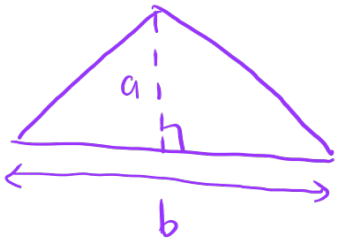
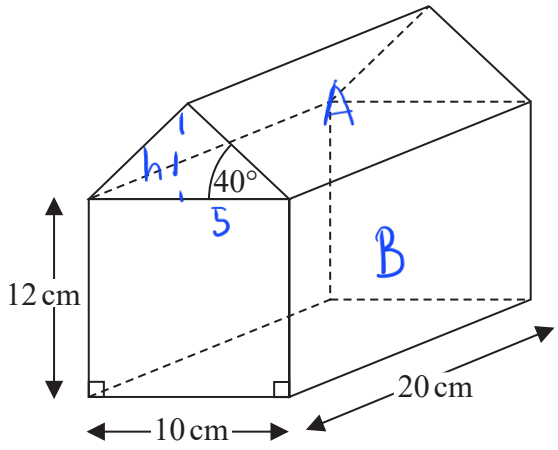
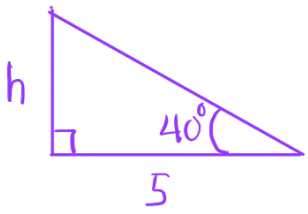
**1** The diagram shows a prism.

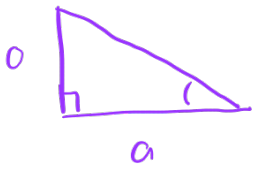



Area $= \frac{1}{2}ab$




$\tan\theta = \frac{O}{A}$




The cross section of the prism has exactly one line of symmetry.

Work out the volume of the prism.
Give your answer correct to 3 significant figures.

Height of triangle $= h = 5\tan 40^\circ$ (1)

$= 4.195$ cm (1)

Cross section of triangle x height

Volume of A $= \left(\frac{1}{2} \times (5+5) \times 4.195\right) \times (20)$

$= \frac{1}{2} \times 10 \times 4.195 \times 20$

$= 419.5\ cm^3$ (1)

Volume of B $= 12 \times 10 \times 20$

$= 2400\ cm^3$ (1)

Total volume $= 419.5 + 2400$

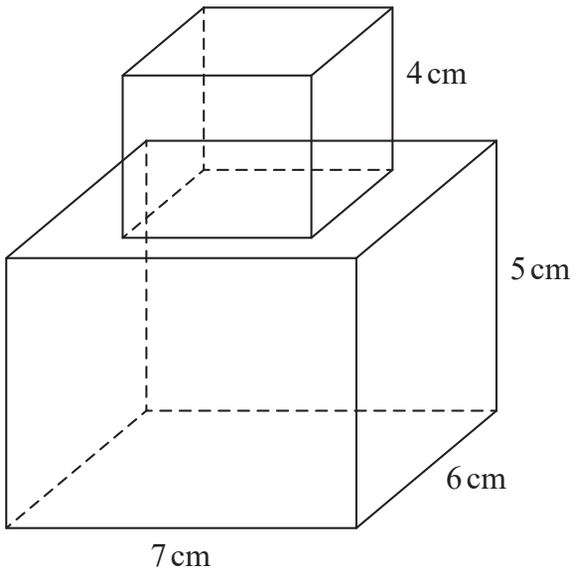
$= 2819.5\ cm^3$

$= 2820\ cm^3$ (3 s.f.) 2820 (1)

..... cm³

**(Total for Question 1 is 5 marks)**

**2** A cube is placed on top of a cuboid, as shown in the diagram, to form a solid.



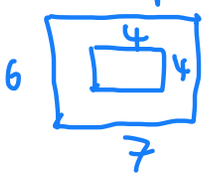

The cube has edges of length 4 cm.
The cuboid has dimensions 7 cm by 6 cm by 5 cm.

Work out the total surface area of the solid.

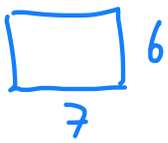
Split into 2 shapes

Cuboid:

top




bottom




sides




front / back




✓ (1)

$7 \times 6 - 4 \times 4 + 6 \times 7 + 2 \times 6 \times 5 + 2 \times 7 \times 5$

$42 - 16 + 42 + 60 + 70$

$= 198$ ✓

Cube: top + sides + front + back

$4^2 + 2 \times 4^2 + 2 \times 4^2$

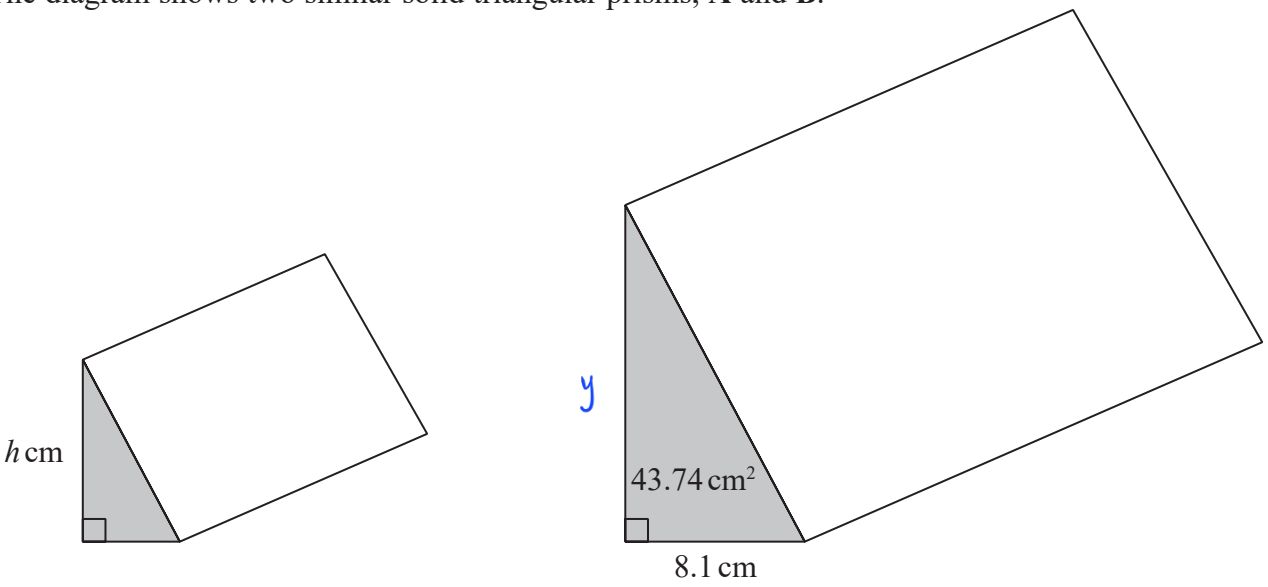
$= 80$ ✓ (1)

Total $= 198 + 80 = 278$ ✓ (1)

278 ..... $cm^2$

**(Total for Question 2 is 3 marks)**

**3** The diagram shows two similar solid triangular prisms, **A** and **B**.




Prism **A** Prism **B**

The volume of prism **A** is 58.806 cm³
The volume of prism **B** is 1587.762 cm³

The cross section of each prism is a right-angled triangle.

For prism **B**
the length of the base of the triangle is 8.1 cm
the area of the triangle is 43.74 cm²

The height of the triangle for prism **A** is $h$ cm.

Work out the value of $h$.

Finding the scale factor of B over A

$$\text{scale factor} = \frac{1587.762}{58.806} = 27 \quad (1)$$

Finding height y :

$$\text{Area} = \frac{1}{2} \times b \times y$$

$$43.74 = \frac{1}{2} \times 8.1 \times y$$

$$y = \frac{43.74 \times 2}{8.1} = 10.8 \text{ cm} \quad (1)$$

because 27 is VOLUME scale factor, for length we use linear scale factor which is cube root for volume scale factor

Finding the value of h :

Compare y to h with scale factor of $\sqrt[3]{27}$

$$h = \frac{y}{\sqrt[3]{27}} = \frac{10.8}{3} = 3.6 \quad (1)$$

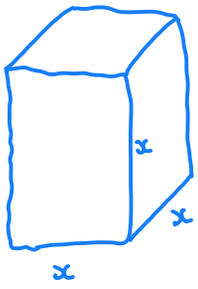
$h =$ 3.6 (1)

**(Total for Question 3 is 4 marks)**

**4** A cube has a total surface area of $150\,cm^2$

Work out the volume of the cube.

diagram




Surface area = 150

6 x area of one face = 150

area of one face = 25 ✓(1)

$x^2 = 25$ so $x = \sqrt{25} = 5$ ✓(1)

length 'x' = 5 cm

volume of cube = length$^3$ ✓(1)

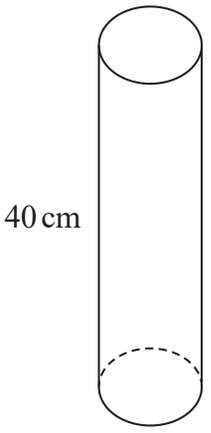
$= 5^3 = 125$

✓(1)

125 ..... $cm^3$

**(Total for Question 4 is 4 marks)**

**5** The diagram shows a solid cylinder on a horizontal floor.




$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

The cylinder has a

volume of $1200\,\text{cm}^3$
height of 40 cm.

The cylinder exerts a force of 90 newtons on the floor.

Work out the pressure on the floor due to the cylinder.

already know the force, just need area




volume = 1200

cross sectional area × height = 1200

area $\pi r^2$ × 40 = 1200

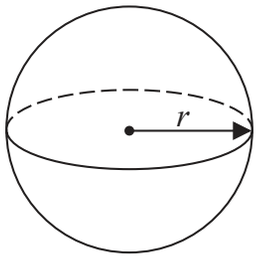
area $\pi r^2$ = 30 $cm^2$ ✓(1)

Pressure = $\frac{\text{Force}}{\text{Area}} = \frac{90\text{ N}}{30\text{ cm}^2}$ ✓(1) = 3 N / $cm^2$

3 ✓(1) ..... newtons/$cm^2$

**(Total for Question 5 is 3 marks)**

**6** Here is a sphere.




Surface area of sphere = $4\pi r^2$

$\frac{3}{8}$ of the surface area of this sphere is $75\pi\,\text{cm}^2$

Find the diameter of the sphere.
Give your answer in the form $a\sqrt{b}$ where $a$ is an integer and $b$ is a prime number.

$\frac{3}{8}$ of surface area $= 75\pi$
$\div 3$ $\div 3$

$\frac{1}{8}$ of surface area $= 25\pi$
$\times 8$ $\times 8$

Whole surface area $= 200\pi$ ✓(1)

$4\pi r^2 = 200\pi$
cancel $\pi$'s and divide by 4
$r^2 = 50$ ✓(1) so $r = \sqrt{50}$ ✓(1)

diameter $= 2r = 2\sqrt{50}$ or $2\sqrt{25\times 2} = 10\sqrt{2}$

✓(1)
$10\sqrt{2}$ ..... cm

**(Total for Question 6 is 4 marks)**

**7** A solid cuboid is made of metal.

The metal has a density of $9\,g/cm^3$
The volume of the cuboid is $72\,cm^3$

Work out the mass of the cuboid.

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

mass = density × volume

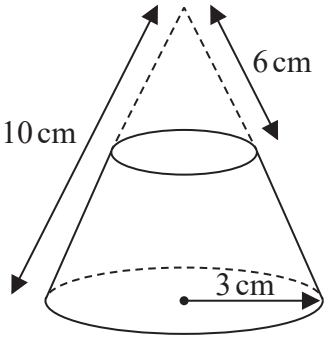
= $9\ gcm^{-3} \times 72\ cm^3$ (1)

= 648 g (1)

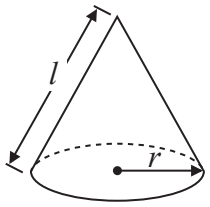
648 ..... g

**(Total for Question 7 is 2 marks)**

**8** A solid frustum is made by removing a small cone from a large cone as shown in the diagram.




Curved surface area of cone = $\pi rl$




The slant height of the small cone is 6 cm.
The slant height of the large cone is 10 cm.
The radius of the base of the large cone is 3 cm.

Calculate the total surface area of the frustum.
Give your answer correct to 3 significant figures.

Finding scale factor of small cone to large cone :

$\frac{6}{10} = 0.6$

Finding radius of small cone :

$0.6 \times 3 \text{ cm} = 1.8 \text{ cm}$ (1)

Finding surface area of whole cone :

$\pi r^2 + \pi r l = \pi(3)^2 + \pi(3)(10) = 39\pi \text{ cm}^2$
(1) (1)

Finding surface area of small cone (curved):

$\pi r l = \pi(1.8)(6) = 10.8\pi \text{ cm}^2$

Finding surface area of small cone (base):

$\pi r^2 = \pi(1.8)^2 = 3.24\pi \text{ cm}^2$

Finding total surface area of frustrum :

$39\pi - 10.8\pi + 3.24\pi$ (1)

$= 31.44\pi = 98.8 \text{ cm}^2$ (1)

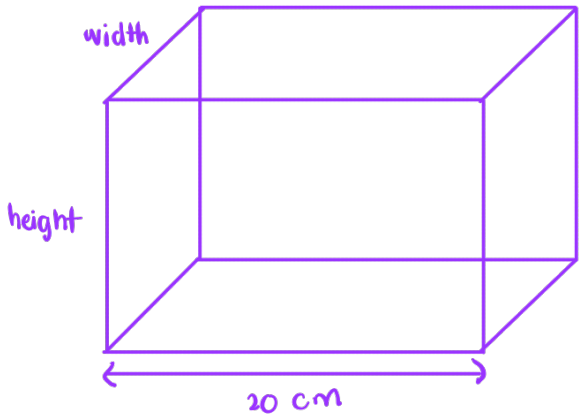
98.8 ..... $\text{cm}^2$

**(Total for Question 8 is 5 marks)**

**9** A solid cuboid has a volume of $300\,cm^3$
The cuboid has a total surface area of $370\,cm^2$

The length of the cuboid is 20 cm.
The width of the cuboid is greater than the height of the cuboid.

Work out the height of the cuboid.
You must show all your working.




volume = length × width × height

$300\ cm^3 = 20\ cm \times width \times height$

$width \times height = \frac{300\ cm^3}{20\ cm} = 15\ cm^2$ (1) — (1)

Total surface area = 2 × (20 × height) + 2 × (20 × width) + 2 (width × height)

$370\ cm^2 = 2\left[(20 \times height) + (20 \times width) + (width \times height)\right]$ (1)

$\frac{370\ cm^2}{2} = (20 \times (width + height)) + 15\ cm^2$

$20\,(w+h) = 185 - 15$

$= 170$

$w+h = \frac{170}{20} = 8.5$

$w = 8.5 - h$ — (2)

(2) into (1) ← eliminating w

$(8.5 - h)\,h = 15$ (1)

$h^2 - 8.5h + 15 = 0$

$(h - 2.5)(h - 6) = 0$ (1)

$h = 2.5$ or $h = 6$

since $w \times h = 15\ cm^2$,

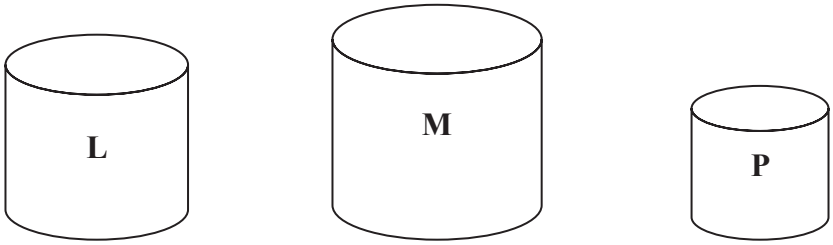
$h \neq 6$ because that would mean $h > w$.

Hence, $h = 2.5$ (1)

2.5 ..... cm

**(Total for Question 9 is 5 marks)**

**10** **L**, **M** and **P** are three similar solid cylinders made from the same material.




**L** has a mass of 64 g
**M** has a mass of 125 g

**M** has a total surface area of 144 $cm^2$
**P** has a total surface area of 16 $cm^2$

since ratio of volumes L : M is 64 : 125, the ratio of height is the cube root of each

Work out

height of cylinder **L** : height of cylinder **M** : height of cylinder **P**

Ratio of height L : M

: 4 : 5 (1)

Height L : $\sqrt[3]{64}$ : 4 cm

Height M : $\sqrt[3]{125}$ : 5 cm

Ratio of height M : P

(÷4) 12 : 4 (÷4)

3 : 1 (1)

Height M : $\sqrt{144}$ = 12 cm

Height P : $\sqrt{16}$ = 4 cm

since ratio of area M : P is 144 : 16, the ratio of height is the square root of each

Ratio of height L : M : P

3 x 4 : 5 x 3

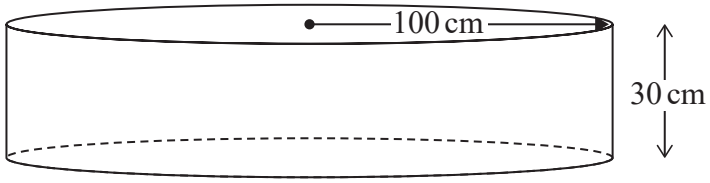
5 x 3 : 1 x 5 (1)

12 : 15 : 5 (1)

12 : 15 : 5

**(Total for Question 10 is 4 marks)**

**11** A paddling pool is in the shape of a cylinder.




The pool has radius 100 cm.
The pool has depth 30 cm.

The pool is empty.
It is then filled with water at a rate of 250 $cm^3$ per second.

Work out the number of minutes it takes to fill the pool completely.
Give your answer correct to the nearest minute.
You must show all your working.

Volume of pool = $\pi r^2 h$ → same as a cylinder

$= \pi \times (100)^2 \times (30)$ $r = 100$, $h = 30$

$= 300\,000\,\pi\ cm^3$ (1)

Rate = $250\ cm^3/s$

$\text{Rate} = \frac{\text{Volume}}{\text{Time}}$

$250 = \frac{300\,000\,\pi}{\text{Time}}$

$\text{Time} = \frac{300\,000\,\pi}{250}$

$= 3769.9\ldots$ seconds (1)

$= 3769.9\ldots \div 60$ (1)

$= 62.83\ldots$ minutes

$\approx 63$ minutes

nearest minutes

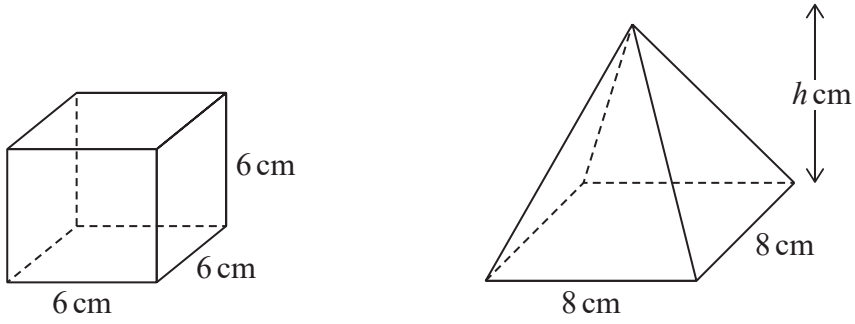
1 minute = 60 seconds

63 (1)

..... minutes

**(Total for Question 11 is 4 marks)**

**12** The diagram shows a cube and a square-based pyramid.




The volume of the cube is equal to the volume of the pyramid.

Work out the perpendicular height, $h$ cm, of the pyramid.

Volume of cube = $l^3$

Volume of pyramid = $\frac{1}{3} l^2 h$

Volume of cube = Volume of pyramid

$6 \times 6 \times 6 = \frac{1}{3} \times (8 \times 8) \times h$

(1) $216 = \frac{64}{3} h$

$h = \frac{216 \times 3}{64}$ (1)

$h = 10.125$ (1)

10.125 ..... cm

**(Total for Question 12 is 3 marks)**