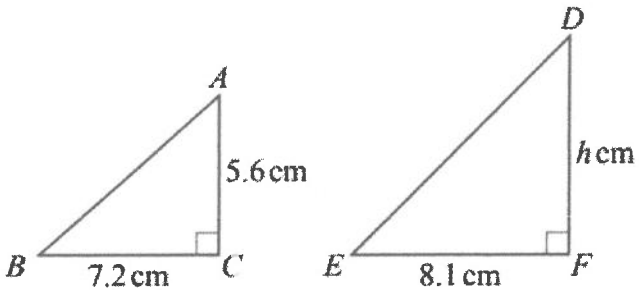
9



NOT TO SCALE

Triangle ABC is similar to triangle DEF.

Calculate the value of h.

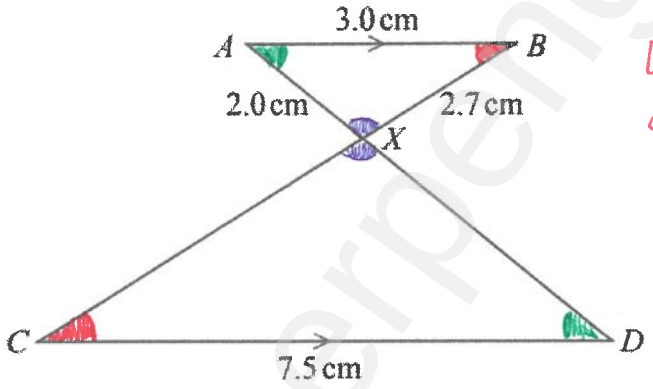
Scale Factor:

$$\frac{8.1}{7.2} = 1.125$$

$$h = 5.6 \times 1.125$$
$$= 6.3\text{cm}$$

$h =$ 6.3 cm [2]

10



Use alternate angles to work out which angles are equal.

NOT TO SCALE

In the diagram, AB and CD are parallel.
The lines CB and AD intersect at X.
$AB = 3.0\,\text{cm}$, $AX = 2.0\,\text{cm}$, $BX = 2.7\,\text{cm}$ and $CD = 7.5\,\text{cm}$.

Find the length of BC.

Scale Factor:

$$\frac{7.5}{3.0} = 2.5$$

XC is similar to XB:

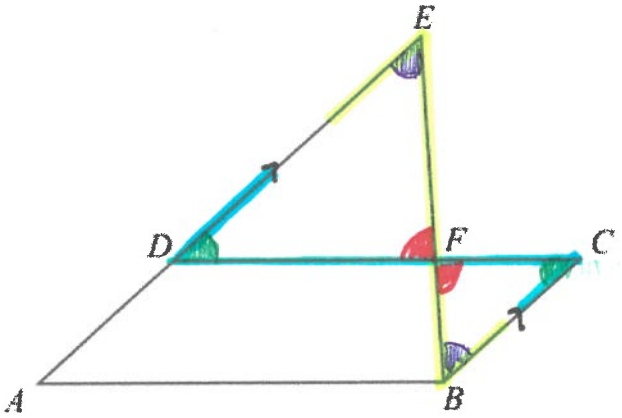
$$XC = 2.7 \times 2.5$$
$$= 6.75$$

BC:

$$BC = BX + XC$$
$$= 2.7 + 6.75$$
$$=$$

$BC =$ 9.45 cm [3]

9



NOT TO SCALE

ABCD is a parallelogram.
EDA and *EFB* are straight lines.

(a) Show that triangles *EDF* and *BCF* are similar.

$D\hat{F}E = C\hat{F}B$ (vertically opposite angles are equal)

$D\hat{E}F = C\hat{B}F$ (alternate angles are equal)

$E\hat{D}F = B\hat{C}F$ (alternate angles are equal)

All 3 angles are equal, therefore EDF and BCF are similar.

[2]

(b) $BC = 4\,\text{cm}$, $DE = 5\,\text{cm}$ and $FB = 3\,\text{cm}$.

Find *EF*.

BC is similar to DE:

Scale Factor $= \frac{5}{4}$

$= 1{\cdot}25$

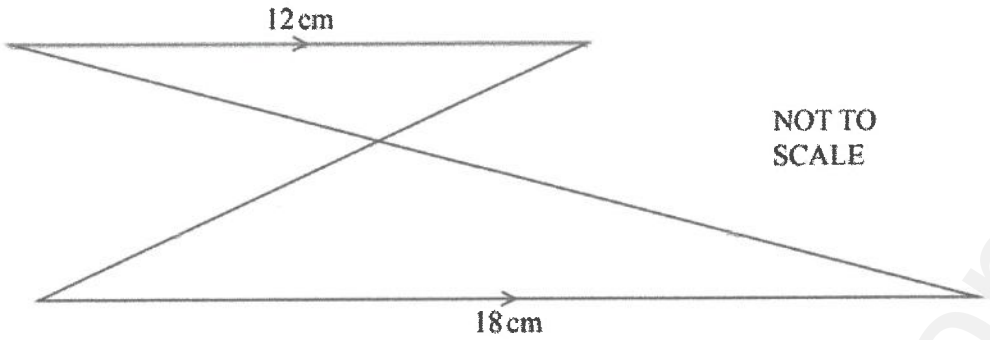
EF is similar to BF:

$EF = 1{\cdot}25 \times 3$

$= 3{\cdot}75$

EF = 3·75 cm [2]

8



The diagram shows two triangles formed by two parallel lines and two intersecting lines.

(a) Use one of these words to complete the statement.

alternate congruent similar cyclic parallel

The triangles are ..Similar.. [1]

(b) The area of the smaller triangle is 24 cm^2.

Calculate the area of the larger triangle.

Linear Scale Factor (LSF):

$LSF = \frac{18}{12}$

$= 1.5$

Area Scale Factor (ASF):

$ASF = 1.5^2$

$= 2.25$

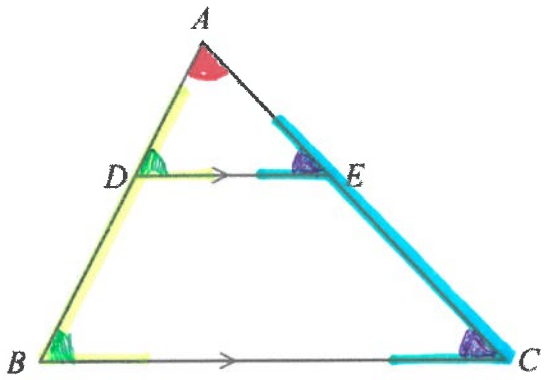
Area of large triangle:

Area : 24×2.25

: 54

..54.. cm^2 [2]

16



NOT TO SCALE

ABC is a triangle.
DE is parallel to BC.

(a) Show that triangle ADE is similar to triangle ABC.

$D\hat{A}E = B\hat{A}E$ (same angle)

$A\hat{D}E = A\hat{B}C$ (corresponding angles are equal)

$A\hat{E}D = A\hat{C}B$ (corresponding angles are equal)

All 3 angles are equal, therefore ADE and ABC are similar.

[2]

(b) $AD : DB = 2 : 3$.

Find the ratio Area of triangle ADE : Area of triangle ABC.

Linear Scale Factor (LSF):

$2 : 3$

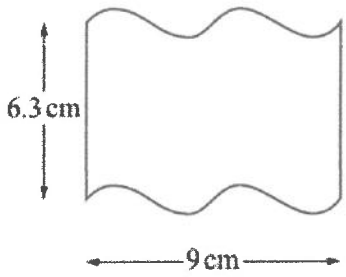
Area Scale Factor (ASF):

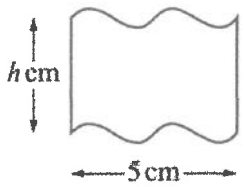
$2^2 : 3^2$

$4 : 9$

4 : 9 [1]

11





NOT TO SCALE

The two shapes are mathematically similar.

(a) Find the value of h.

Scale Factor:

$\frac{9}{5} = 1.8$

$h \times 1.8 = 6.3$

$h = \frac{6.3}{1.8}$

$h =$ 3.5cm [2]

(b) The area of the smaller shape is $16\,cm^2$.

Calculate the area of the larger shape.

LSF: 1.8

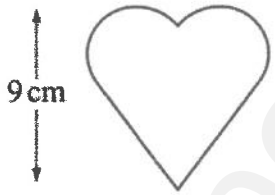
ASF: $1.8^2 = 3.24$

Area of large shape: 16×3.24

$= 51.84$

51.84 cm^2 [2]

25



NOT TO SCALE

The two shapes are mathematically similar.
The area of the larger shape is $36\,cm^2$ and the area of the smaller shape is $25\,cm^2$.
The height of the larger shape is 9 cm and the height of the smaller shape is x cm.

Find the value of x.

Area Scale Factor (ASF):

$\frac{36}{25}$

Linear Scale Factor (LSF):

$\sqrt{\frac{36}{25}} = \frac{6}{5}$

Height of small shape:

$x \times \frac{6}{5} = 9$

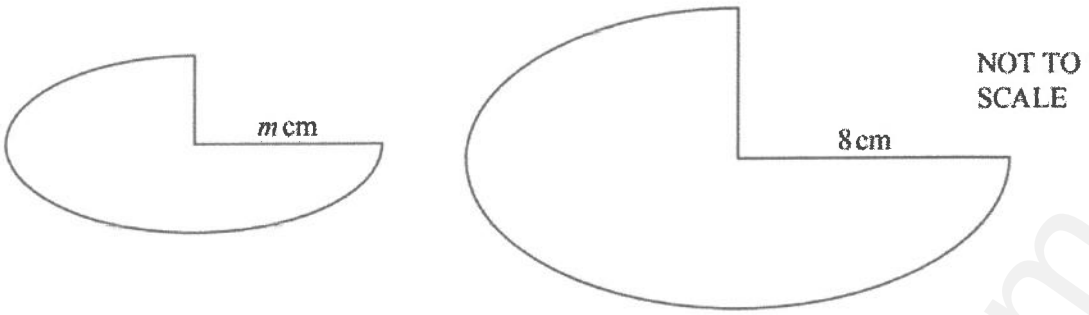
$x = 9 \div \frac{6}{5}$

$= 9 \times \frac{5}{6}$

$= 7.5$

$x =$ 7.5cm [3]

17



The diagram shows two shapes that are mathematically similar.
The smaller shape has area 52.5 cm^2 and the larger shape has area 134.4 cm^2.

Calculate the value of m.

ASF: $\frac{134.4}{52.5} = \frac{64}{25}$

LSF: $\sqrt{\frac{64}{25}} = \frac{8}{5}$

$m \times \frac{8}{5} = 8$

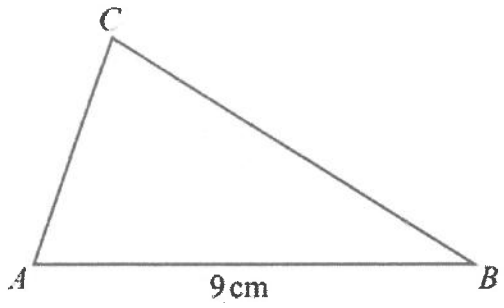
$m = 8 \div \frac{8}{5}$

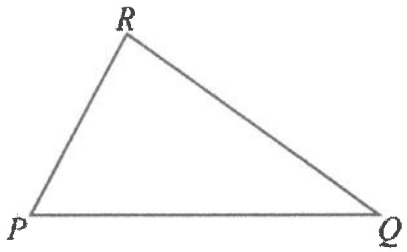
$= 8 \times \frac{5}{8}$

$= 5\,cm$

$m =$ 5cm [3]

12





NOT TO SCALE

Triangle PQR is similar to triangle ABC with $\frac{PR}{AC} = \frac{2}{3}$.

Scale factor from big shape to small shape

$AB = 9$ cm and the area of triangle ABC is 18 cm^2.

(a) Find the length of PQ.

$PQ = 9 \times \frac{2}{3}$

$= 6\text{cm}$

6 ..... cm [1]

(b) Find the area of triangle PQR.

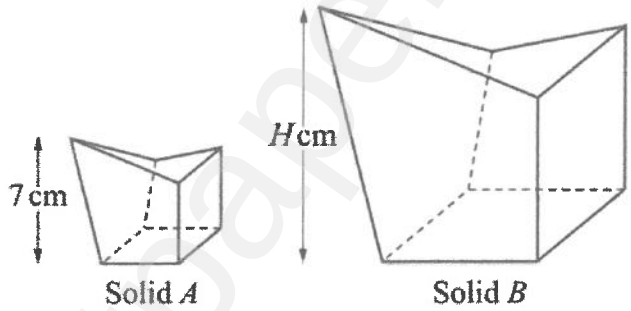
ASF (big to small): $\left(\frac{2}{3}\right)^2 = \frac{4}{9}$

$\text{Area} = 18 \times \frac{4}{9}$

$= 8\text{cm}^2$

8 ..... cm^2 [2]

17 Solid A is mathematically similar to solid B.



NOT TO SCALE

The height of solid A is 7 cm and its surface area is 60 cm^2.
The surface area of solid B is 540 cm^2.

Calculate the height of solid B.

ASF: $\frac{540}{60} = 9$

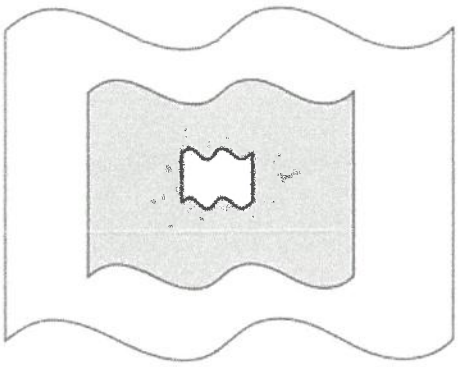
LSF: $\sqrt{9} = 3$

$H = 7 \times 3$

$= 21\text{cm}$

21 ..... cm [3]

15



NOT TO SCALE

The diagram shows three shapes that are mathematically similar.
The heights of the shapes are in the ratio small : medium : large = 1 : 5 : 8.

Find the ratio shaded area : total unshaded area.
Give your answer in its simplest form.

LSF: 1 : 5 : 8

ASF: $1^2 : 5^2 : 8^2$

$= 1 : 25 : 64$

Shaded: 25

Unshaded: $64 + 1 = 65$

shaded : unshaded

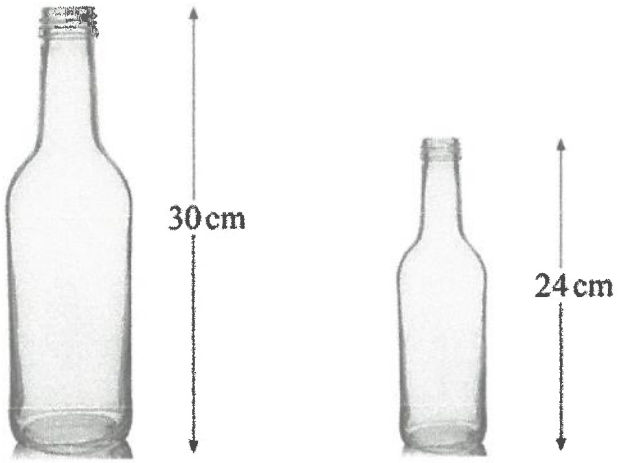
25 : 65

÷5 ↓ ÷5

5 : 13

5 : 13 [4]

9



NOT TO SCALE

The two bottles are mathematically similar.
The height of the large bottle is 30 cm.
The height of the small bottle is 24 cm.
The volume of the large bottle is 250 cm^3.

Calculate the volume of the small bottle.

Linear Scale Factor:

$\frac{30}{24} = \frac{5}{4}$

Volume Scale Factor:

$\left(\frac{5}{4}\right)^3 = \frac{125}{64}$

$V \times \frac{125}{64} = 250$

$V = 250 \div \frac{125}{64}$

$= 250 \times \frac{64}{125}$

= 128 ..... cm^3 [3]

22 The volumes of two mathematically similar objects are 56 cm^3 and 875 cm^3.
The height of the smaller object is 18 cm.

Find the height of the larger object.

Volume Scale Factor:

$\frac{875}{56} = \frac{125}{8}$

Linear Scale Factor:

$\sqrt[3]{\frac{125}{8}} = \frac{5}{2}$

$18 \times \frac{5}{2} = 45\text{ cm}$

45 ..... cm [3]

20 A model of a statue has a height of 4 cm.
The volume of the model is 12 cm^3.
The volume of the statue is 40 500 cm^3.

Calculate the height of the statue.

VSF: $\frac{40\,500}{12} = 3375$

LSF: $\sqrt[3]{3375} = 15$

$4 \times 15 = 60\text{cm}$

60 cm [3]

16 A paperweight has height 4 cm and volume 38.4 cm^3.
A mathematically similar paperweight has height 7 cm.

Calculate the volume of this paperweight.

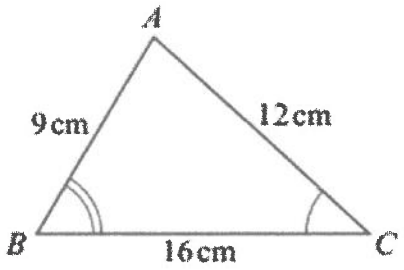
LSF: $\frac{7}{4}$

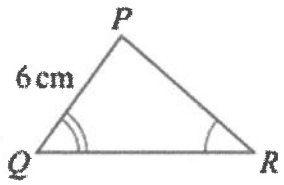
VSF: $\left(\frac{7}{4}\right)^3 = \frac{343}{64}$

$38.4 \times \frac{343}{64} = 205.8$

205.8 cm^3 [3]

13





NOT TO SCALE

Triangle *ABC* and triangle *PQR* are mathematically similar.

(a) Calculate the length of *PR*.

Scale Factor:

$\frac{9}{6} = \frac{3}{2}$

$PR \times \frac{3}{2} = 12$

$PR = 12 \div \frac{3}{2}$

$= 12 \times \frac{2}{3}$

PR = 8 cm [2]

(b) Triangle *ABC* and triangle *PQR* are the cross-sections of two prisms.
These prisms are mathematically similar.
The volume of the smaller prism is 1120 cm^3.

Calculate the volume of the larger prism.

LSF: $\frac{3}{2}$

VSF: $\left(\frac{3}{2}\right)^3 = \frac{27}{8}$

$1120 \times \frac{27}{8} = 3780$

3780 cm^3 [2]

18 Two bottles are mathematically similar.
The small bottle has a capacity of 324 ml and a height of 12 cm.
The large bottle has a capacity of 768 ml.

Calculate the height of the large bottle.

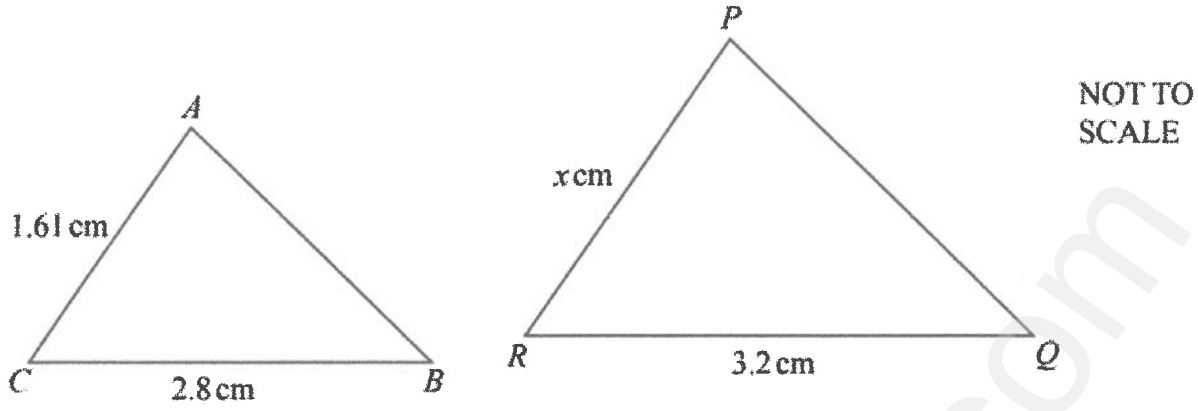
VSF: $\frac{768}{324} = \frac{64}{27}$

LSF: $\sqrt[3]{\frac{64}{27}} = \frac{4}{3}$

$12 \times \frac{4}{3} = 16$ cm

16 cm [3]

20 (a)



NOT TO SCALE

Triangle ABC is mathematically similar to triangle PQR.

Find the value of x.

Scale Factor:

$$\frac{3.2}{2.8} = \frac{8}{7}$$

$$1.61 \times \frac{8}{7} = 1.84 \text{ cm}$$

$x =$ 1.84cm [2]

(b)

NOT TO SCALE

The diagram shows two mathematically similar bowls.
The larger bowl has capacity 7.8 litres and height 11.5 cm.
The smaller bowl has capacity 4 litres.

Calculate the height of the smaller bowl.

Volume Scale Factor:

$$\frac{7.8}{4} = 1.95$$

Linear Scale Factor:

$$\sqrt[3]{1.95}$$

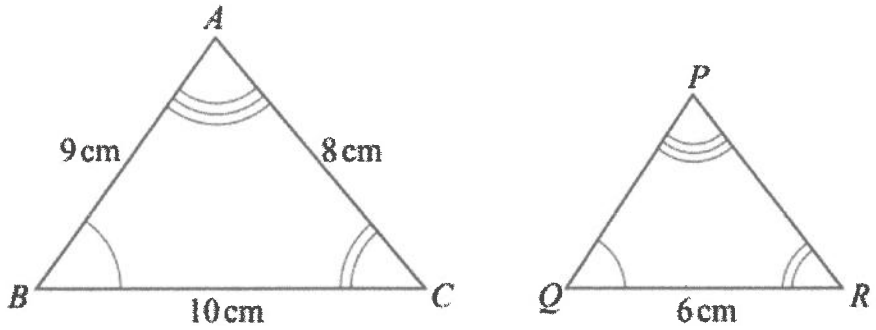
$$h \times \sqrt[3]{1.95} = 11.5$$

$$h = \frac{11.5}{\sqrt[3]{1.95}}$$

$$= 9.20\text{cm}$$

9.20 cm [3]

13



NOT TO SCALE

The diagram shows two similar triangles, ABC and PQR.

(a) Find the length of PR.

Scale Factor:

$\frac{10}{6} = \frac{5}{3}$

$PR \times \frac{5}{3} = 8$

$PR = 8 \div \frac{5}{3}$

$= 8 \times \frac{3}{5}$

$PR =$ 4.8 cm [2]

(b) The triangles are the cross-sections of mathematically similar prisms.
The volume of the larger prism is $500\,cm^3$.

Find the volume of the smaller prism.

LSF: $\frac{5}{3}$

VSF: $\left(\frac{5}{3}\right)^3 = \frac{125}{27}$

$V \times \frac{125}{7} = 500$

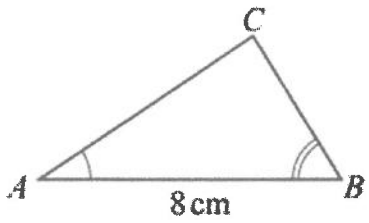
$V = 500 \div \frac{125}{7}$

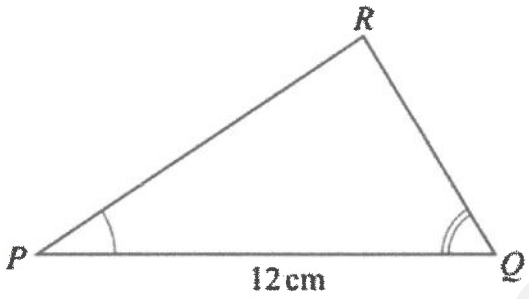
$= 500 \times \frac{7}{125}$

$= 28$

28 cm^3 [2]

8 (a)





NOT TO SCALE

Triangle ABC is mathematically similar to triangle PQR.
The area of triangle ABC is $16\,cm^2$.

(i) Calculate the area of triangle PQR.

LSF: $\frac{12}{8} = \frac{3}{2}$

ASF: $\left(\frac{3}{2}\right)^2 = \frac{9}{4}$

$16 \times \frac{9}{4} = 36 cm^2$

36 ..... cm^2 [2]

(ii) The triangles are the cross-sections of prisms which are also mathematically similar.
The volume of the smaller prism is $320\,cm^3$.

Calculate the length of the larger prism.

LSF: $\frac{3}{2}$

VSF: $\left(\frac{3}{2}\right)^3 = \frac{27}{8}$

Volume of large prism:

$320 \times \frac{27}{8} = 1080$

Volume = cross-section × length

$1080 = 36 \times$ length

length $= \frac{1080}{36}$

$= 30 cm$

30 ..... cm [3]

(b) A bronze statue is 4.5 m high and has a mass of 195 200 kg.
The density of bronze is 8000 kg/m^3.
The volume of a mathematically similar model of the statue is 0.385 m^3.

Calculate the height of the model.
[Density = Mass ÷ Volume]

Volume of Statue:

$$\text{Volume} = \frac{\text{mass}}{\text{density}}$$

$$= \frac{195\,200}{8000}$$

$$= 24.4 \text{ m}^3$$

VSF: $\frac{24.4}{0.385} = \frac{4880}{77}$

LSF: $\sqrt[3]{\frac{4880}{77}}$

Height: $h \times \sqrt[3]{\frac{4880}{77}} = 4.5$

$h = 4.5 \div \sqrt[3]{\frac{4880}{77}}$

$= 1.13$ ..... m [5]

18 Two solids are mathematically similar and have volumes 81 cm^3 and 24 cm^3.
The surface area of the smaller solid is 44 cm^2.

Calculate the surface area of the larger solid.

VSF: $\frac{81}{24} = \frac{27}{8}$

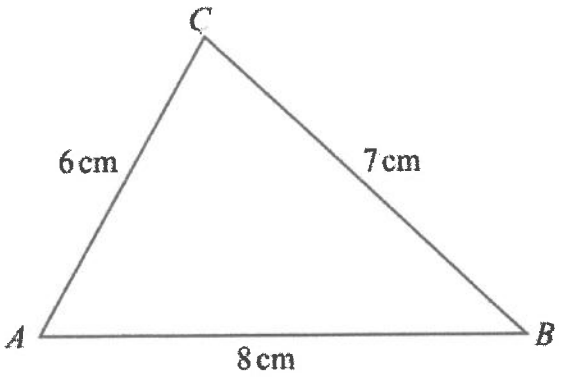
LSF: $\sqrt[3]{\frac{27}{8}} = \frac{3}{2}$

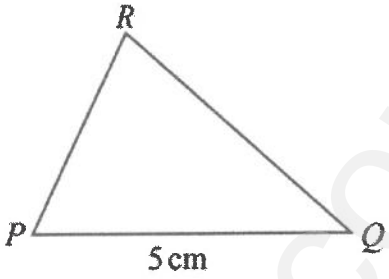
ASF: $\left(\frac{3}{2}\right)^2 = \frac{9}{4}$

$44 \times \frac{9}{4} = 99 \text{ cm}^2$

99 ..... cm^2 [3]

10 (a)





NOT TO SCALE

Triangle PQR is similar to triangle ABC.

Work out the length of PR.

Scale Factor: $\frac{8}{5}$

$PR \times \frac{8}{5} = 6$

$PR = 6 \div \frac{8}{5}$

$= 6 \times \frac{5}{8}$

$PR =$ 3·75 cm [2]

(b) Two mathematically similar containers have capacities of 27 litres and 8 litres.
The surface area of the smaller container is $1600\,cm^2$.

Work out the surface area of the larger container.

VSF: $\frac{27}{8}$

LSF: $\sqrt[3]{\frac{27}{8}} = \frac{3}{2}$

ASF: $\left(\frac{3}{2}\right)^2 = \frac{9}{4}$

$1600 \times \frac{9}{4} = 3600\,cm^2$

3600 cm^2 [3]