4.5 Surface Area and Volume of Shapes

Mr Faruk
Teacher of Mathematics
BSc/MSc/PGCE Mathematics
cieigcsesolutions@gmail.com

11 The diagram shows a solid prism.

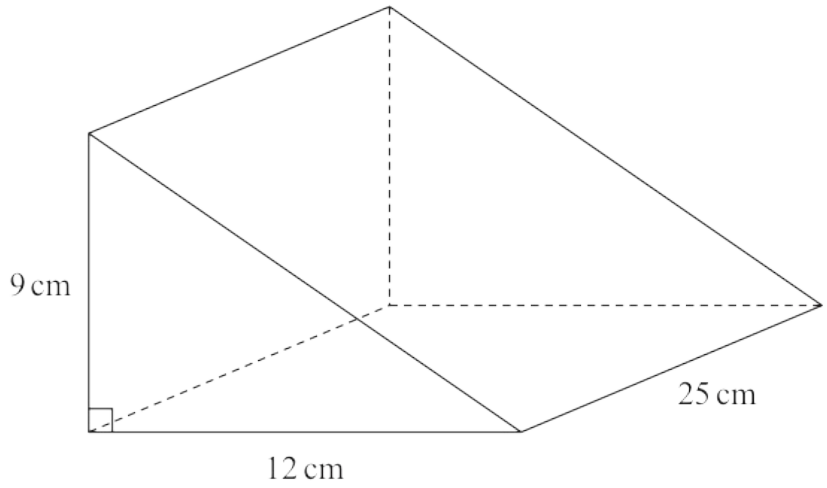


Diagram **NOT** accurately drawn

Work out the volume of the prism.

..... cm^3

(Total for Question 11 is 3 marks)

11

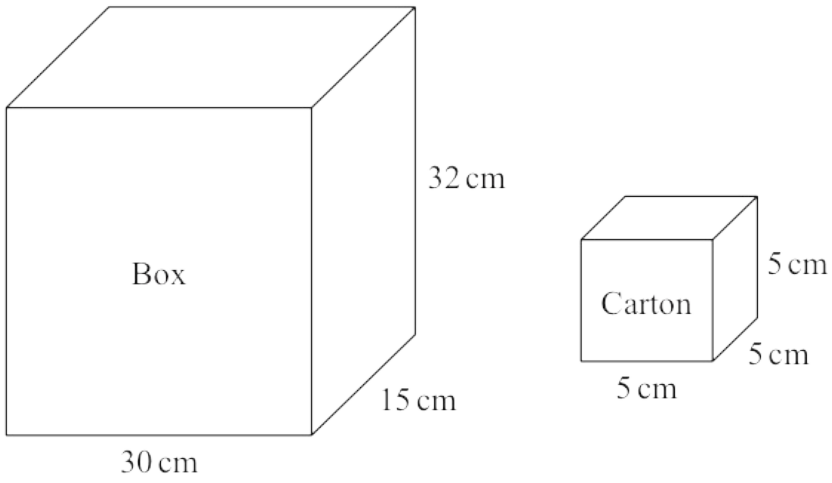


Diagram **NOT** accurately drawn

A wooden box measures 30 cm by 15 cm by 32 cm.
The box has a lid.

A carton measures 5 cm by 5 cm by 5 cm.

James has 110 cartons.
He wants to put all these cartons in the box and be able to shut the lid.

Can James put all 110 cartons in the box and shut the lid?
Show your working clearly.

(Total for Question 11 is 3 marks)

24 Here is an empty pool in the shape of a cuboid.

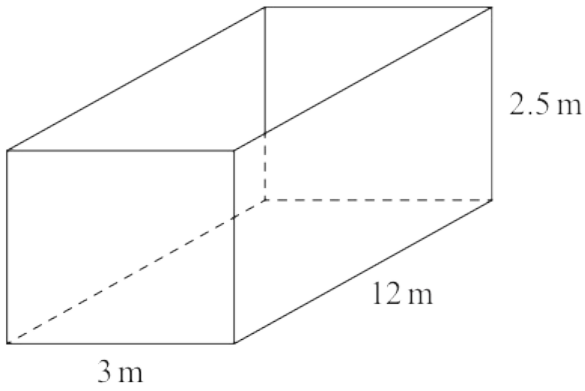


Diagram **NOT** accurately drawn

The width of the pool is 3 m.
The length of the pool is 12 m.
The top of the pool is 2.5 m above the base of the pool.

Jeb is going to put water in the pool.
The level of the surface of the water will be 60 cm below the top of the pool.

Water flows into the pool at 400 litres per minute.
$1\ m^3 = 1000$ litres

How long will it take to fill the pool to 60 cm below the top of the pool?
Give your answer in hours and minutes.

..... hours ..... minutes

(Total for Question 24 is 4 marks)

9 Sahil has a fish tank in the shape of a cuboid, as shown in the diagram.

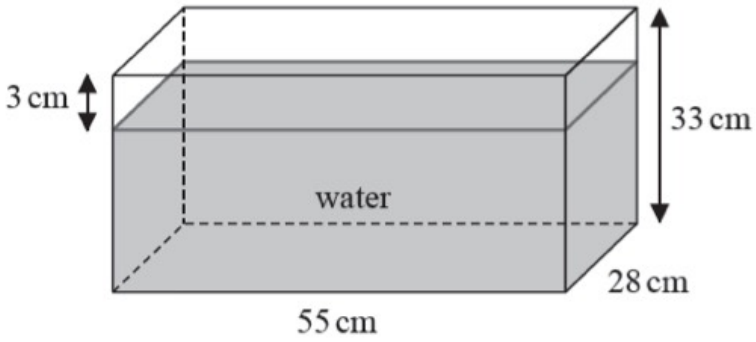


Diagram **NOT** accurately drawn

The tank is

55 cm long
28 cm wide
33 cm high

The surface of the water in the tank is 3 cm below the top of the tank.

Sahil is going to put some neon tetra fish in his tank.
He must allow 4 litres of water for each of the neon tetra fish he puts in the tank.

What is the greatest number of neon tetra fish Sahil can put in his tank?

(Total for Question 9 is 4 marks)

15 The diagram shows Jonah's fish tank.

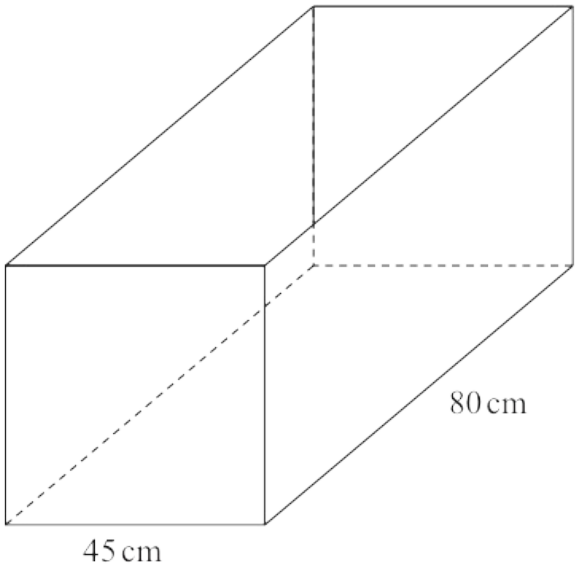


Diagram **NOT** accurately drawn

The fish tank is in the shape of a cuboid.

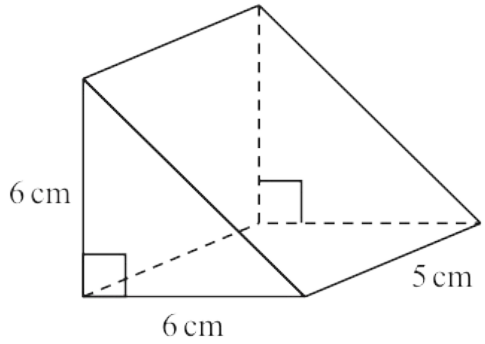
Jonah wants to keep 20 fish in the fish tank.
He knows that he must have 9 litres of water for each fish in the fish tank.

What is the minimum depth of water in the fish tank that Jonah must have?

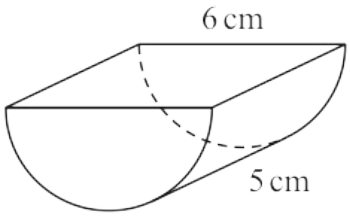
cm

(Total for Question 15 is 4 marks)

16 The diagram shows two solid toy bricks, Brick **A** and Brick **B**.



Brick **A**



Brick **B**

Diagram **NOT** accurately drawn

Brick **A** is a triangular prism of length 5 cm.
The cross section of Brick **A** is an isosceles right-angled triangle with equal sides of length 6 cm.

Brick **B** is half a cylinder of length 5 cm.
The semicircular cross section of Brick **B** has diameter 6 cm.

The volume of Brick **A** is greater than the volume of Brick **B**.

How much greater?
Give your answer correct to 1 decimal place.

cm^3

(Total for Question 16 is 4 marks)

20 The diagram shows a solid cuboid made from wood.

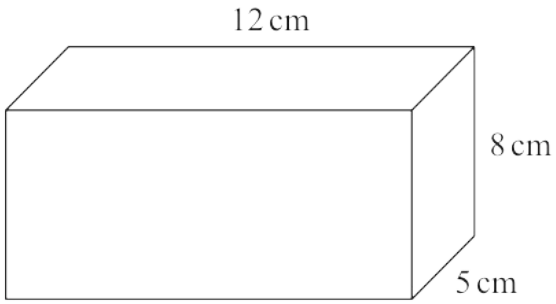


Diagram **NOT** accurately drawn

The wood has density 0.7 g/cm^3

Work out the mass of the cuboid.

..... grams

(Total for Question 20 is 3 marks)

15 A cylinder has diameter 14 cm and height 20 cm.

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

..... cm^3

(Total for Question 15 is 2 marks)

15 The diagram shows a cylinder.

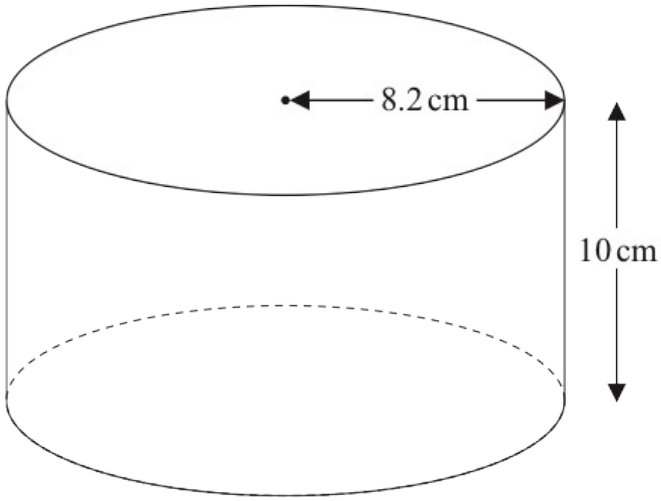


Diagram **NOT** accurately drawn

The cylinder has radius 8.2 cm and height 10 cm.
The cylinder is empty.

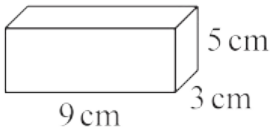
Pam pours 1.5 litres of water into the cylinder.

Work out the depth of the water in the cylinder.
Give your answer correct to 1 decimal place.

..... cm

(Total for Question 15 is 3 marks)

11 Karl has 5700 bricks.
He wants to put all the bricks into crates.



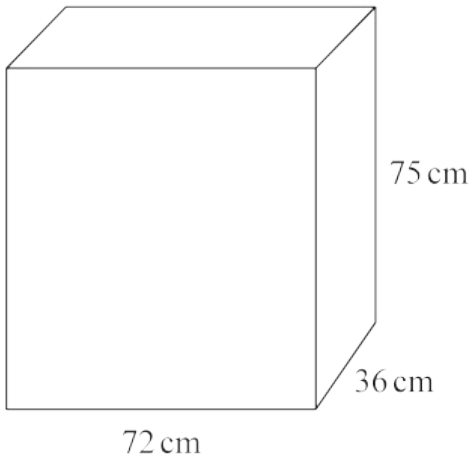


Diagram **NOT** accurately drawn

Each brick is a cuboid measuring 9 cm by 3 cm by 5 cm.
Each crate is a cuboid measuring 72 cm by 36 cm by 75 cm.

Karl has 4 crates.

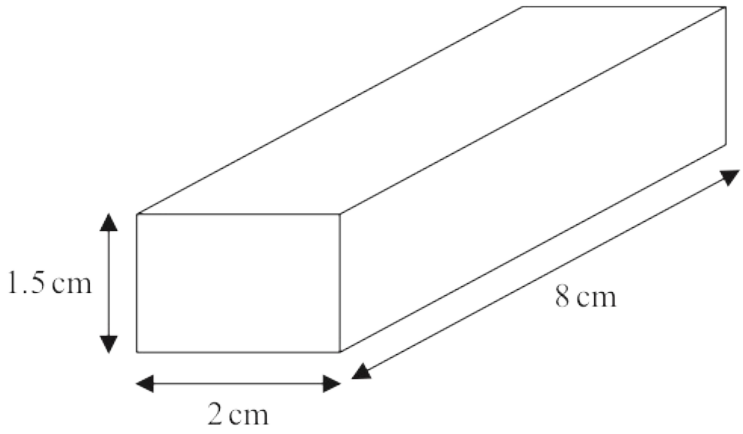
Is there enough room in the 4 crates for 5700 bricks?
Show your working clearly.

(Total for Question 11 is 4 marks)

23 Pablo made a solid gold statue.

He melted down some gold blocks and used the gold to make the statue.
Each block of gold was a cuboid, as shown below.

Diagram **NOT** accurately drawn



The mass of the statue is 5.73 kg.
The density of gold is 19.32 g/cm^3

Work out the least number of gold blocks Pablo melted down in order to make the statue.
Show your working clearly.

(Total for Question 23 is 5 marks)

3

Here is a solid cuboid.

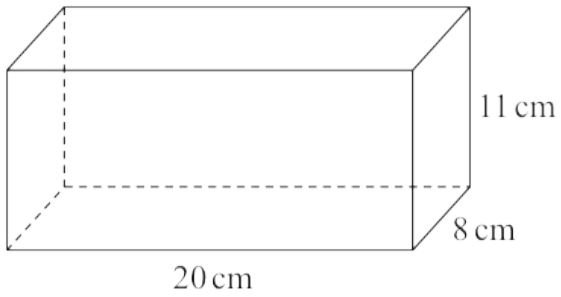


Diagram **NOT** accurately drawn

(c) Work out the volume of the cuboid.

..... cm^3

(2)

24 The diagram shows a solid cylinder with radius 3 m.

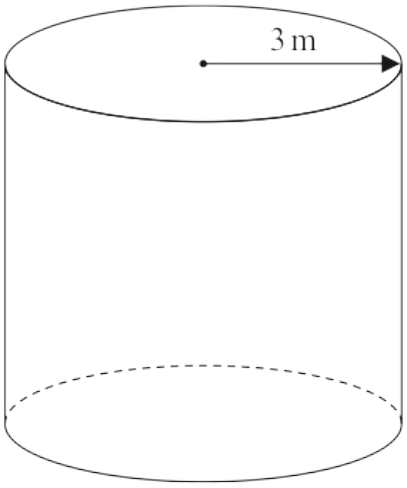


Diagram **NOT** accurately drawn

The volume of the cylinder is 72π m^3

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

..... m^2

(Total for Question 24 is 5 marks)

19 The diagram shows a container for water in the shape of a prism.

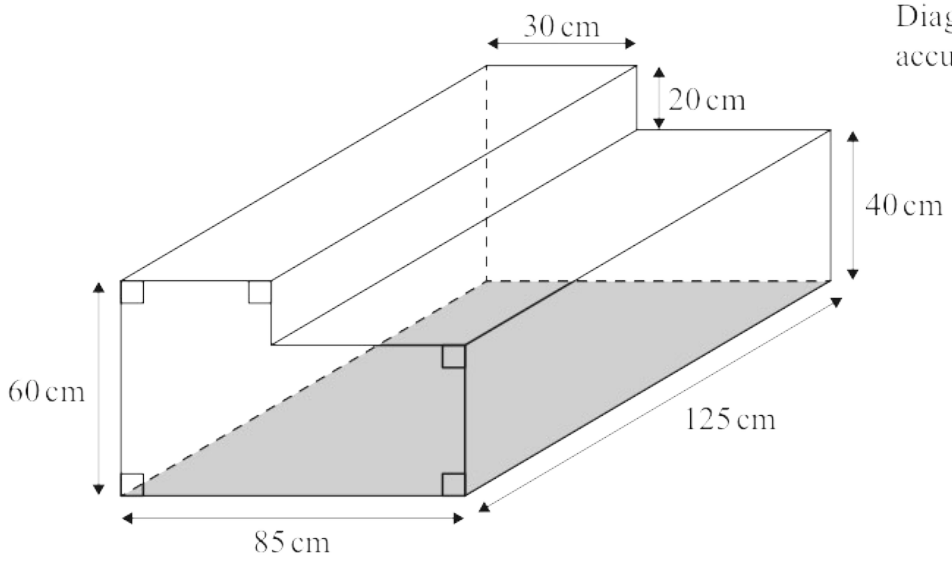


Diagram **NOT** accurately drawn

The rectangular base of the prism, shown shaded in the diagram, is horizontal.
The container is completely full of water.

Tuah is going to use a pump to empty the water from the container so that the volume of water in the container decreases at a constant rate.

The pump starts to empty water from the container at 10 30 and at 12 00 the water level in the container has dropped by 20 cm.

Find the time at which all the water has been pumped out of the container.

.....

(Total for Question 19 is 4 marks)

14

The diagram shows a cuboid.

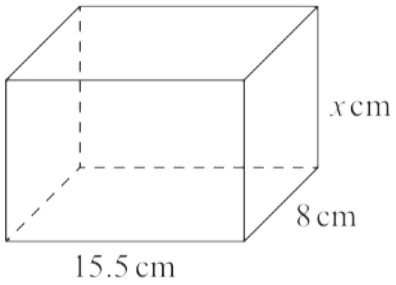


Diagram **NOT** accurately drawn

The volume of the cuboid is 806 cm^3

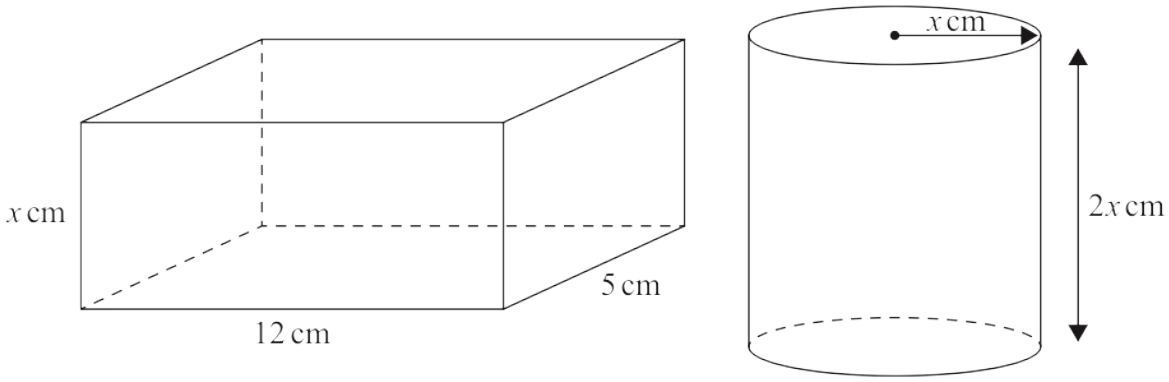
(b) Work out the value of x.

$x =$ .....

(3)

20 The diagram shows a cuboid and a cylinder.

Diagram **NOT** accurately drawn



The dimensions of the cuboid are x cm by 12 cm by 5 cm.
The volume of the cuboid is 270 cm^3

The radius of the cylinder is x cm.
The height of the cylinder is $2x$ cm.

(a) Work out the volume of the cylinder.
Give your answer correct to the nearest whole number.

..... cm^3

(3)

24 Here is a triangular prism.

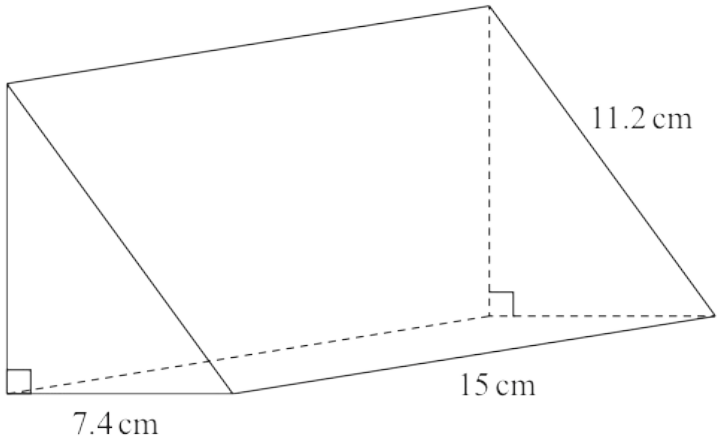


Diagram **NOT** accurately drawn

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

..... cm^3

(Total for Question 24 is 5 marks)

22 A solid aluminium cylinder has radius 10 cm and height h cm.

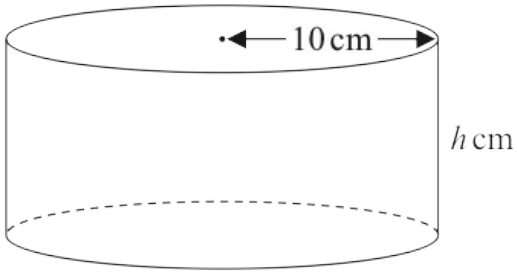


Diagram **NOT** accurately drawn

The mass of the cylinder is 5.4 kg.
The density of aluminium is 0.0027 kg/cm^3

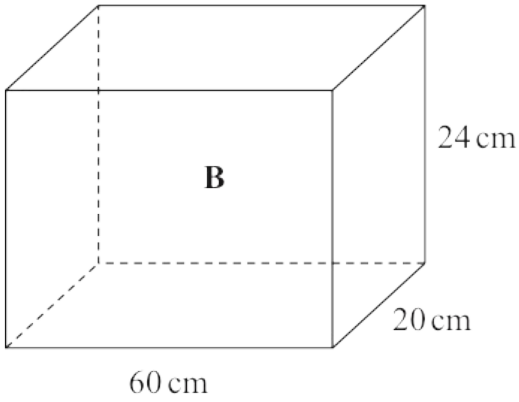
Calculate the value of h.
Give your answer correct to one decimal place.

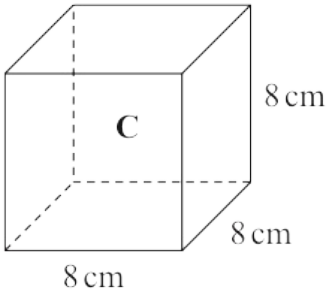
h = ...

(Total for Question 22 is 5 marks)

12 The diagram shows a box **B** and a carton **C**

Diagram **NOT** accurately drawn





The box **B** is in the shape of a cuboid.
Each carton **C** is in the shape of an 8 cm cube.

Martha is going to put as many of the cartons as possible into the box.
She has enough cartons to do this.

Martha will then fill the remaining space inside the box with packing material.

Work out the volume of the space inside the box that Martha will fill with packing material.

..... cm^3

(Total for Question 12 is 5 marks)

24 Jonty has a storage container in the shape of a cuboid, as shown in the diagram.

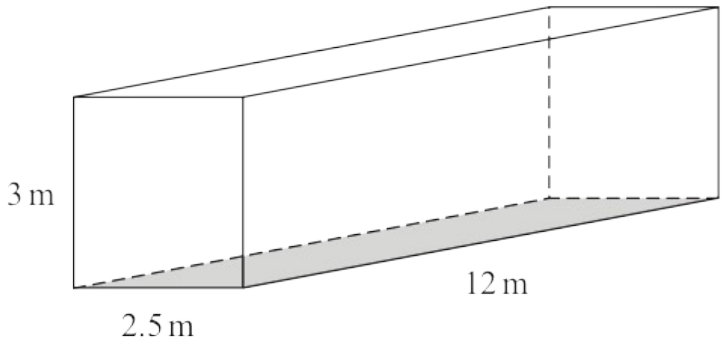


Diagram **NOT** accurately drawn

Jonty is going to paint the outside of his storage container, apart from the base which is shown shaded in the diagram.
He needs enough paint to cover the four sides and the top.

Each tin of paint covers an area of 15 m^2

The cost of each tin of paint recently increased by 10%
After the increase, the cost of each tin of paint is £26.95

Jonty says

"**Before** the increase, I could have bought enough paint for less than £200"

Show that Jonty is correct.
Show your working clearly.

(Total for Question 24 is 6 marks)

13 The diagram shows a solid wooden cuboid.

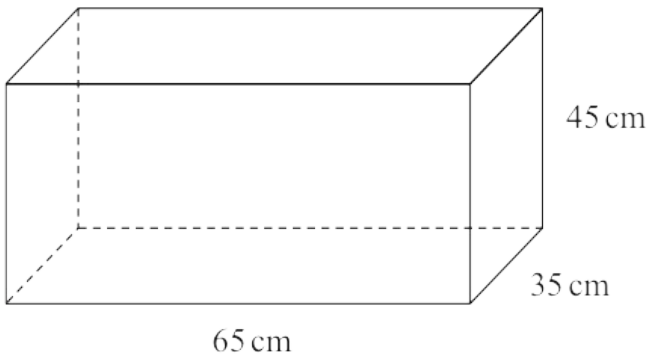


Diagram **NOT** accurately drawn

The cuboid measures 65 cm by 35 cm by 45 cm.

A machine cuts the cuboid to make cubes.
Each cube has edges of length 5 cm.

Work out the maximum number of cubes that can be made from the cuboid.

(Total for Question 13 is 3 marks)

22 A cylinder is placed on the ground.

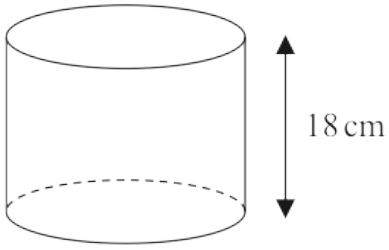


Diagram **NOT** accurately drawn

The height of the cylinder is 18 cm.

The force exerted by the cylinder on the ground is 72 newtons.
The pressure on the ground due to the cylinder is 1.4 newtons / cm^2

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

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

..... cm^3

(Total for Question 22 is 4 marks)

23 The diagram shows a solid cylinder made from iron.

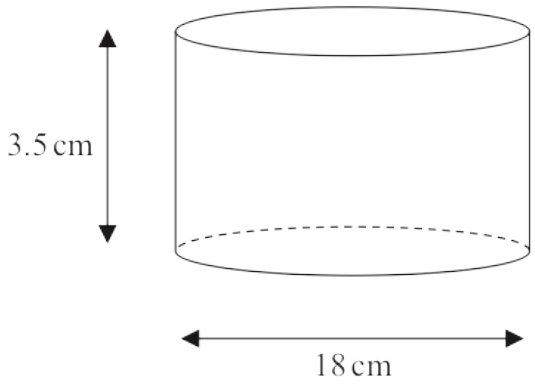


Diagram **NOT** accurately drawn

The cylinder has diameter 18 cm and height 3.5 cm
The mass of the cylinder is 7.04 kg

Work out the density of the iron.
Give your answer in g/cm^3 correct to 2 significant figures.

..... g/cm^3

(Total for Question 23 is 3 marks)

14 The diagram shows a solid prism.

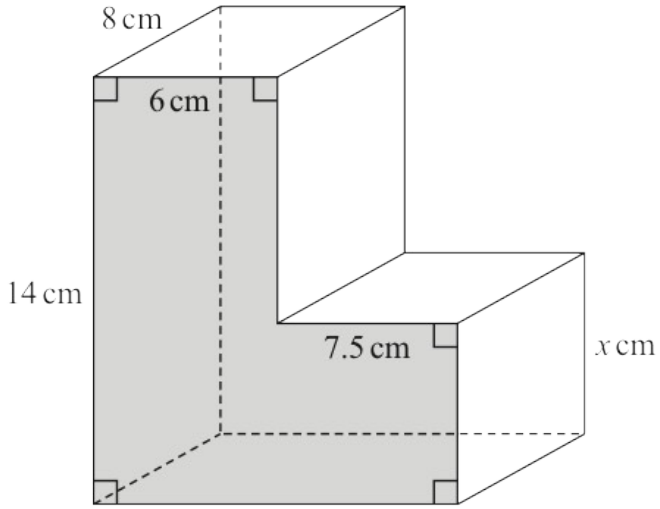


Diagram **NOT** accurately drawn

The cross section of the prism is shown shaded.

The volume of the prism is 924 cm^3

Work out the value of x

$x =$ .....

(Total for Question 14 is 4 marks)

13

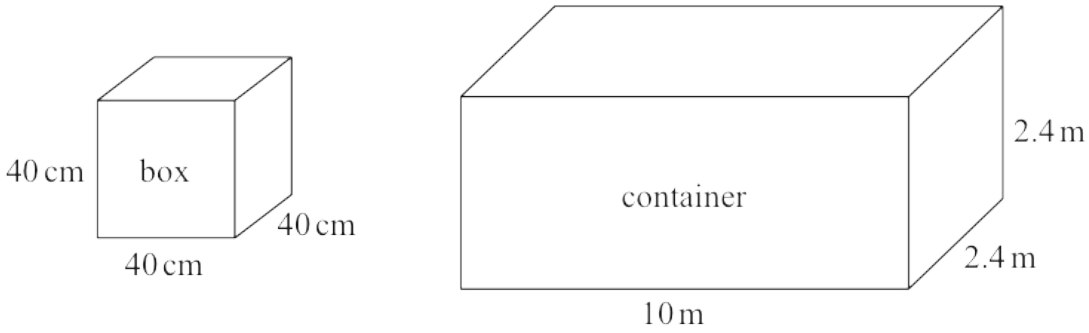


Diagram **NOT** accurately drawn

Tom puts boxes into a shipping container.

The container is a cuboid 10 metres by 2.4 metres by 2.4 metres.
Each box is a cube of side 40 centimetres.

Work out the greatest number of these boxes that Tom can put into the container.

(Total for Question 13 is 3 marks)

16 The diagram shows a solid triangular prism.

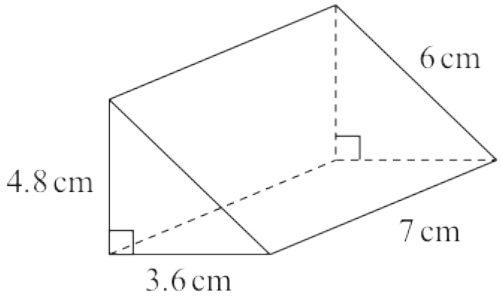


Diagram **NOT** accurately drawn

Work out the **total** surface area of the triangular prism.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 16 is 3 marks)

13

The diagram shows a cuboid.

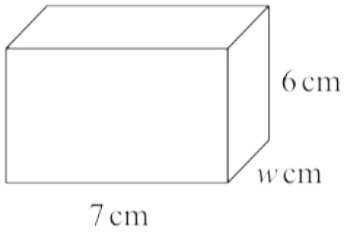


Diagram **NOT** accurately drawn

The volume of the cuboid is 231 cm^3

(b) Calculate the value of w

$w =$ .....

(2)

(Total for Question 13 is 5 marks)