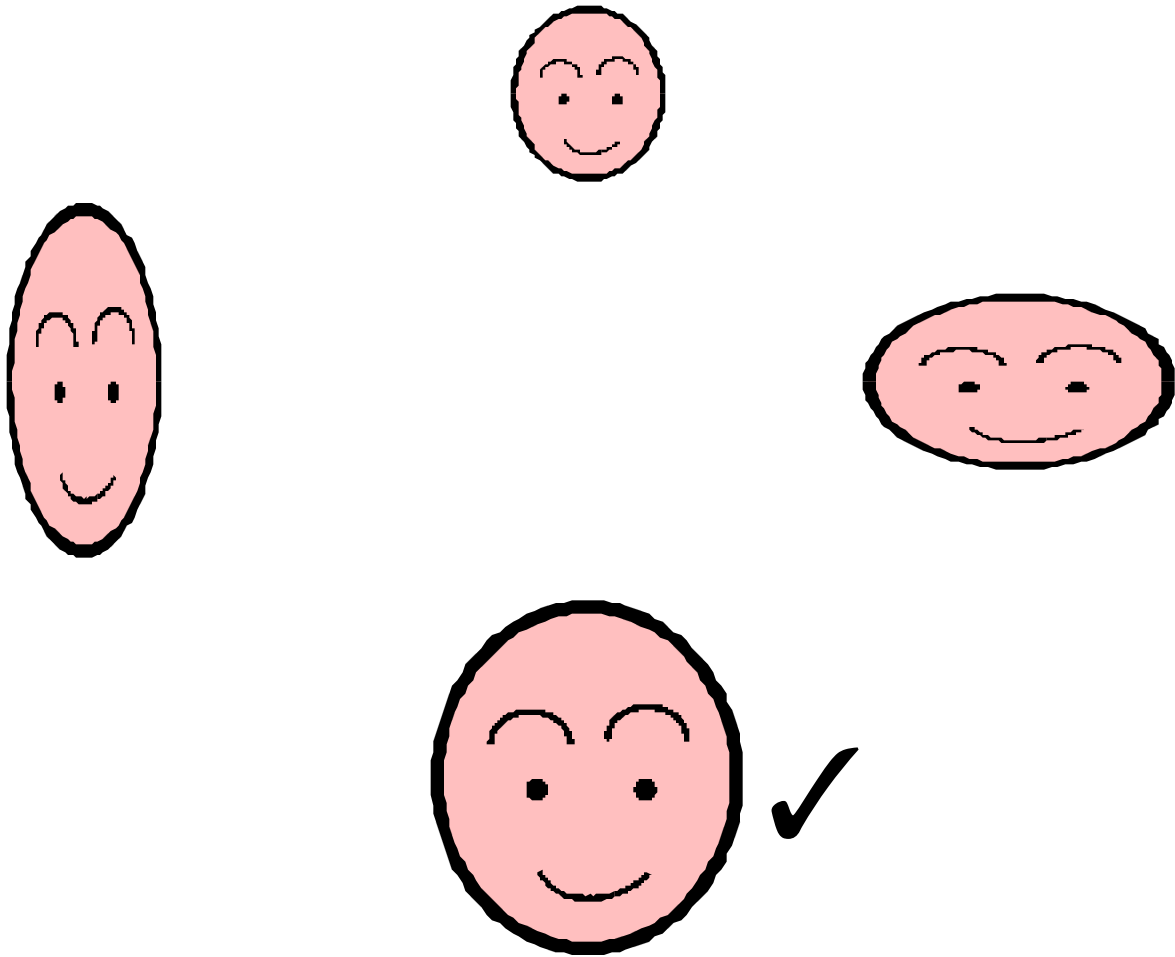


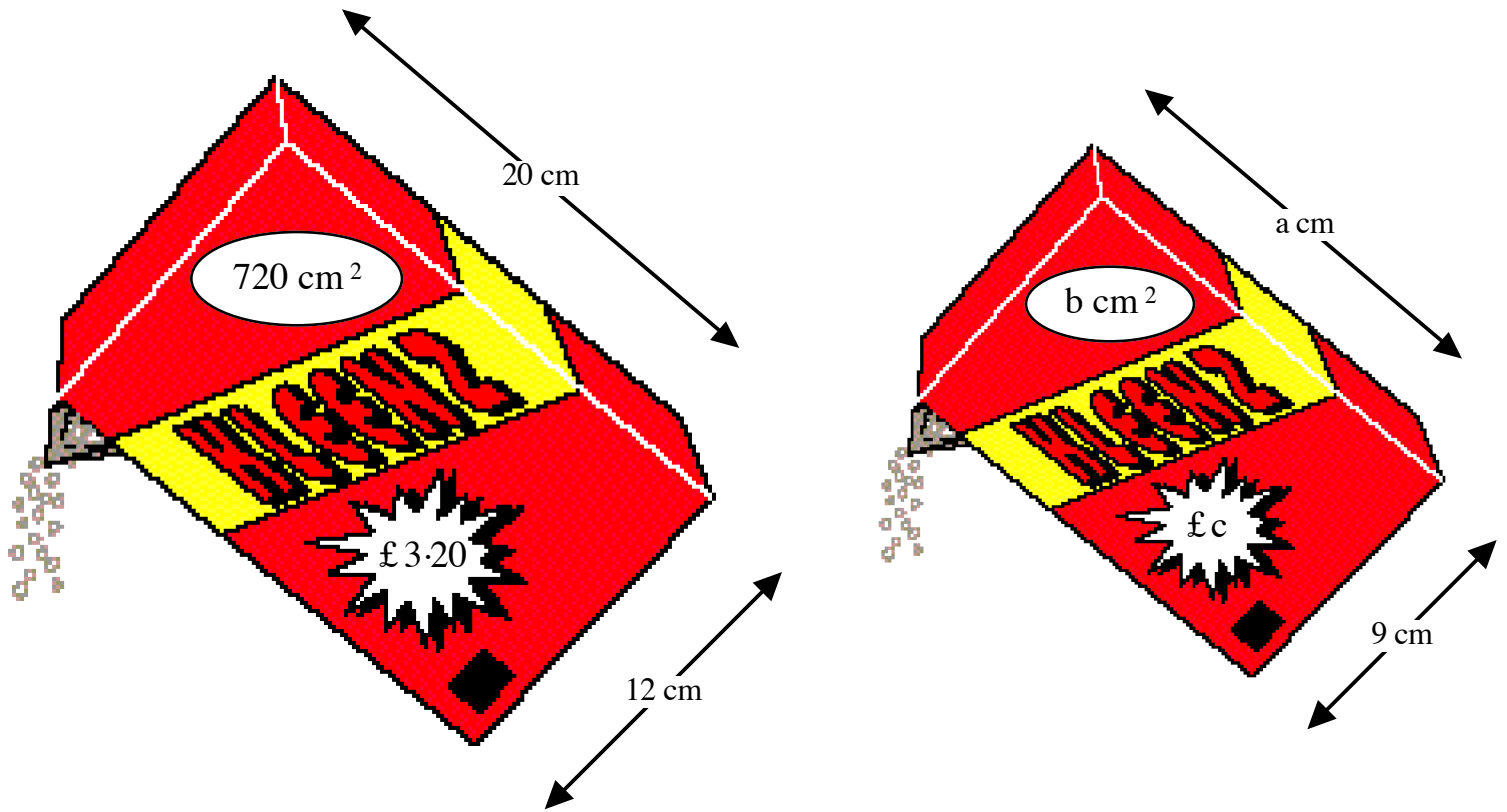
# Similar Shapes



## Examples

NOTE: Calculations in the exercises of the unit do **not** require a calculator but will involve simplifying fractions, working with decimals and simplifying divisions.

1. The pair of boxes shown are similar. Find the unknown length, area and cost of the smaller box. The cost depends on the volume of the box.



Original

Image

$$\text{length scale factor} = \frac{\text{image}}{\text{original}} = \frac{9}{12} = \frac{3}{4}$$

$$a = \frac{3}{4} \times 20 = 15$$

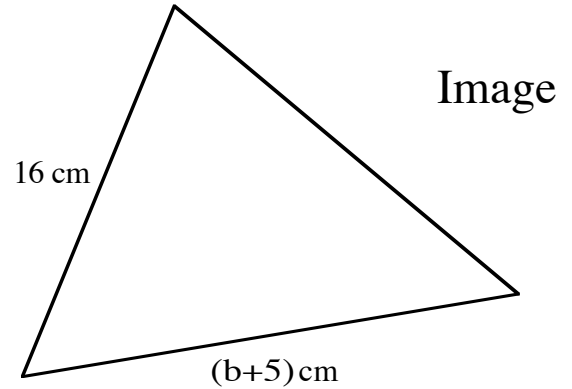
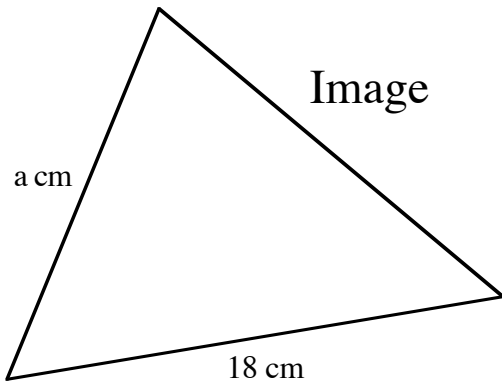
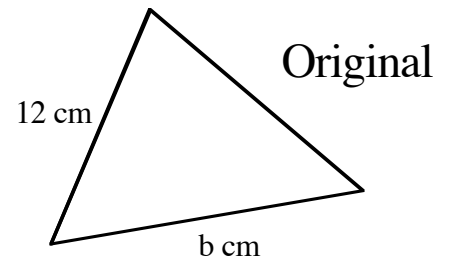
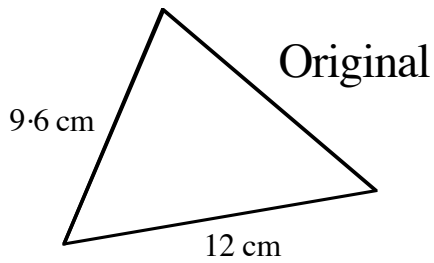
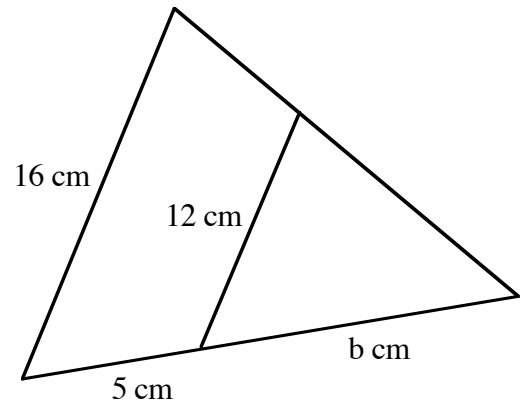
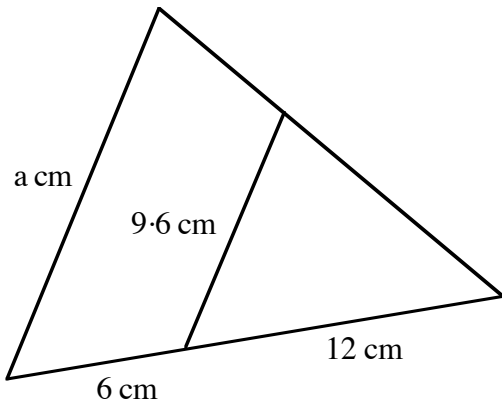
$$\text{area scale factor} = \frac{3}{4} \times \frac{3}{4} = \frac{9}{16}$$

$$b = \frac{9}{16} \times 720 = 405$$

$$\text{volume scale factor} = \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4} = \frac{27}{64}$$

$$c = \frac{27}{64} \times 3.20 = 1.35$$

2. Find the unknown length in each of the triangles.



$$\text{scale factor} = \frac{\text{image}}{\text{original}} = \frac{18}{12} = \frac{3}{2}$$

$$\text{scale factor} = \frac{\text{image}}{\text{original}} = \frac{16}{12} = \frac{b+5}{b}$$

$$a = \frac{3}{2} \times 9.6 = 14.4$$

$$\frac{16}{12} = \frac{b+5}{b}$$

$$16b = 12(b+5)$$

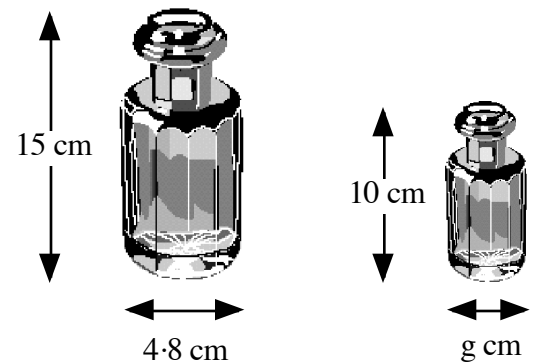
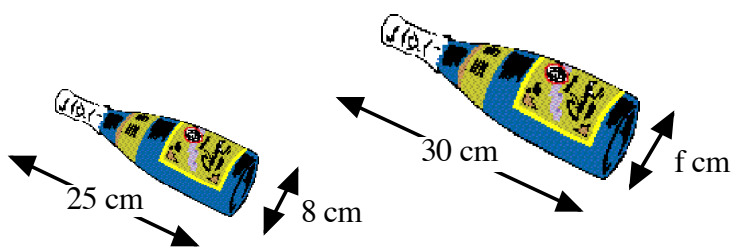
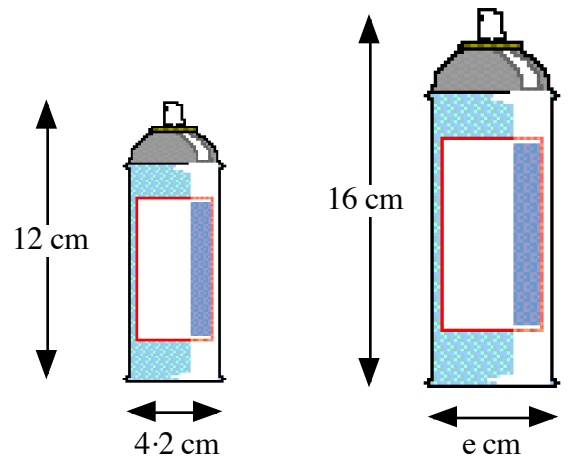
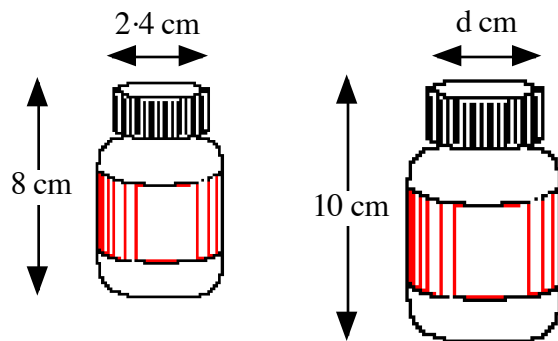
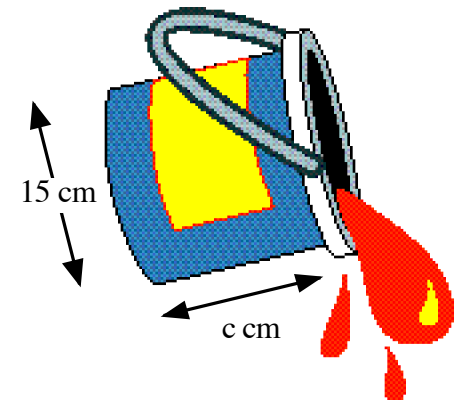
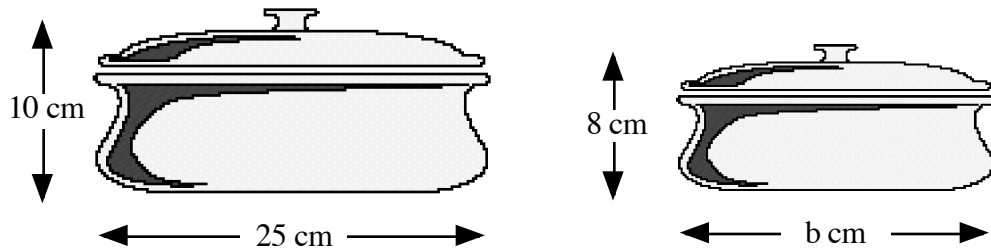
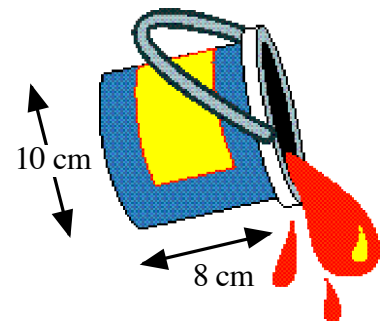
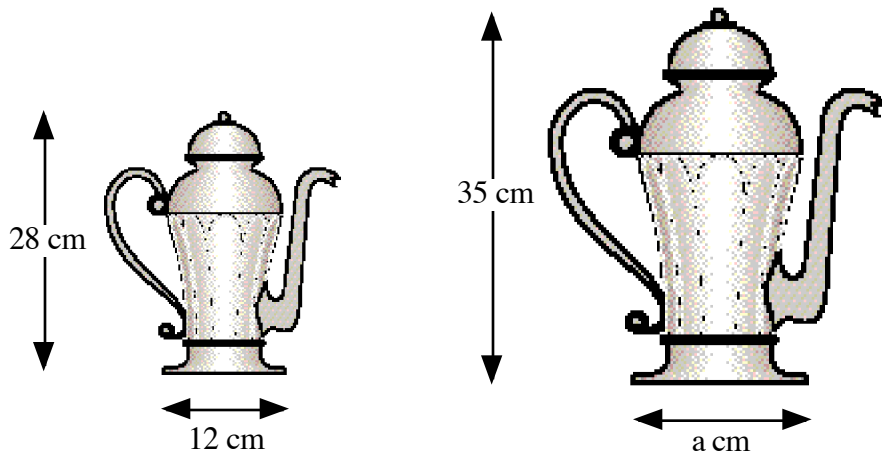
$$16b = 12b + 60$$

$$4b = 60$$

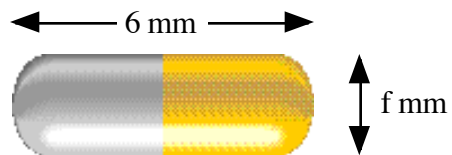
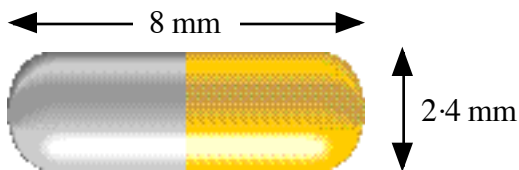
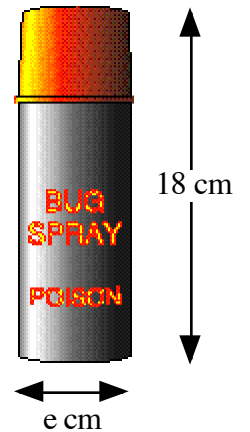
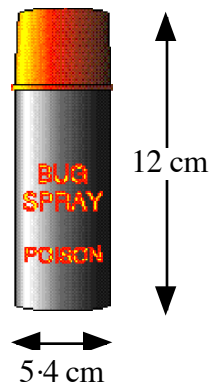
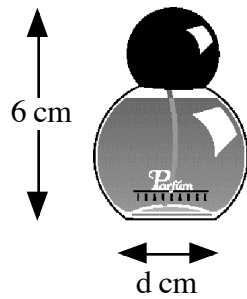
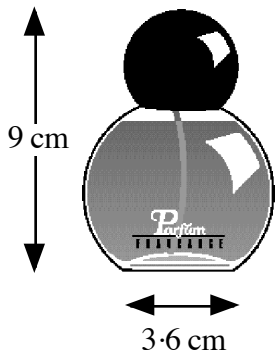
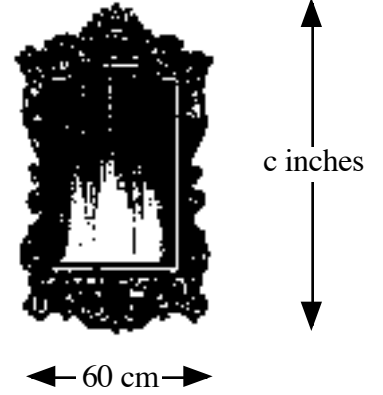
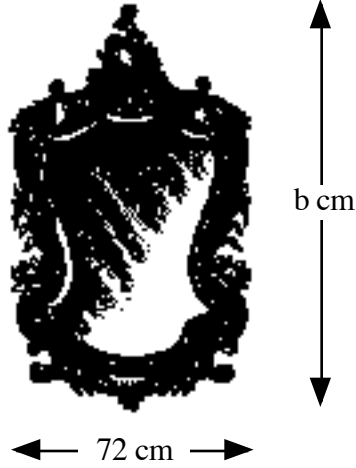
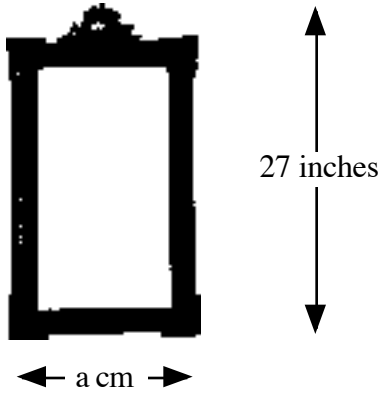
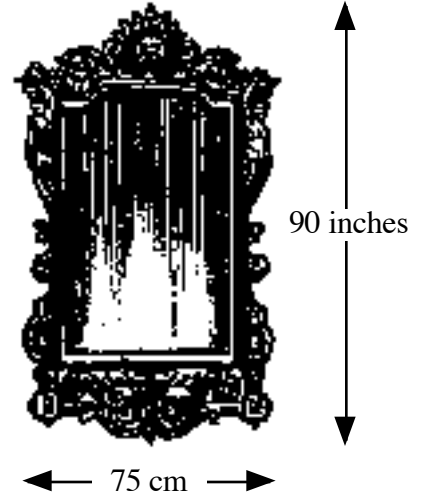
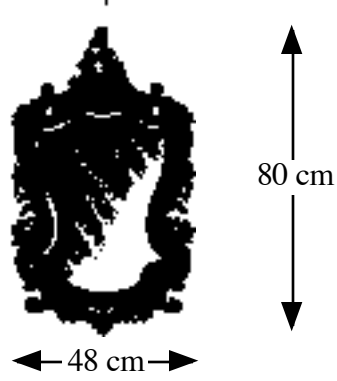
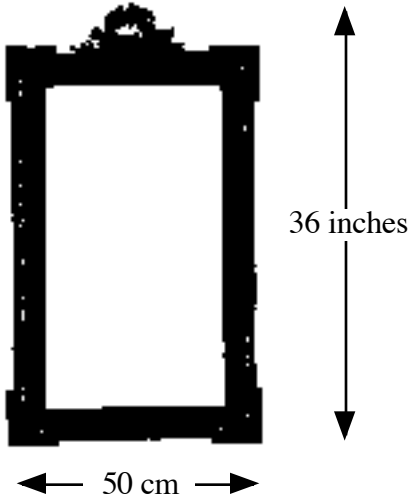
$$b = 15$$

# Similar Shapes: Length

1. In each of the following the pairs of shapes are similar. Find the length of the unknown side.

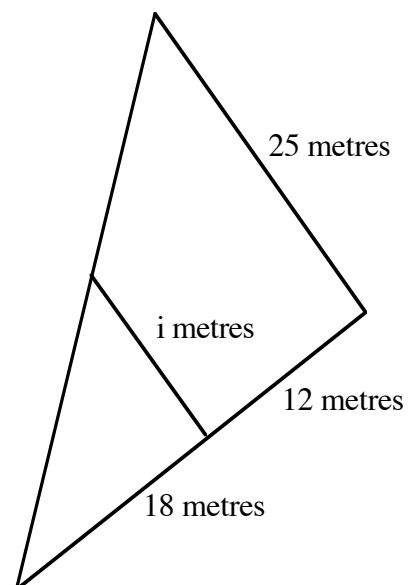
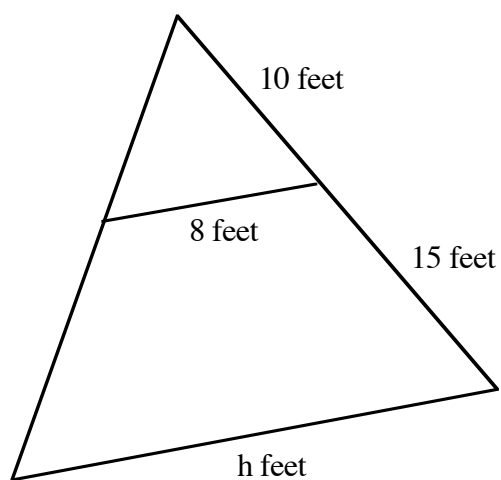
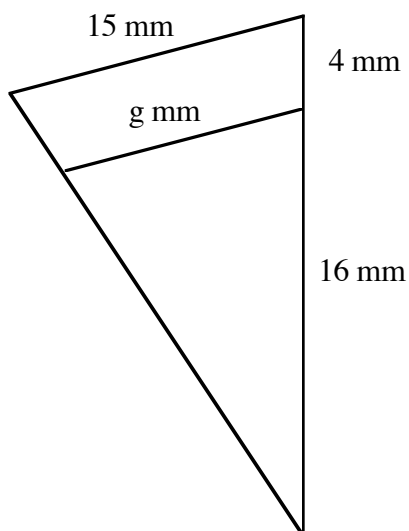
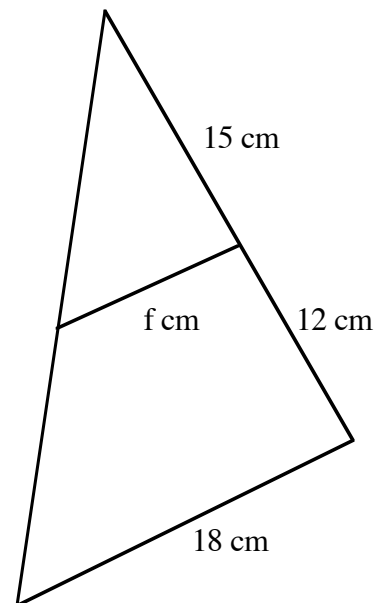
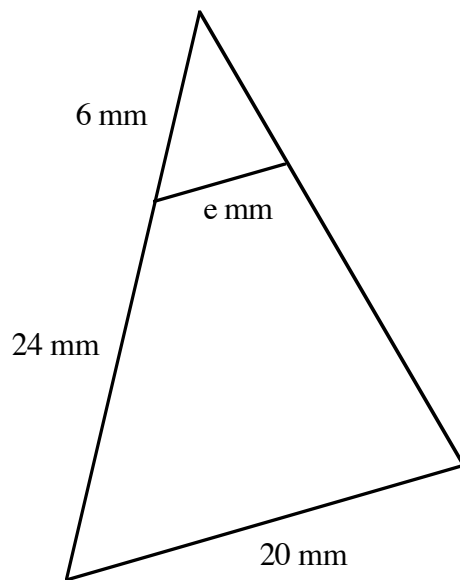
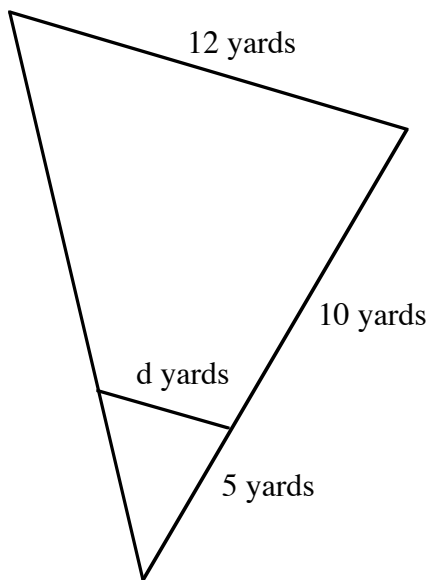
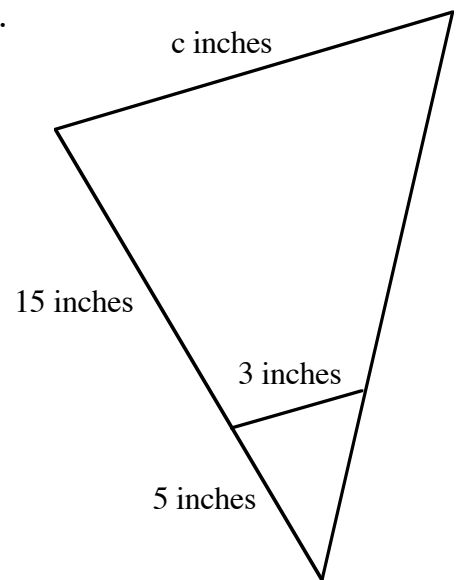
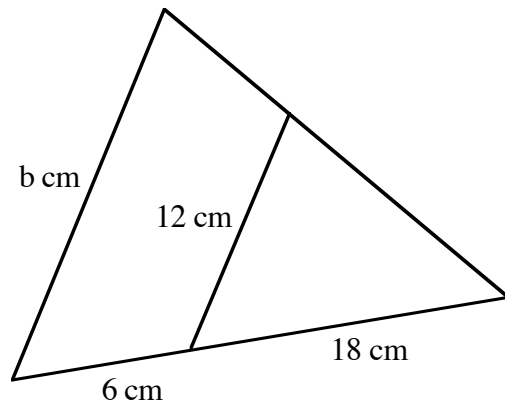
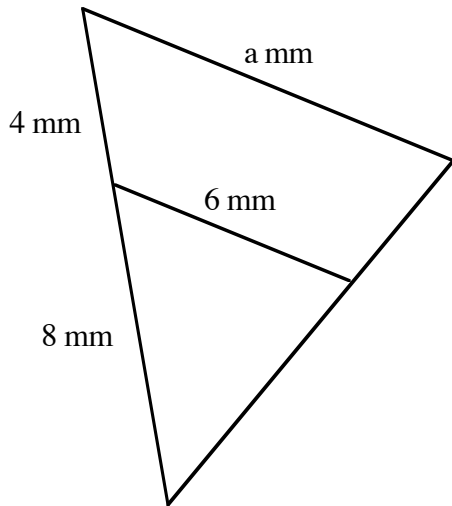


2. In the following the pairs of shapes are similar. Find the length of the unknown side.  
 The mixed units are intentional.

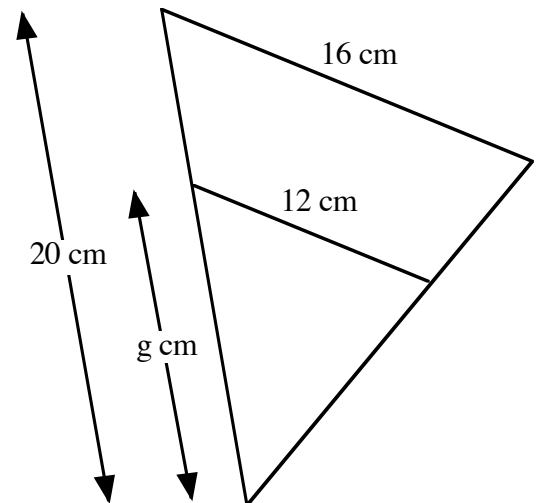
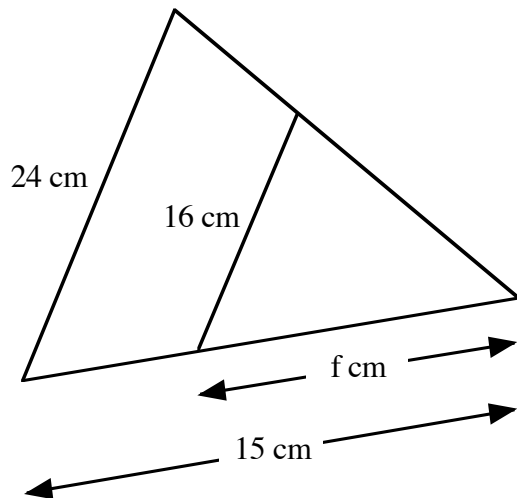
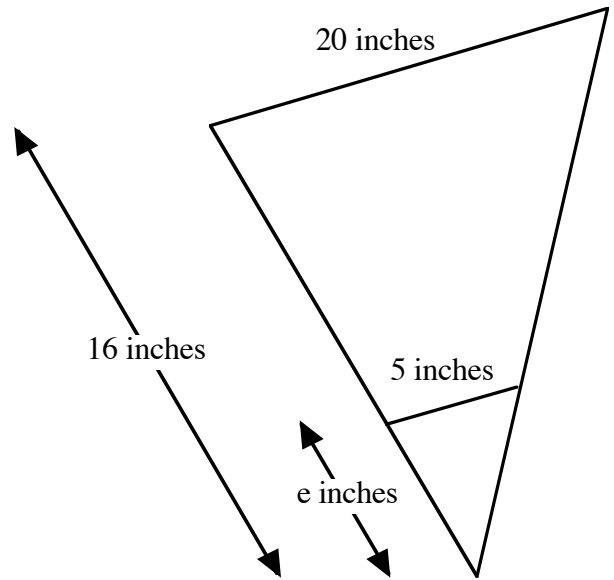
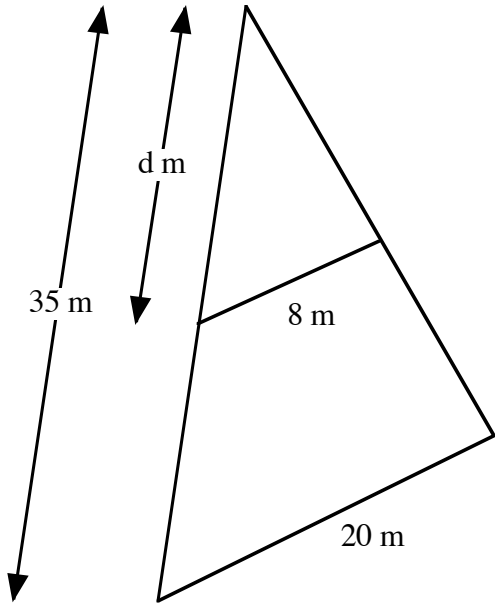
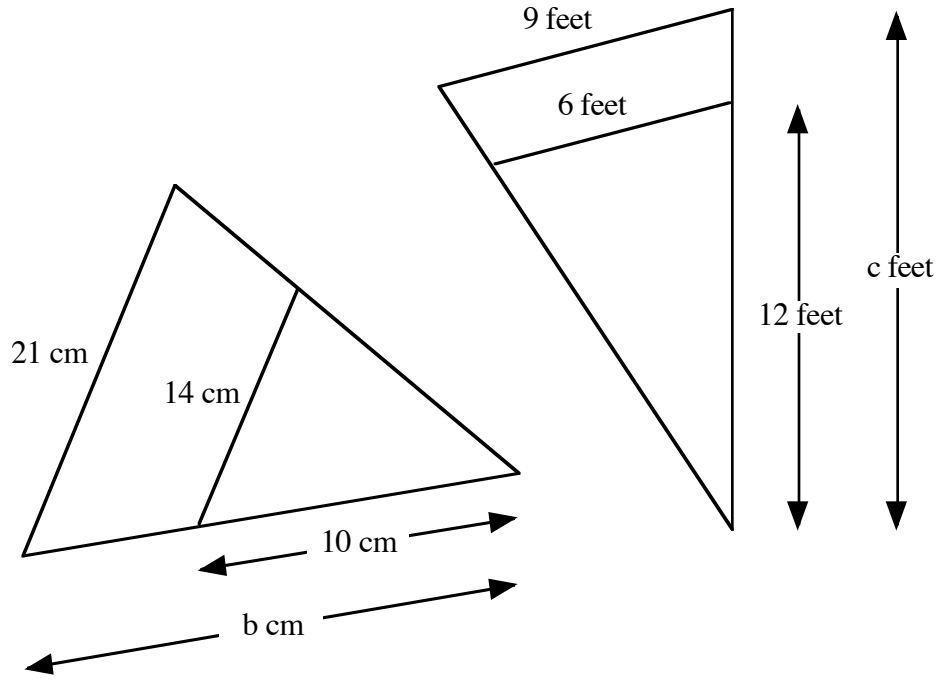
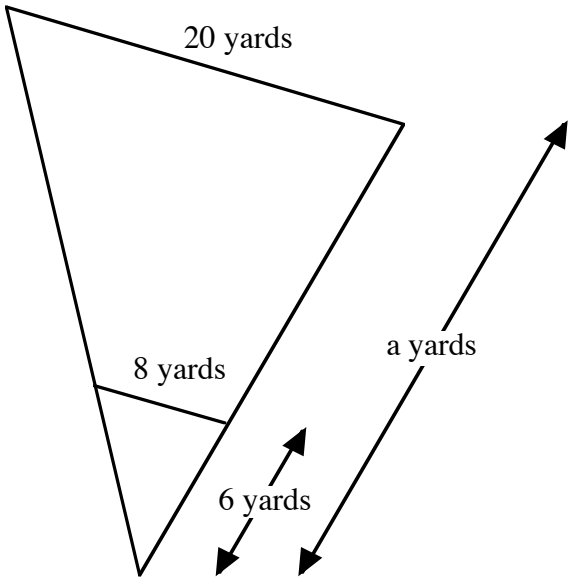


# Similar Shapes: Triangles 1

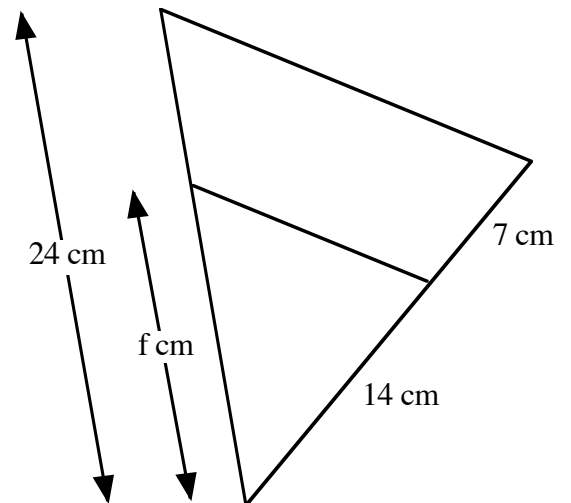
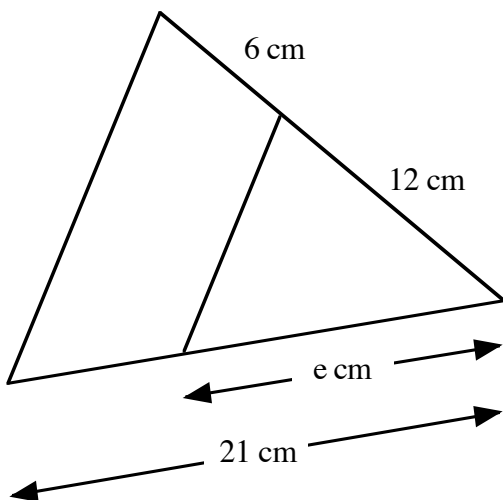
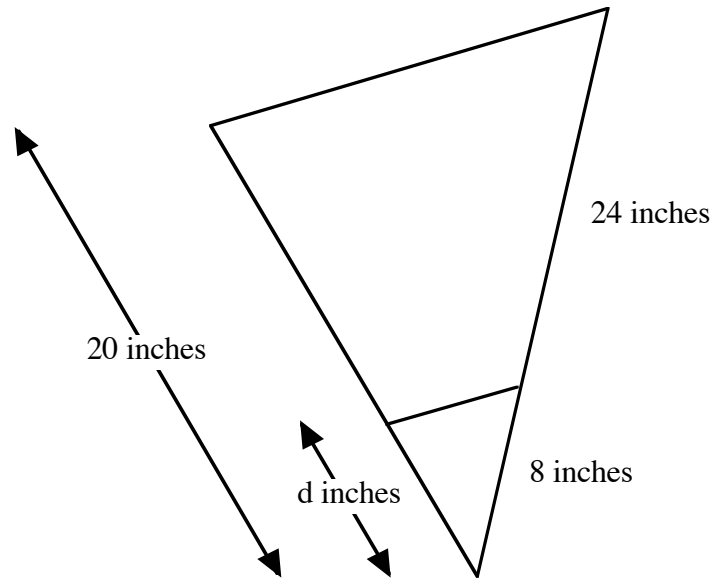
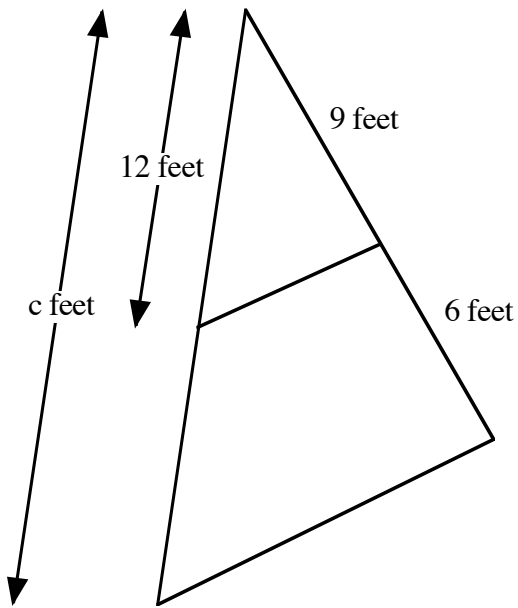
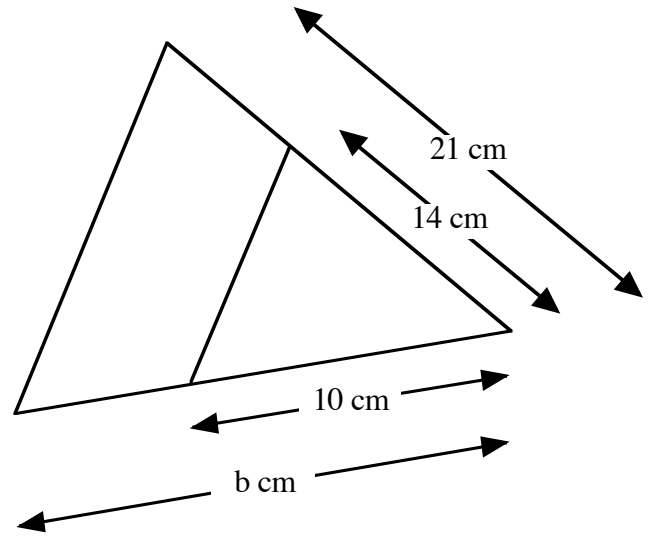
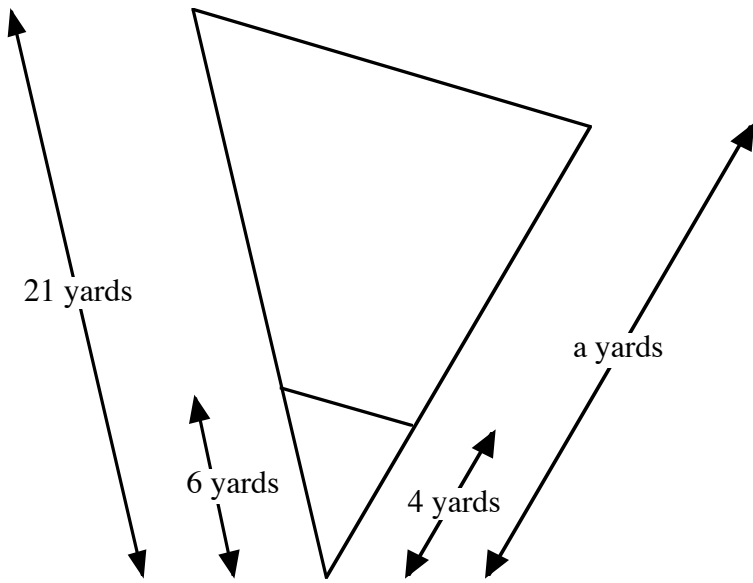
1. In each of the following diagrams find the length of the unknown side.



2. In each of the following diagrams find the length of the unknown side.

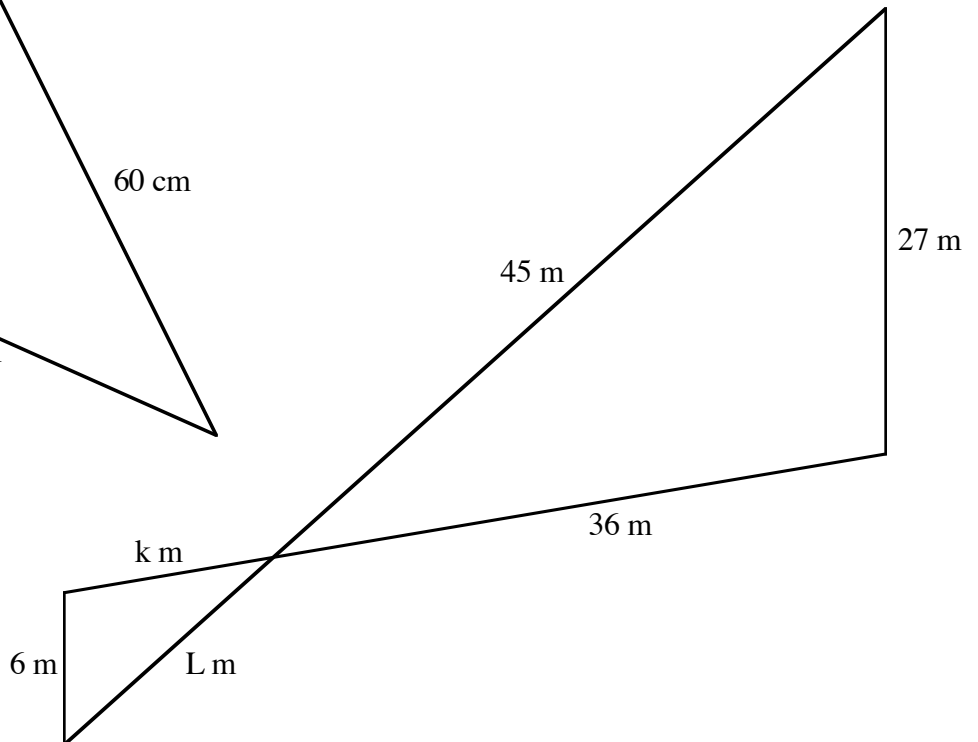
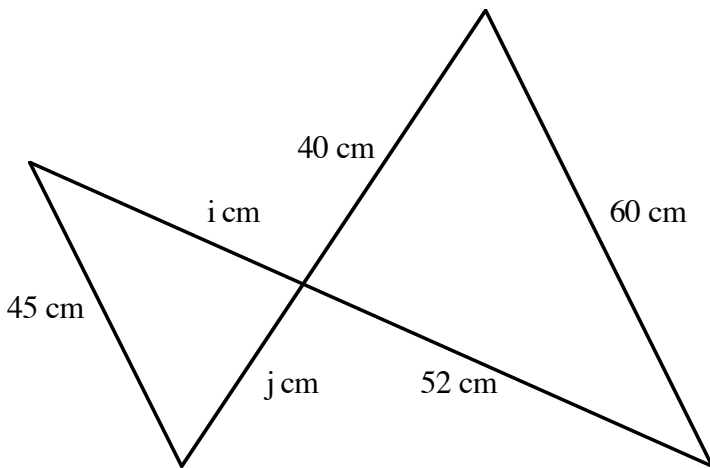
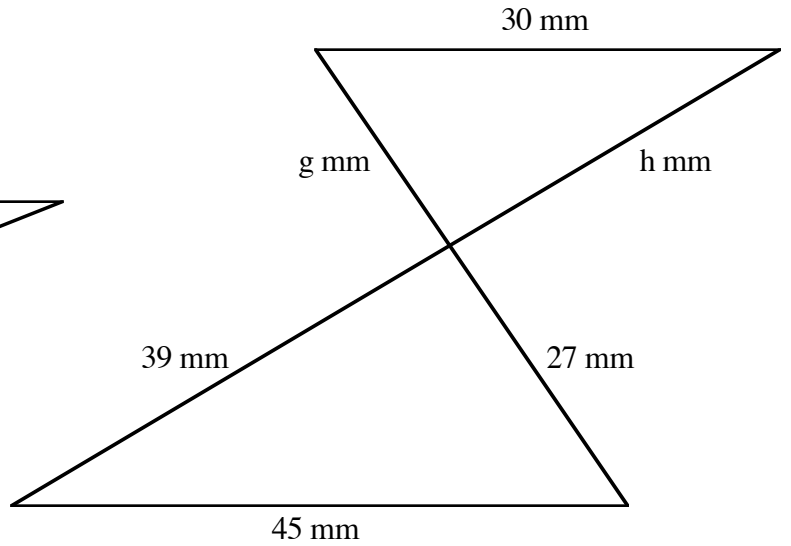
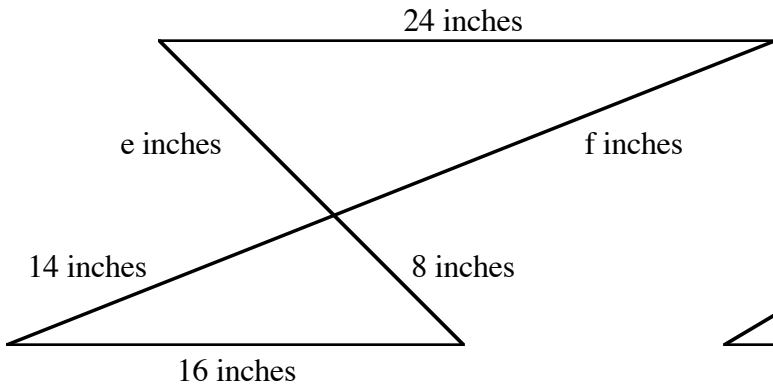
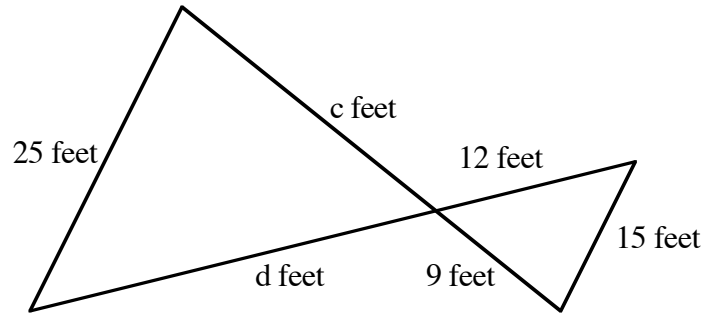
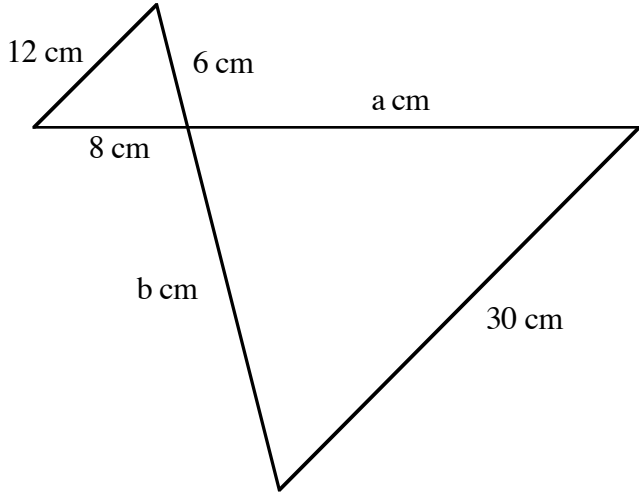


3. In each of the following diagrams find the length of the unknown side.



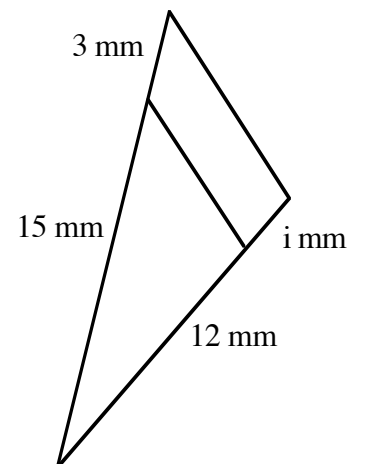
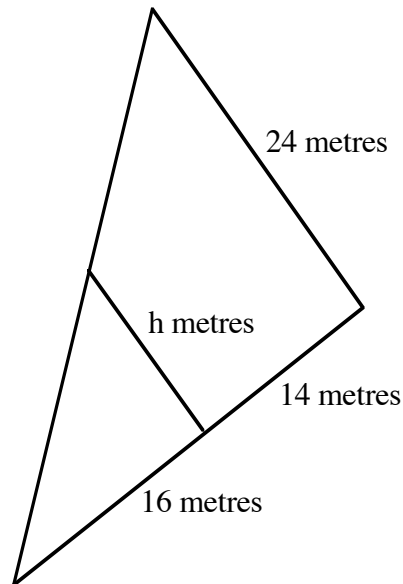
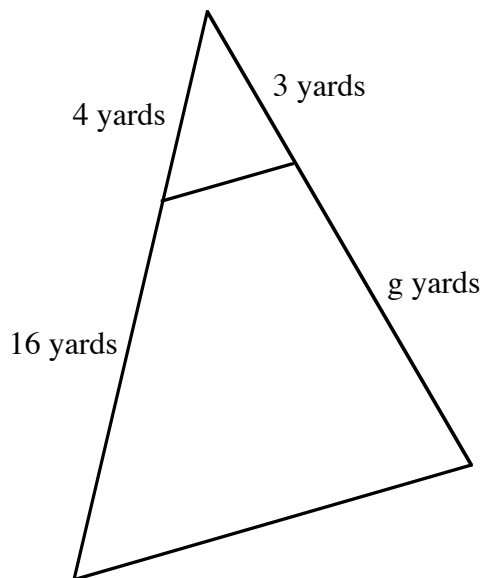
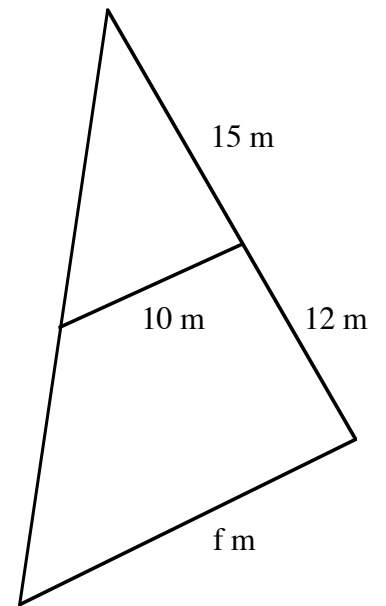
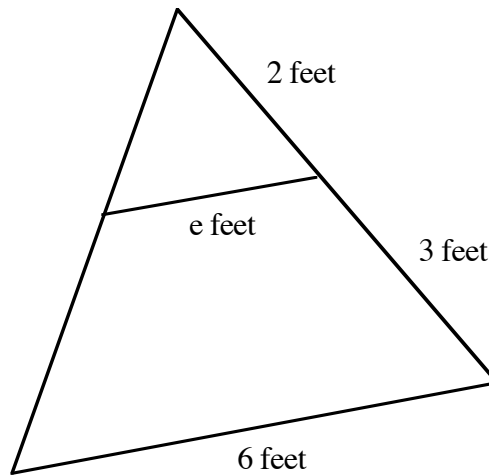
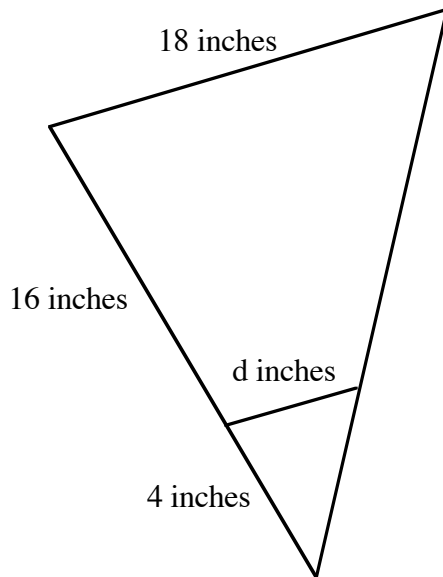
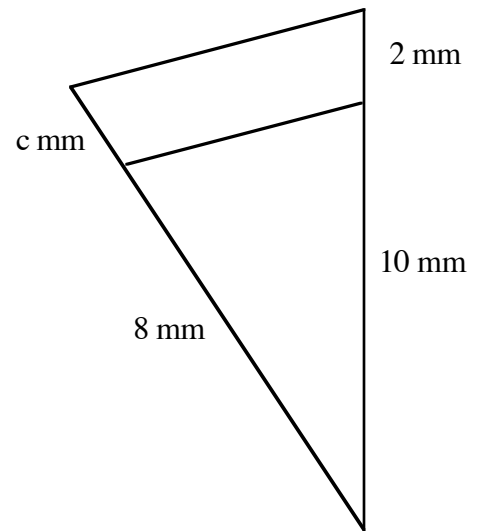
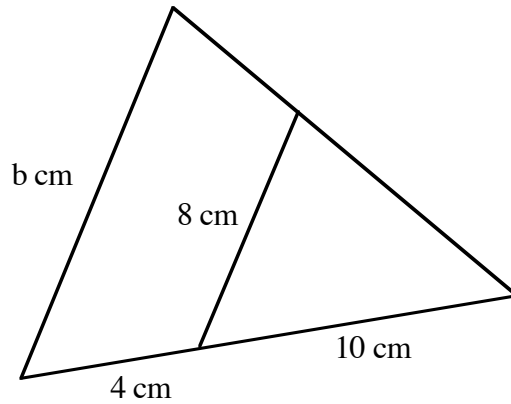
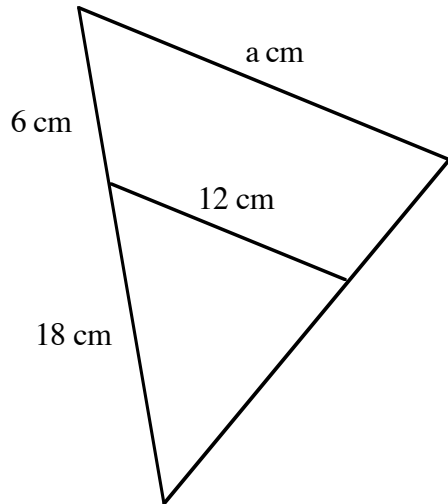


4. In each of the following diagrams find the lengths of the unknown sides.

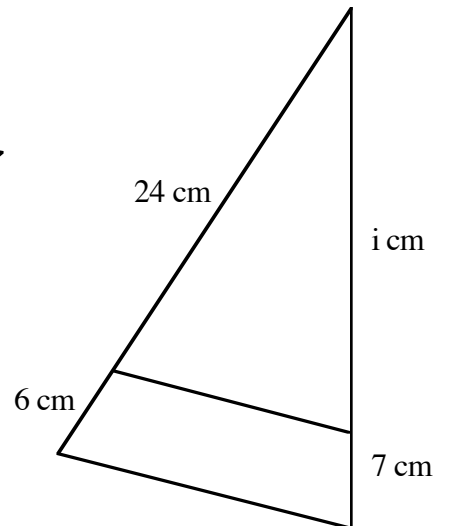
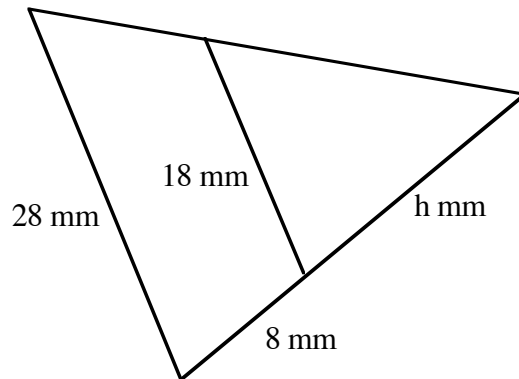
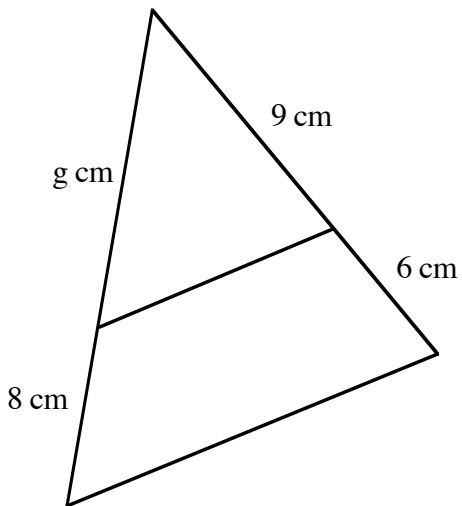
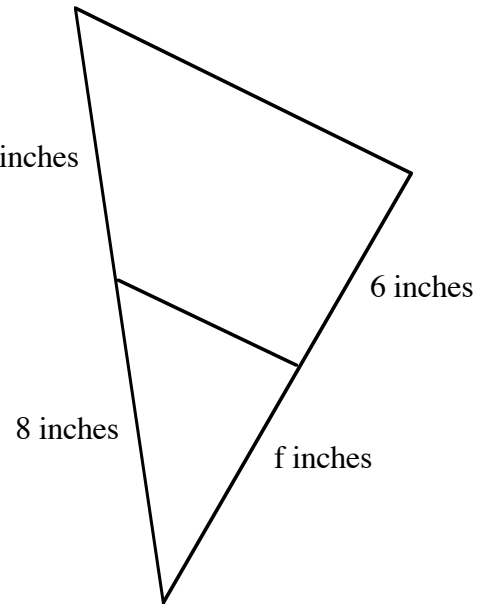
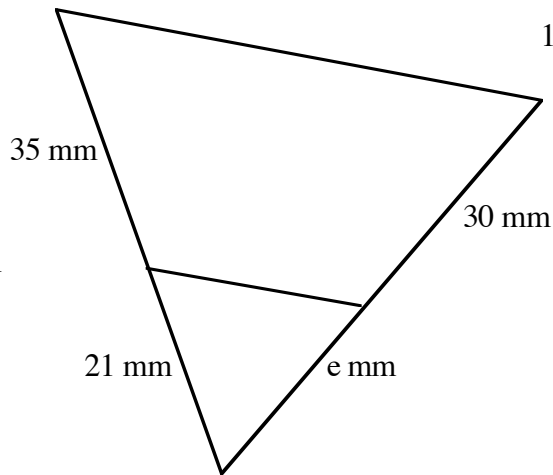
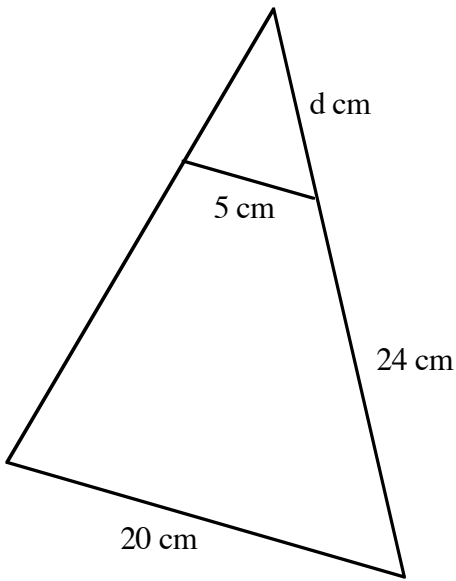
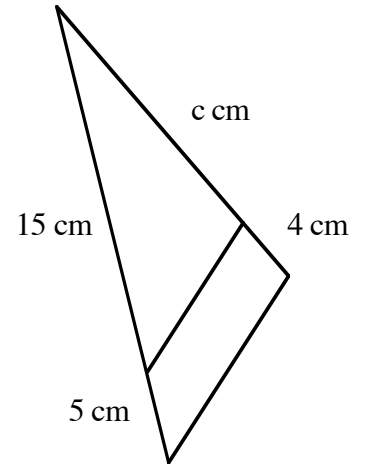
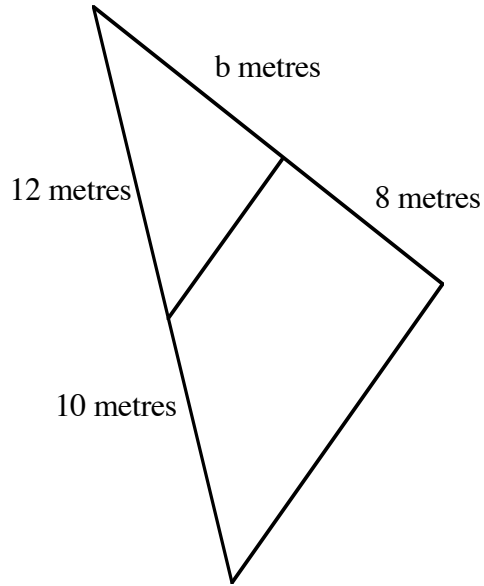
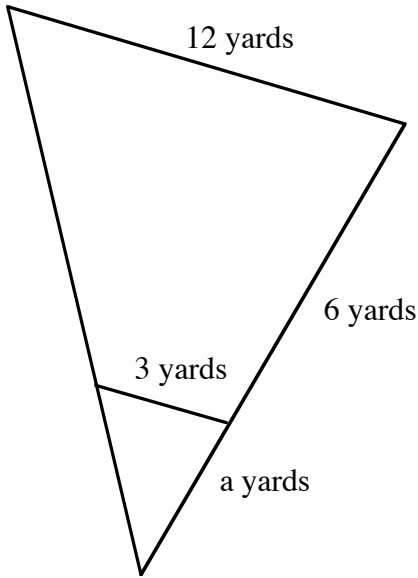


# Similar Shapes: Triangles 2

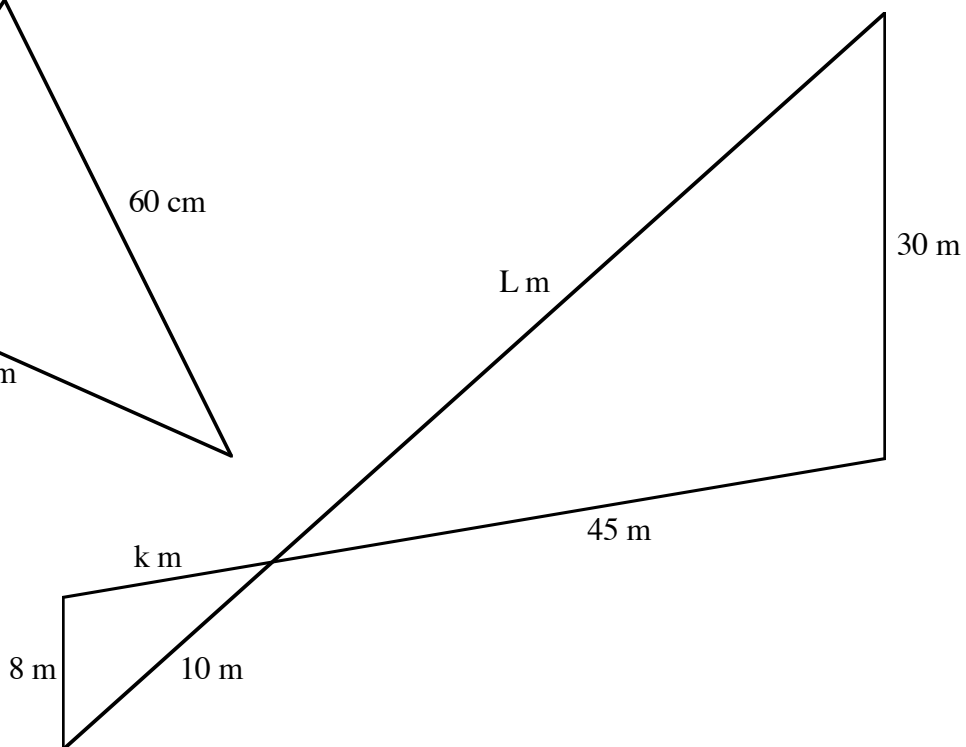
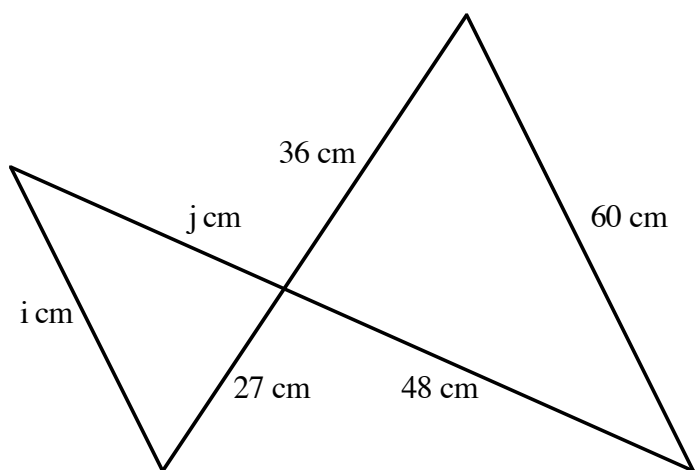
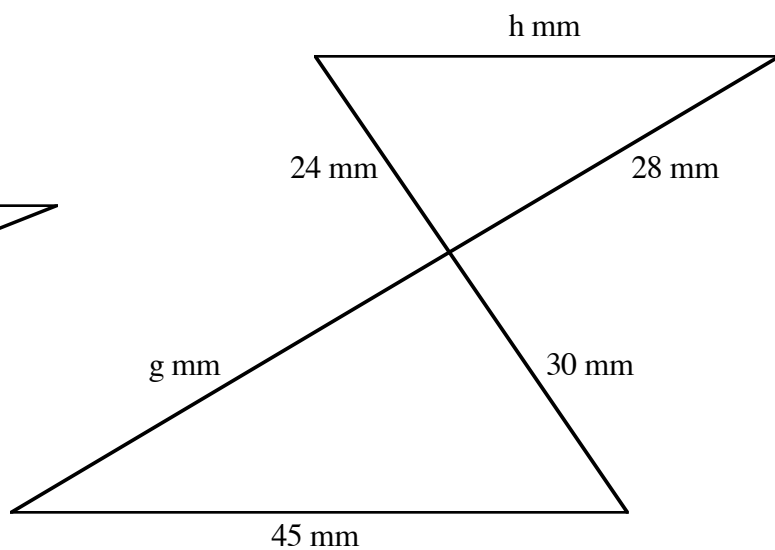
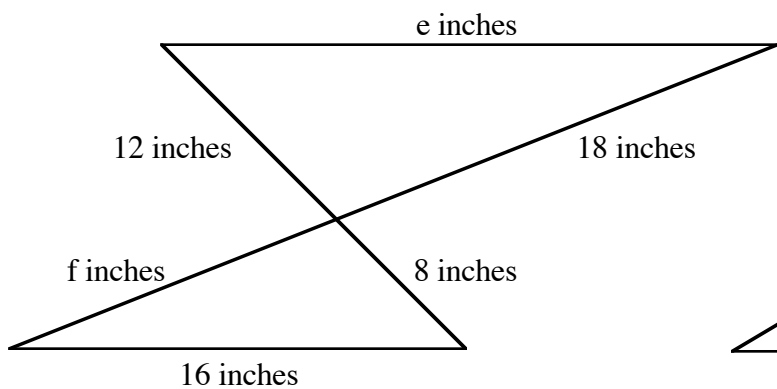
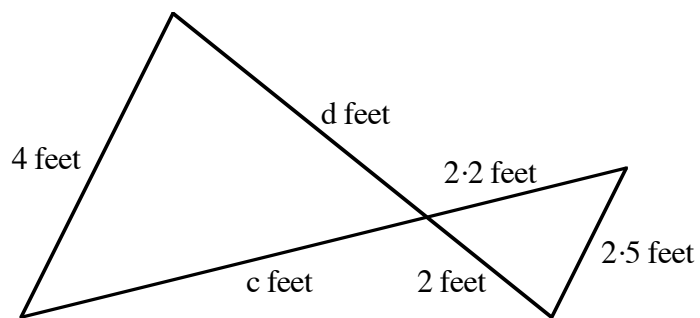
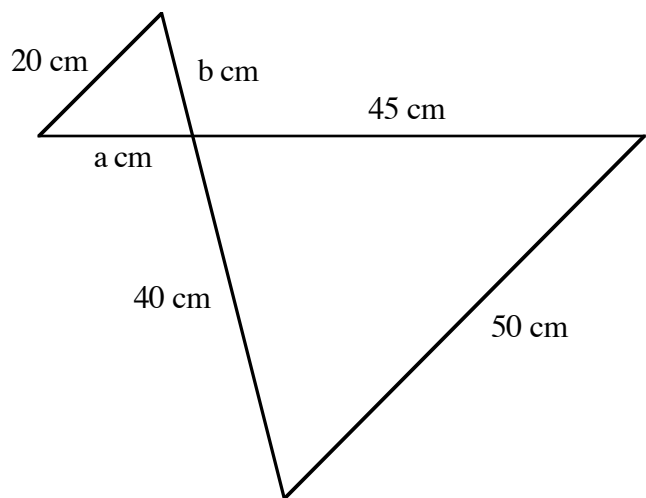
1. In each of the following diagrams find the length of the unknown side.



2. In each of the following diagrams find the length of the unknown side.



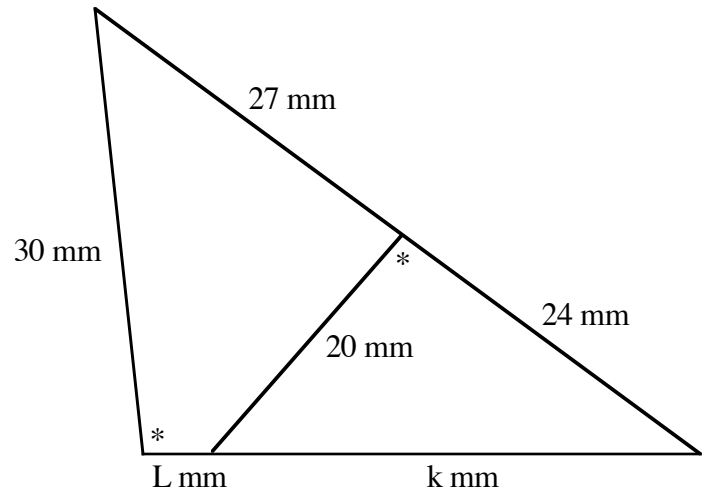
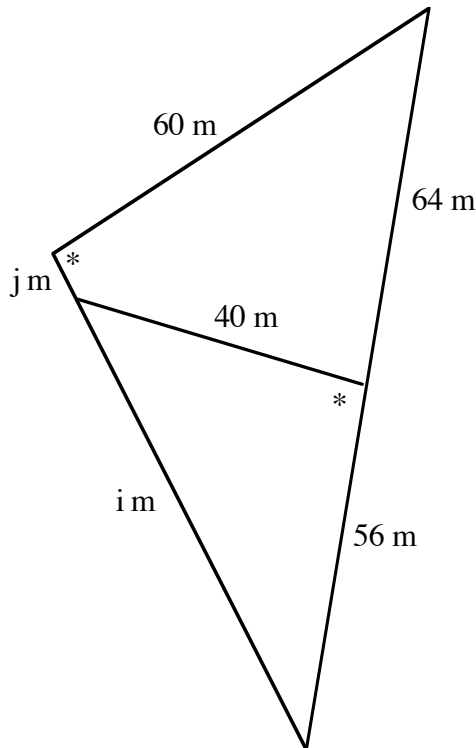
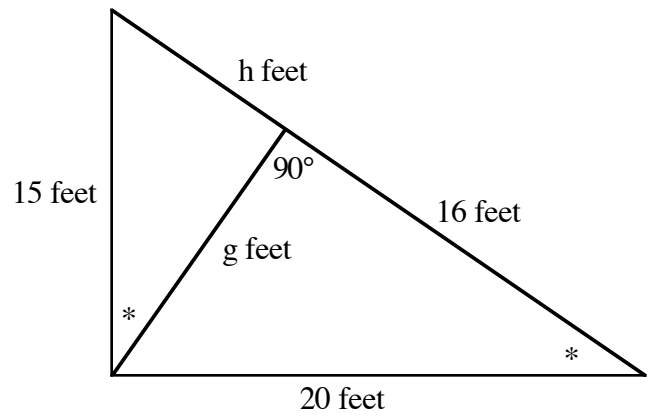
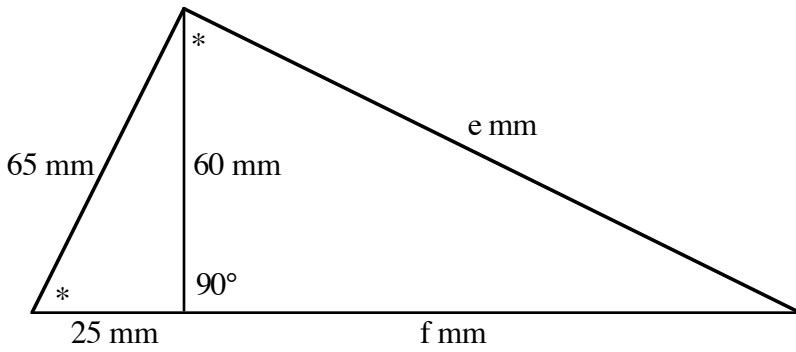
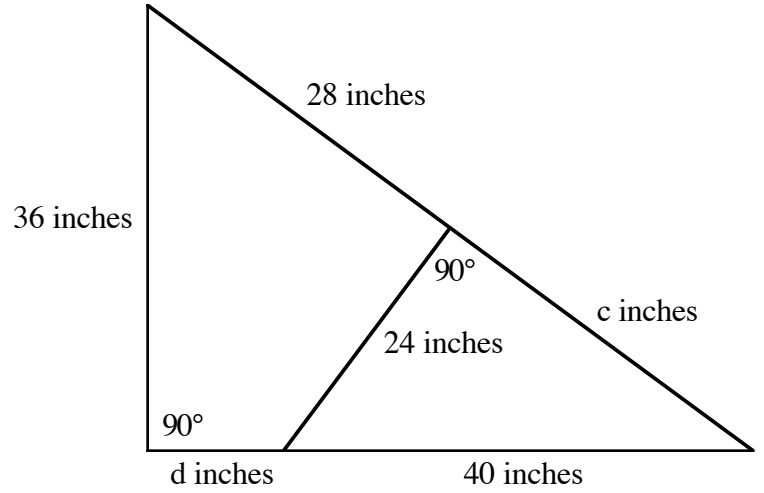
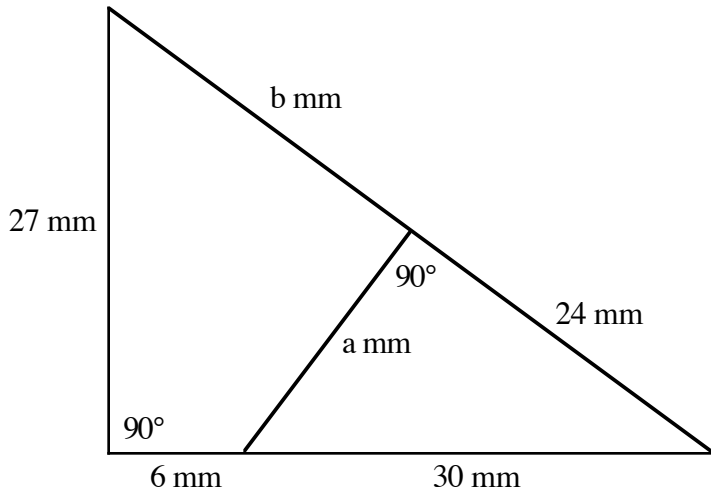
3. In each of the following diagrams find the lengths of the unknown sides.



4. In the following diagrams find the sizes of the unknown lengths.

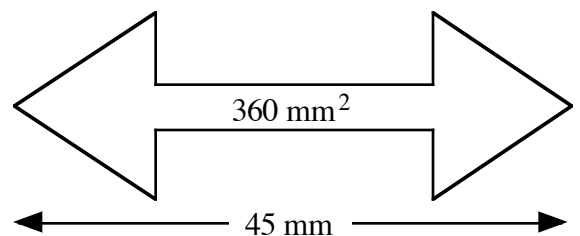
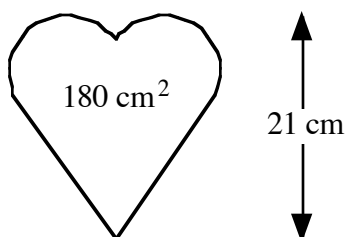
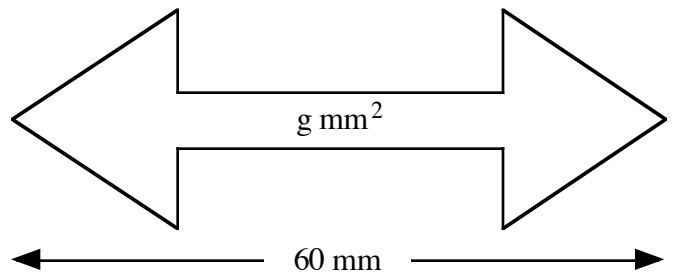
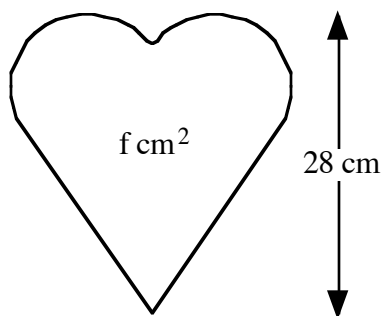
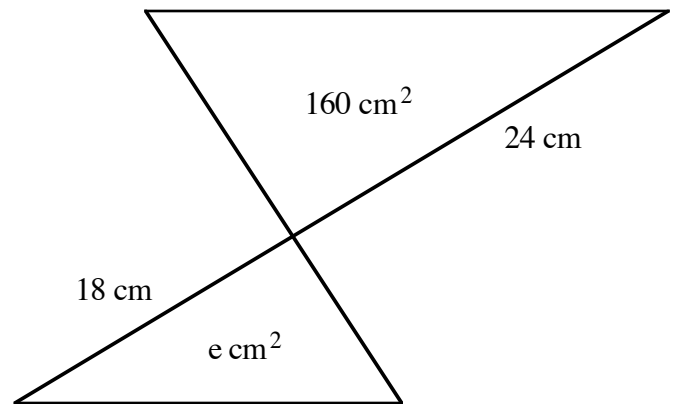
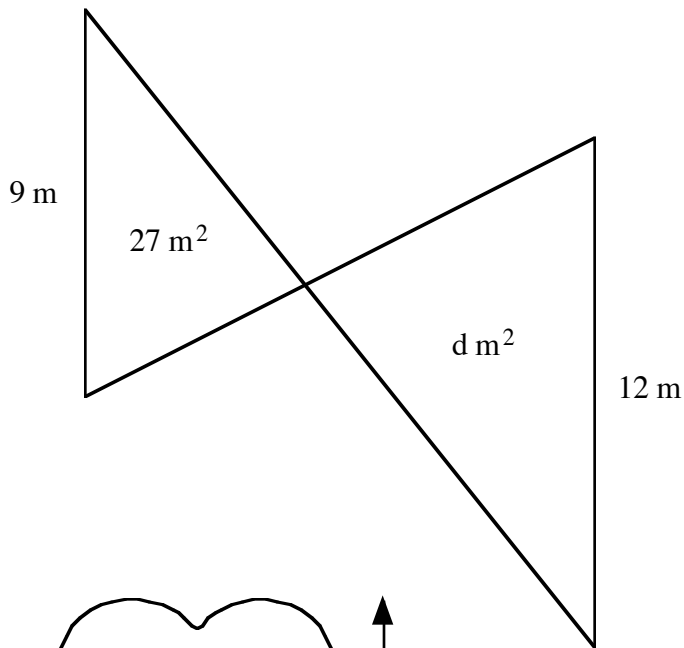
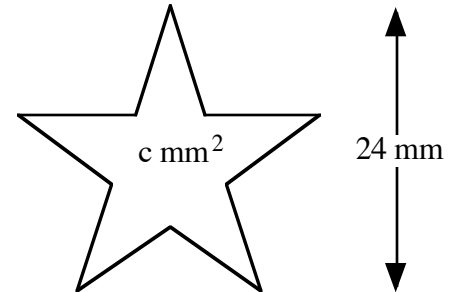
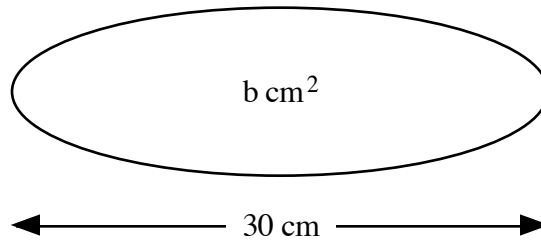
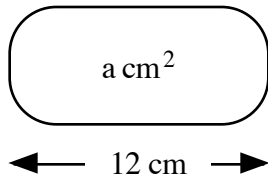
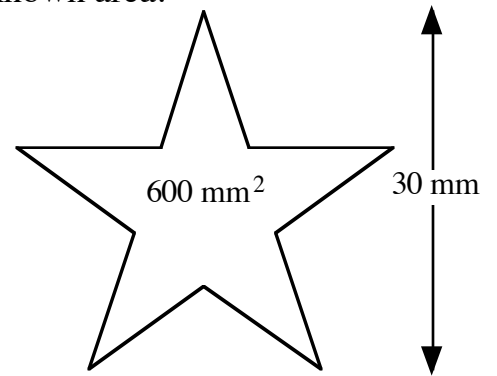
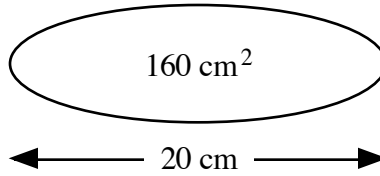
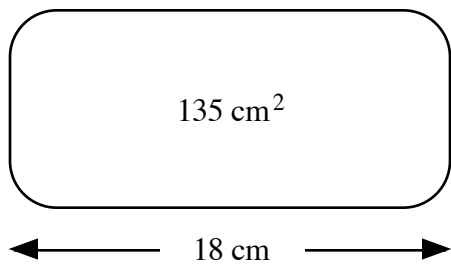
Use **similarity** and **not** Pythagoras' Theorem.

In some diagrams there are two marked angles which are equal.



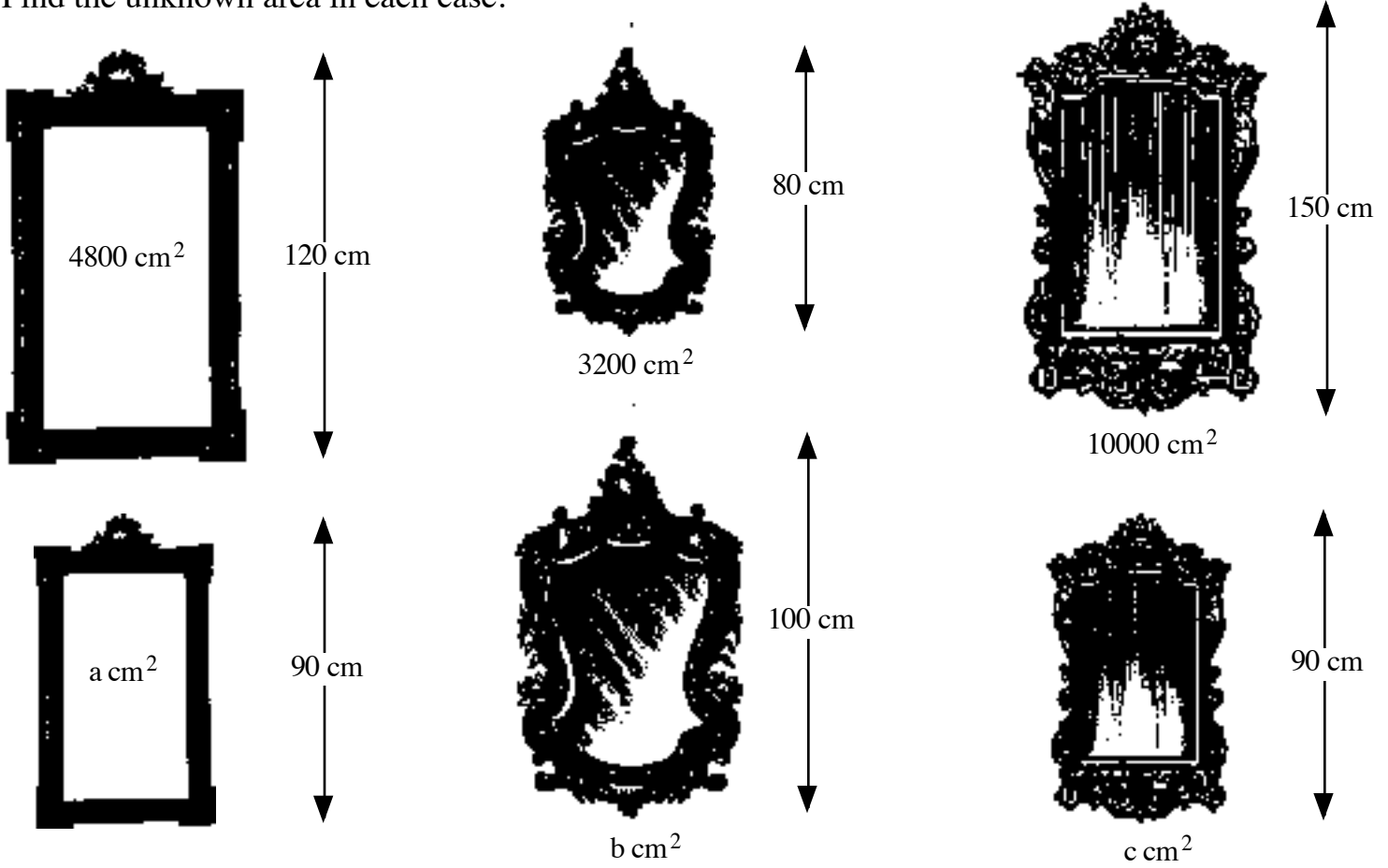
# Similar Shapes: Area

1. In each of the following the pairs of shapes are similar. Find the unknown area.



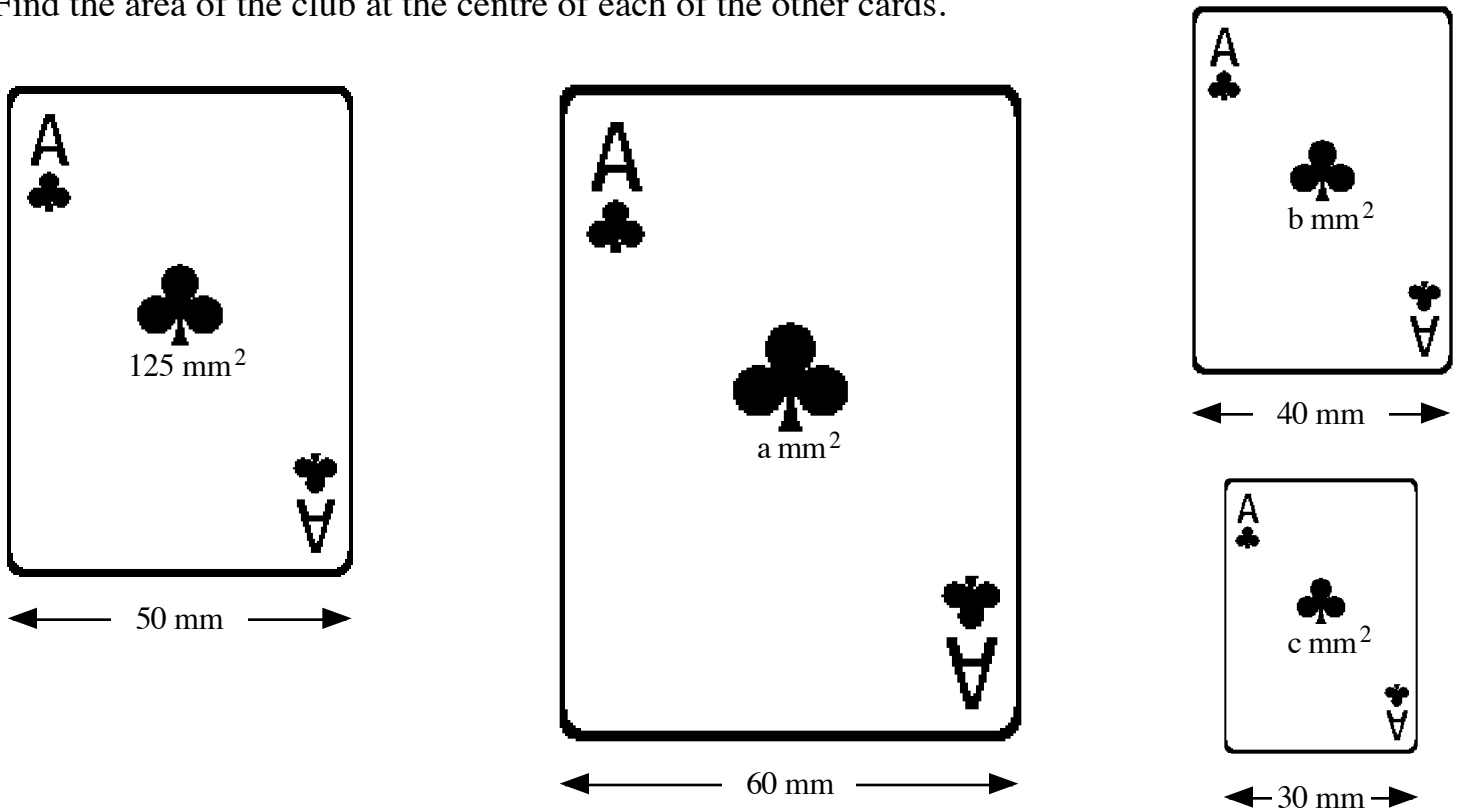
2. In each of the following the pairs of mirrors are similar shapes.

Find the unknown area in each case.

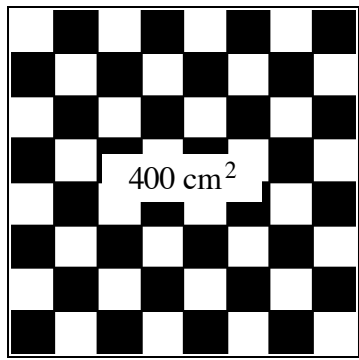


3. In each of the following the cards are similar. The area of the club at the centre is given.

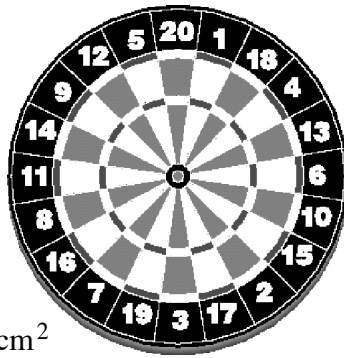
Find the area of the club at the centre of each of the other cards.



4. In each of the following the pairs or triplets of shapes are similar. Find the unknown areas.

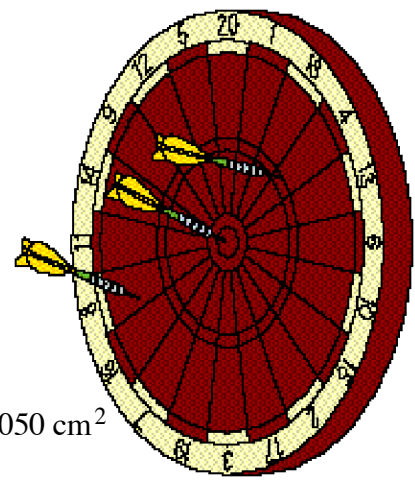


20 cm



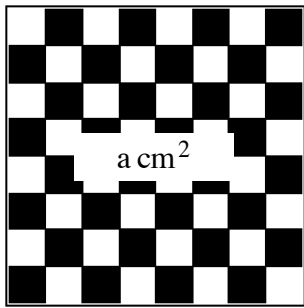
1800 cm<sup>2</sup>

48 cm

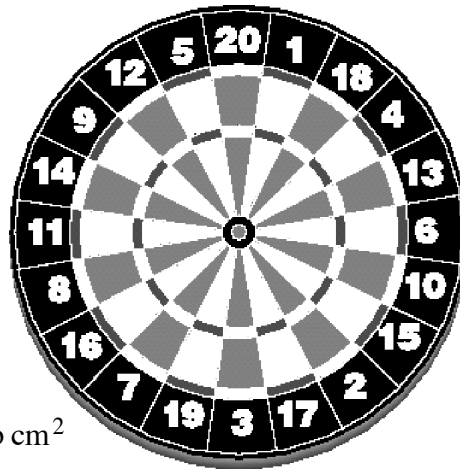


4050 cm<sup>2</sup>

72 cm

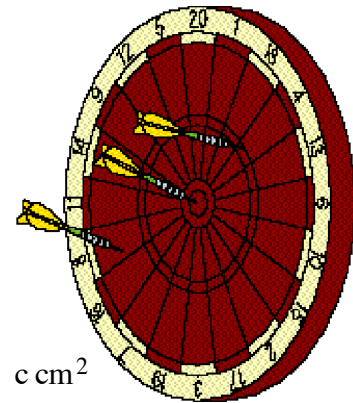


18 cm



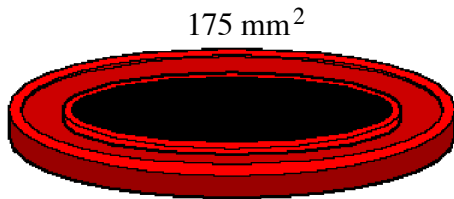
b cm<sup>2</sup>

56 cm



c cm<sup>2</sup>

48 cm



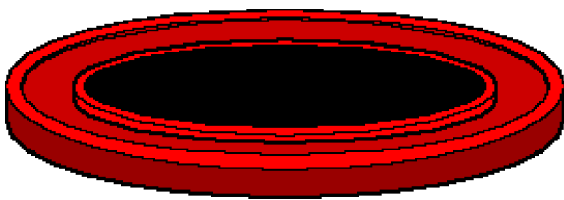
175 mm<sup>2</sup>

15 mm



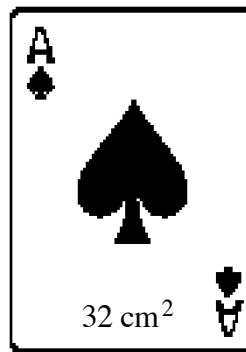
d mm<sup>2</sup>

12 mm



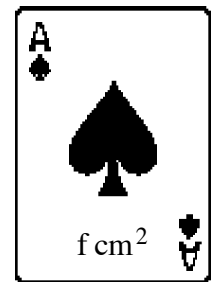
e mm<sup>2</sup>

18 mm



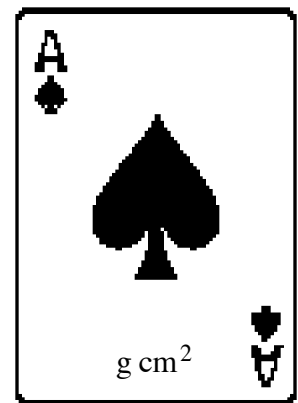
8 cm

32 cm<sup>2</sup>



6 cm

f cm<sup>2</sup>



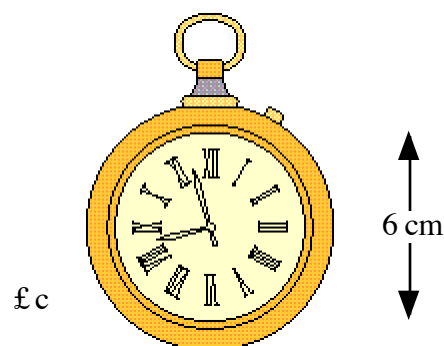
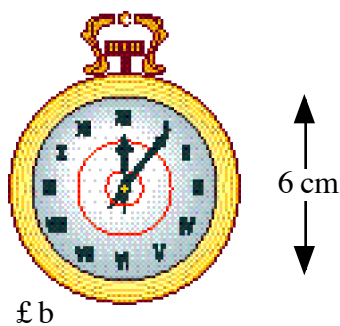
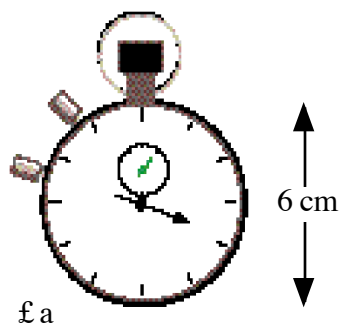
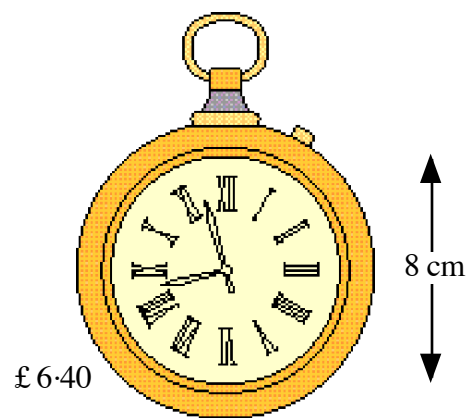
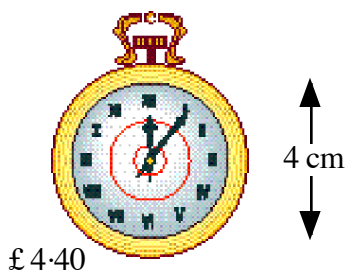
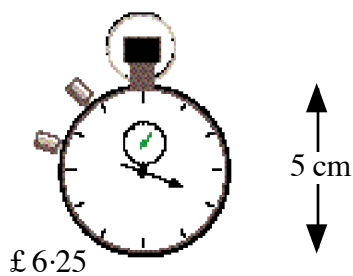
10 cm

g cm<sup>2</sup>



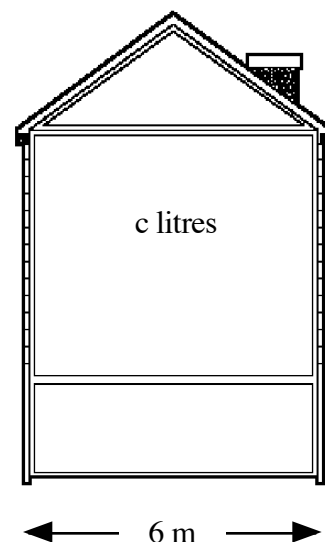
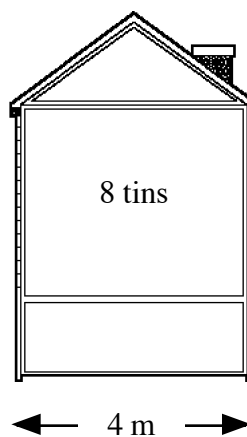
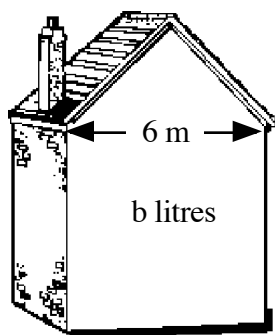
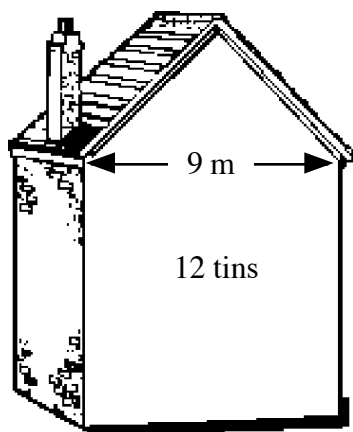
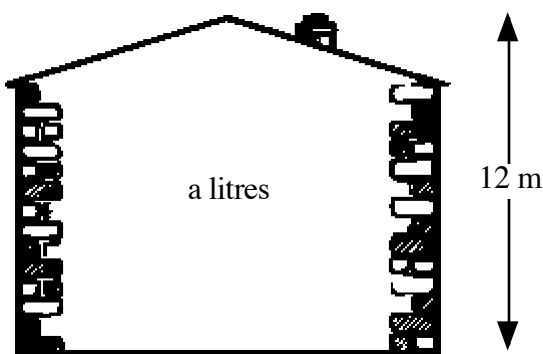
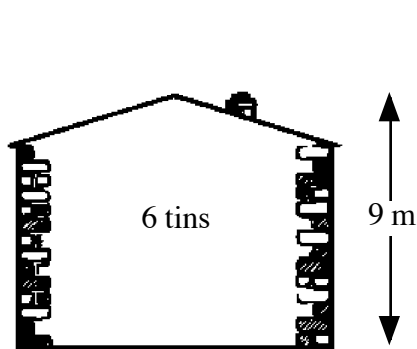
5. In each of the following the pairs of watches are similar. The diameter of each of the faces is given. The watch faces are to be coated with gold paint. The cost depends on the area of the face.

The cost of coating one of the watch faces is given. In each case, find the cost of coating the other watch face.



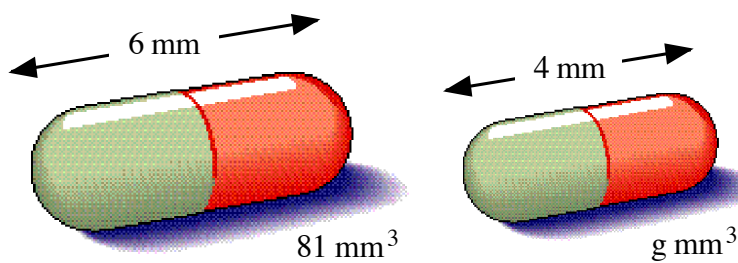
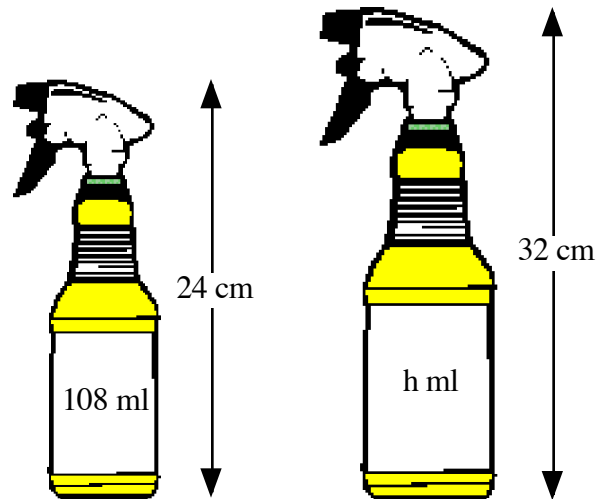
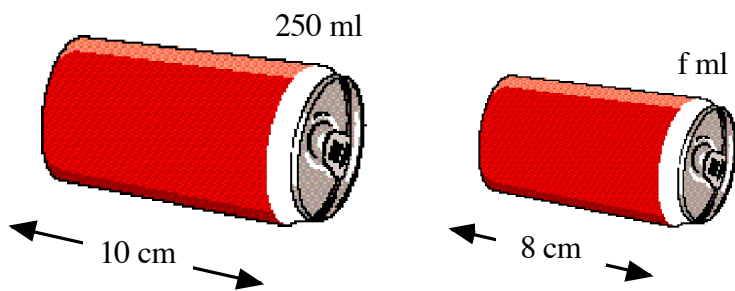
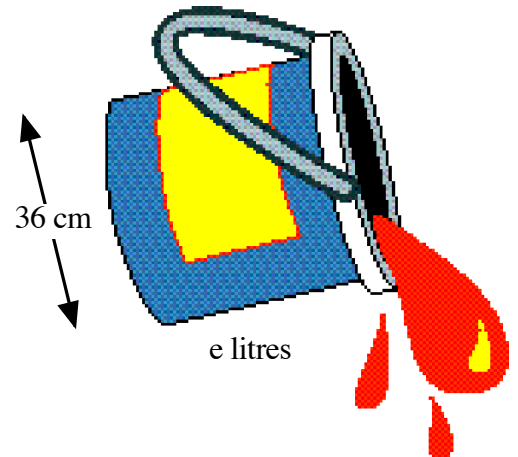
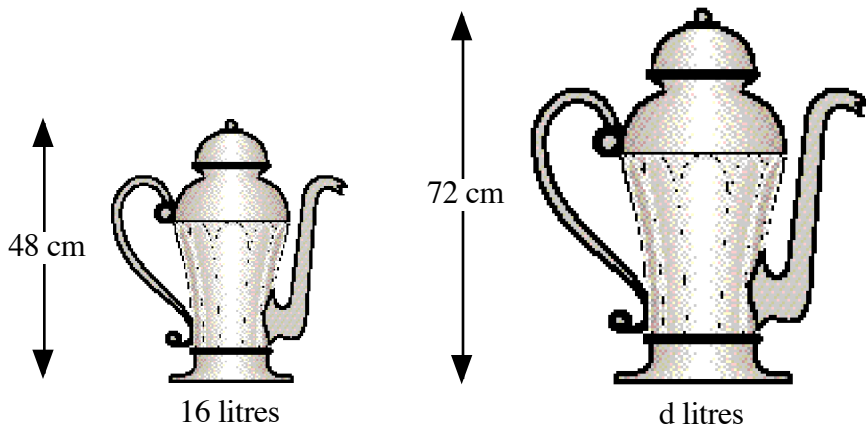
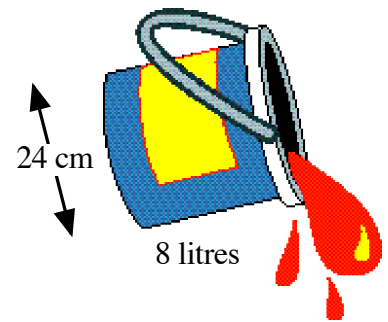
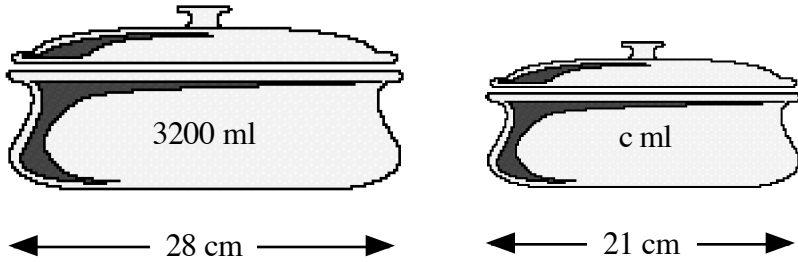
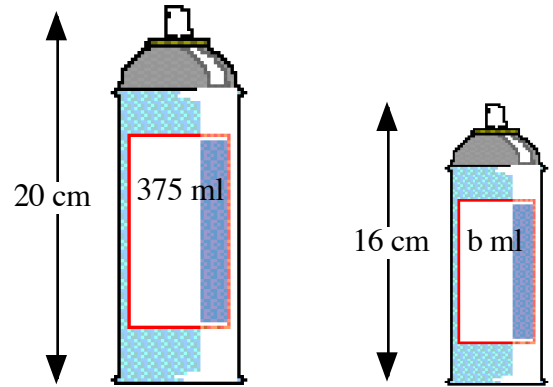
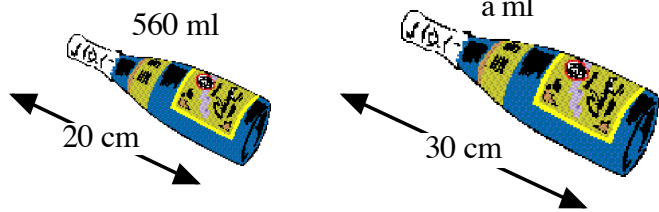
6. The end faces of buildings are shown. In each of the pairs the end faces are similar. The number of **6 litre** tins of paint required to paint one of the end faces is given.

Find the number of **litres** of paint required to paint the other end face.



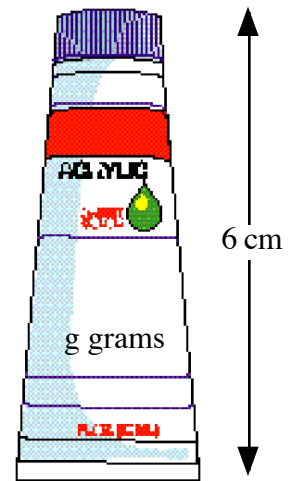
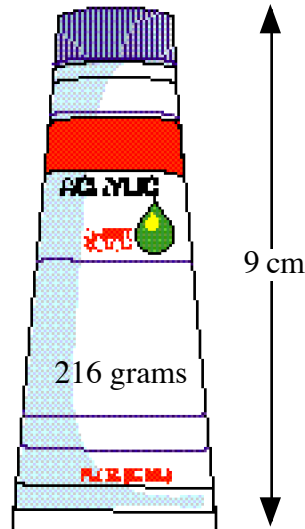
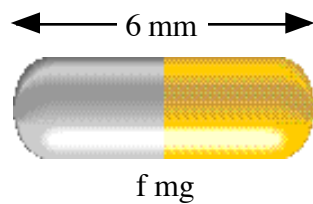
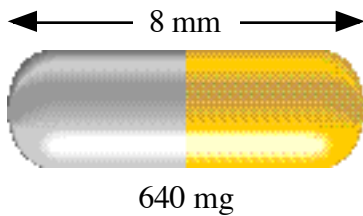
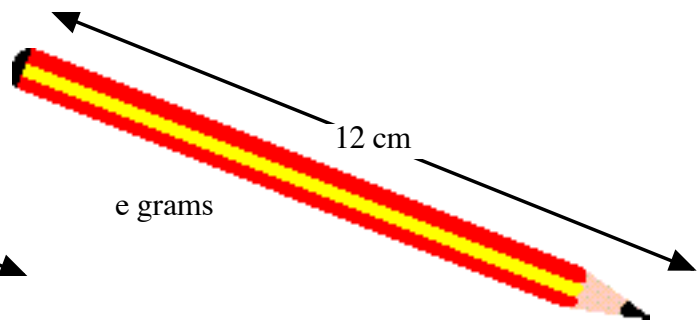
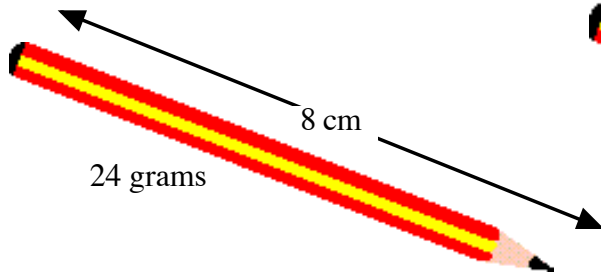
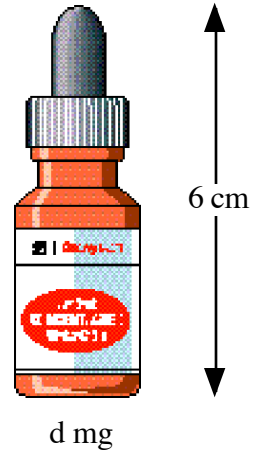
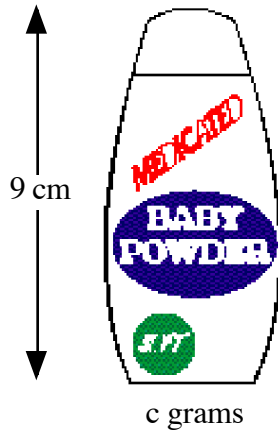
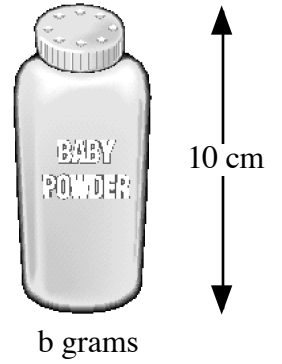
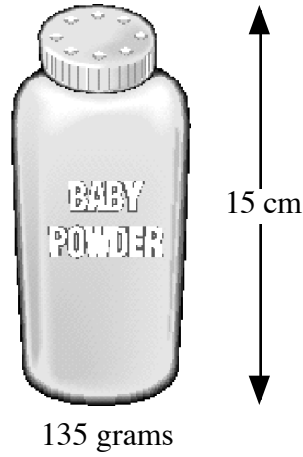
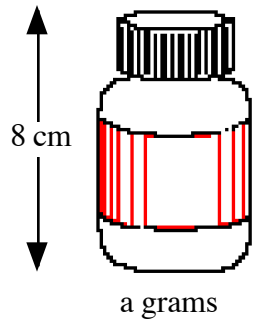
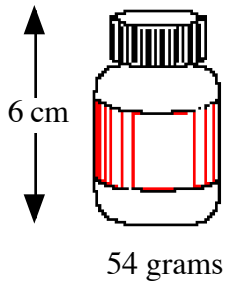
# Similar Shapes: Volume

1. In each of the following the pairs of items are similar.  
Find the unknown volumes.



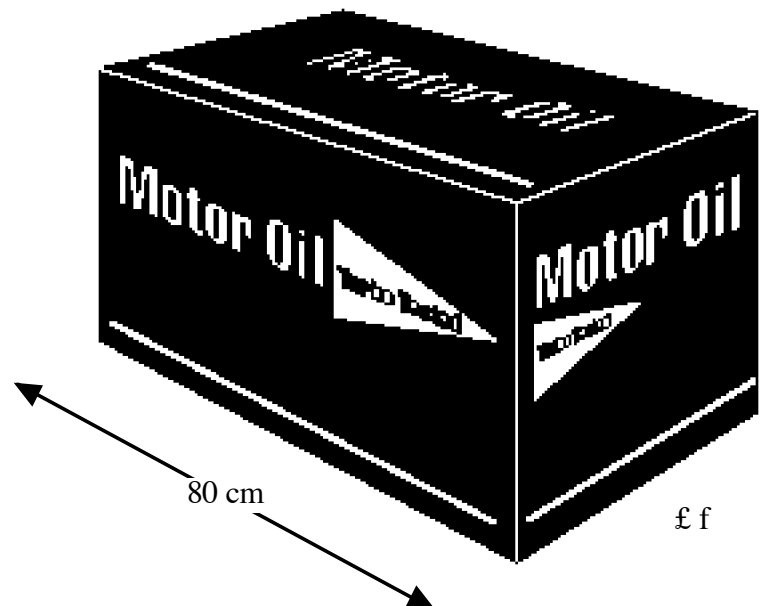
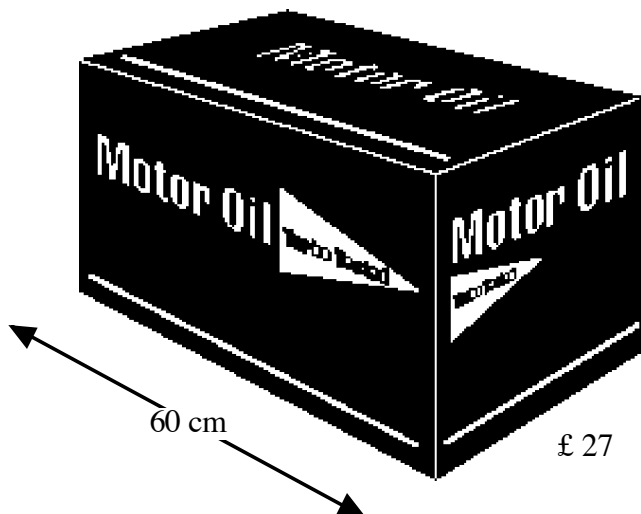
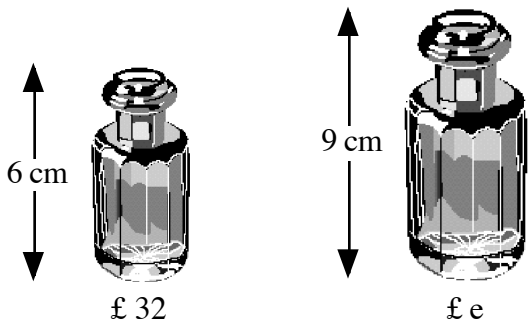
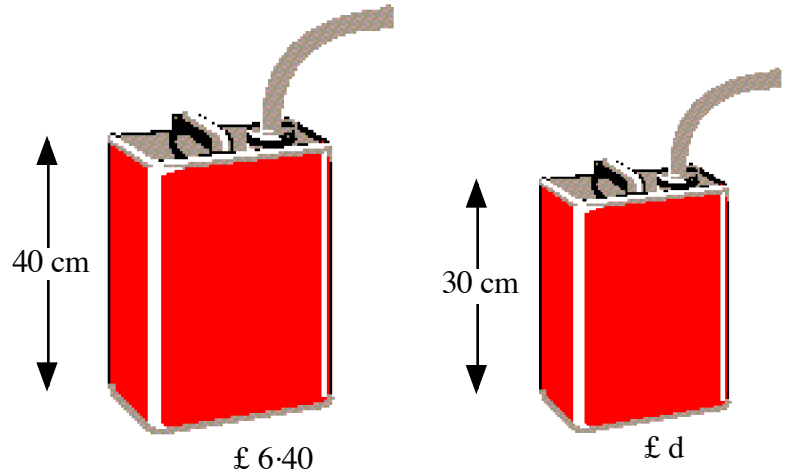
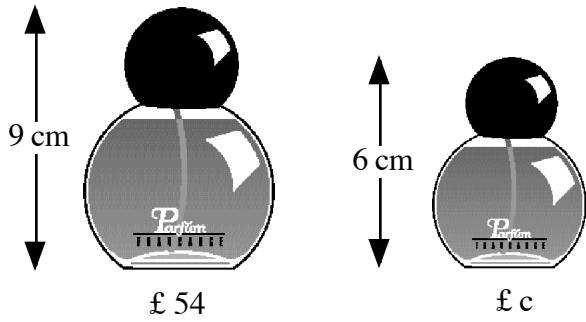
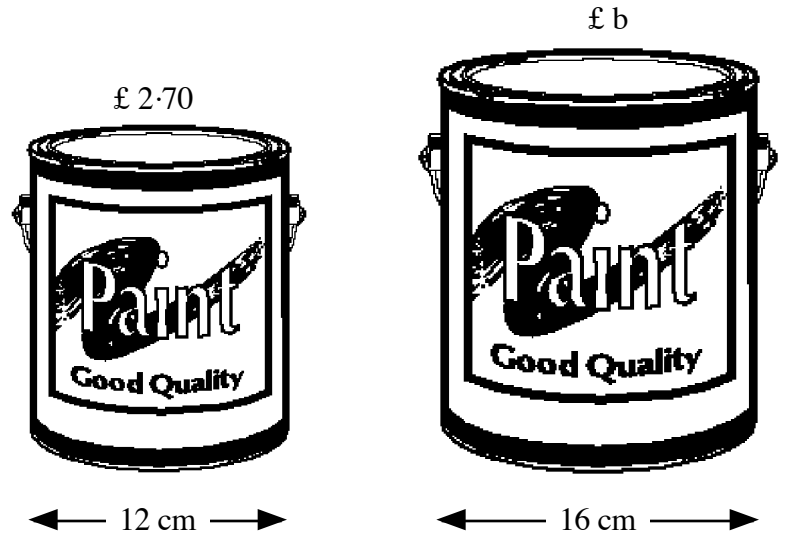
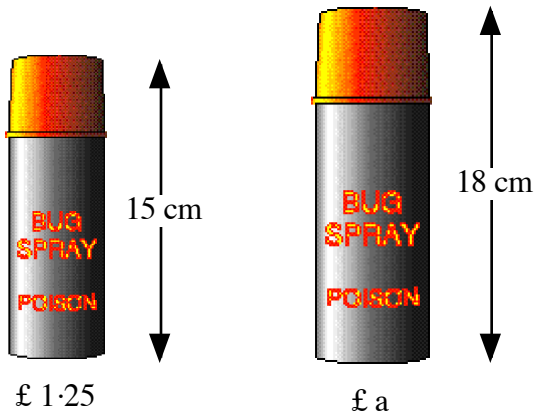
2. In each of the following the pairs of items are similar.  
The mass of the item depends on its volume.

Find the unknown masses.



3. In each of the following the pairs of items are similar.  
The cost of the item depends on the volume.

Find the unknown costs.



# Answers

## Length

1.  $a = 15$      $b = 20$      $c = 12$      $d = 3$      $e = 5.6$      $f = 9.6$      $g = 3.2$
2.  $a = 37.5$      $b = 120$      $c = 72$      $d = 2.4$      $e = 8.1$      $f = 1.8$

## Triangles 1

1.  $a = 9$      $b = 16$      $c = 12$      $d = 4$      $e = 4$      $f = 10$      $g = 12$      $h = 20$      $i = 15$
2.  $a = 15$      $b = 15$      $c = 18$      $d = 14$      $e = 4$      $f = 10$      $g = 15$
3.  $a = 14$      $b = 15$      $c = 20$      $d = 5$      $e = 14$      $f = 16$
4.  $a = 20$      $b = 15$      $c = 15$      $d = 20$      $e = 12$      $f = 21$      $g = 18$      $h = 26$      $i = 39$   
 $j = 30$      $k = 8$      $l = 10$

## Triangles 2

1.  $a = 16$      $b = 11.2$      $c = 1.6$      $d = 3.6$      $e = 2.4$      $f = 18$      $g = 12$      $h = 12.8$      $i = 2.4$
2.  $a = 2$      $b = 9.6$      $c = 12$      $d = 8$      $e = 18$      $f = 4.8$      $g = 12$      $h = 14.4$      $i = 28$
3.  $a = 18$      $b = 16$      $c = 3.52$      $d = 3.2$      $e = 24$      $f = 12$      $g = 35$      $h = 36$      $i = 45$   
 $j = 36$      $k = 12$      $l = 37.5$
4.  $a = 18$      $b = 21$      $c = 32$      $d = 8$      $e = 156$      $f = 144$      $g = 12$      $h = 9$      $i = 80$   
 $j = 4$      $k = 34$      $l = 2$

## Area

1.  $a = 60$      $b = 360$      $c = 384$      $d = 48$      $e = 90$      $f = 320$      $g = 640$
2.  $a = 2700$      $b = 5000$      $c = 3600$
3.  $a = 180$      $b = 80$      $c = 45$
4.  $a = 324$      $b = 2450$      $c = 1800$      $d = 112$      $e = 252$      $f = 18$      $g = 50$
5.  $a = 9$      $b = 9.90$      $c = 3.60$
6.  $a = 64$      $b = 32$      $c = 108$

## Volume

1.  $a = 1890$      $b = 192$      $c = 1350$      $d = 54$      $e = 27$      $f = 128$      $g = 24$      $h = 256$
2.  $a = 128$      $b = 40$      $c = 108$      $d = 8640$      $e = 81$      $f = 270$      $g = 64$
3.  $a = 2.16$      $b = 6.40$      $c = 16$      $d = 2.70$      $e = 108$      $f = 64$