

**1** 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<sup>3</sup>

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**(Total for Question 1 is 2 marks)**

2 The diagram shows a solid cube.

The cube is placed on a table so that the whole of one face of the cube is in contact with the table.

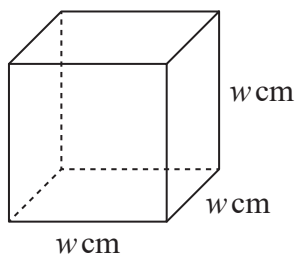


Diagram **NOT**  
accurately drawn

The cube exerts a force of 56 newtons on the table.

The pressure on the table due to the cube is 0.14 newtons/cm<sup>2</sup>

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

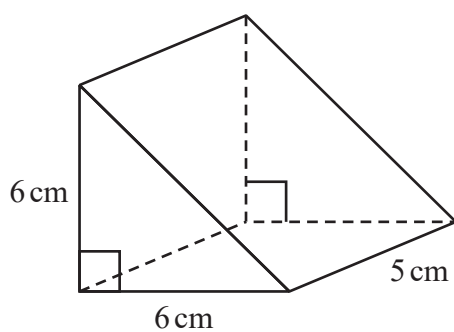
Work out the volume of the cube.

..... cm<sup>3</sup>

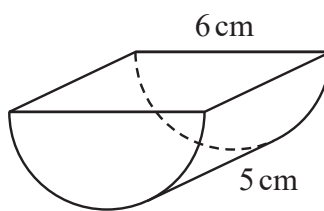
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(Total for Question 2 is 4 marks)

- 3 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.

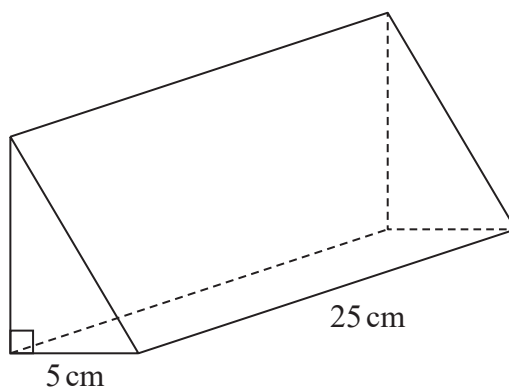
How much greater?

Give your answer correct to 1 decimal place.

cm<sup>3</sup>

(Total for Question 3 is 4 marks)

- 4 The diagram shows a prism.



The cross section of the prism is a right-angled triangle.  
The base of the triangle has length 5 cm

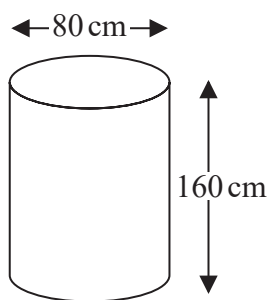
The prism has length 25 cm  
The prism has volume  $750 \text{ cm}^3$

Work out the height of the prism.

..... cm

(Total for Question 4 is 3 marks)

- 5 Karina has 4 tanks on her tractor.  
Each tank is a cylinder with diameter 80 cm and height 160 cm.



The 4 tanks are to be filled completely with a mixture of fertiliser and water.

The fertiliser has to be mixed with water in the ratio 1 : 100 by volume.

Karina has 32 litres of fertiliser.

$$1 \text{ litre} = 1000 \text{ cm}^3$$

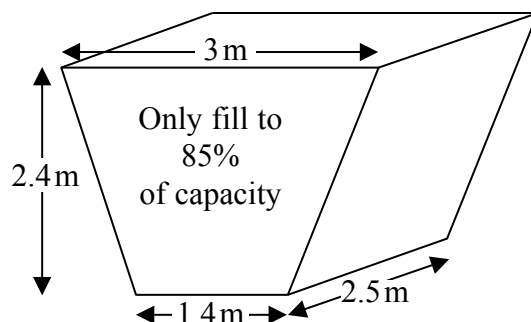
Has Karina enough fertiliser for the 4 tanks?

You must show how you get your answer.

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(Total for Question 5 is 4 marks)

- 6 The diagram shows an oil tank in the shape of a prism.  
The cross section of the prism is a trapezium.



The tank is empty.

Oil flows into the tank.

After one minute there are 300 litres of oil in the tank.

Assume that oil continues to flow into the tank at this rate.

- (a) Work out how many **more** minutes it takes for the tank to be 85% full of oil.  
(1 m<sup>3</sup> = 1000 litres)

..... minutes  
(5)

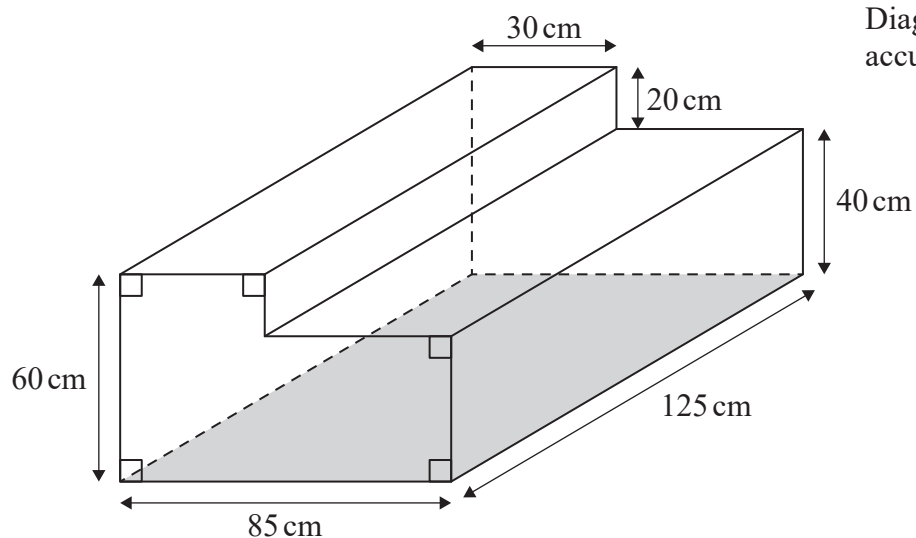
The assumption about the rate of flow of the oil could be wrong.

- (b) Explain how this could affect your answer to part (a).

.....  
.....  
(1)

(Total for Question 6 is 6 marks)

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



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 7 is 4 marks)

- 8 The diagram shows a cuboid and a cylinder.

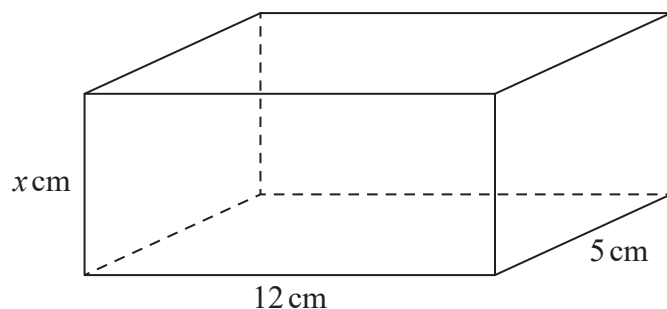
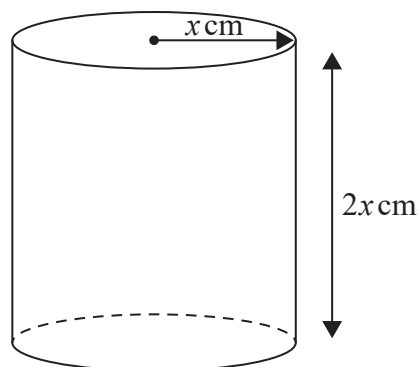


Diagram **NOT**  
accurately drawn



The dimensions of the cuboid are  $x$  cm by 12 cm by 5 cm.  
The volume of the cuboid is  $270 \text{ cm}^3$

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.

.....  $\text{cm}^3$   
(3)

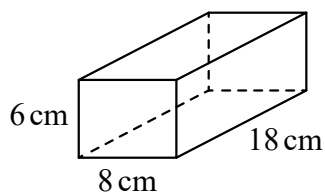
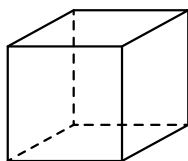
- (b) Change  $1 \text{ m}^3$  to  $\text{cm}^3$

.....  $\text{cm}^3$   
(1)

(Total for Question 8 is 4 marks)



- 9 The diagram shows a cube and a cuboid.



The total surface area of the cube is equal to the total surface area of the cuboid.

Janet says,

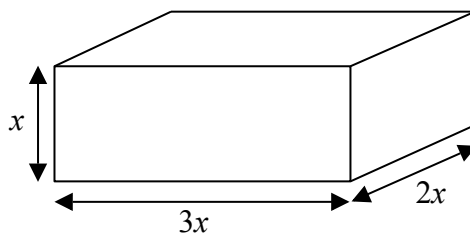
“The volume of the cube is equal to the volume of the cuboid.”

Is Janet correct?

You must show how you get your answer.

(Total for Question 9 is 5 marks)

**10** Here is a cuboid.



All measurements are in centimetres.

$x$  is an integer.

The total volume of the cuboid is less than  $900 \text{ cm}^3$

Show that  $x \leq 5$

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**(Total for Question 10 is 3 marks)**

11 Here is a triangular prism.

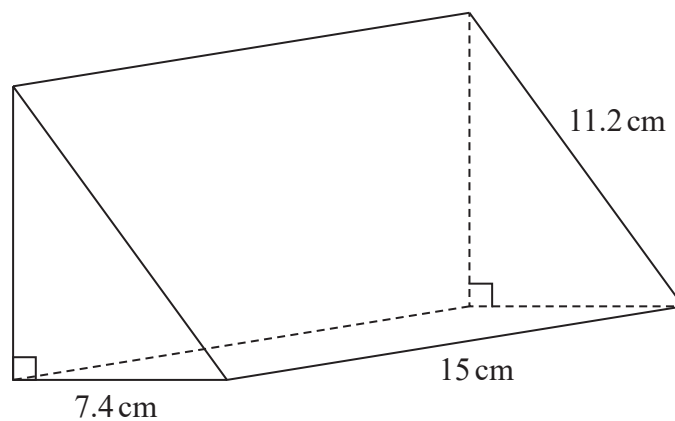


Diagram **NOT**  
accurately drawn

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

.....  $\text{cm}^3$

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(Total for Question 11 is 5 marks)

12

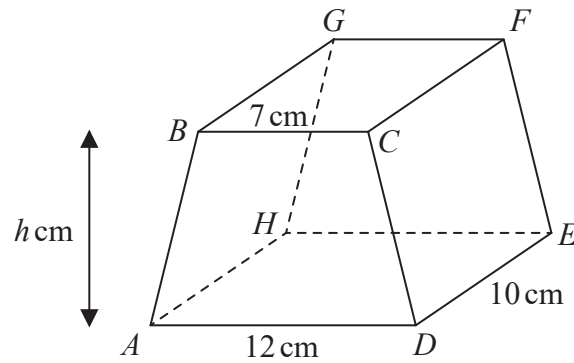


Diagram **NOT**  
accurately drawn

The diagram shows a prism  $ABCDEFGH$  in which  $ABCD$  is a trapezium with  $BC$  parallel to  $AD$  and  $CDEF$  is a rectangle.

$$BC = 7 \text{ cm} \quad AD = 12 \text{ cm} \quad DE = 10 \text{ cm}$$

The height of trapezium  $ABCD$  is  $h \text{ cm}$

The volume of the prism is  $608 \text{ cm}^3$

Work out the value of  $h$ .

$$h = \dots\dots\dots$$

(Total for Question 12 is 3 marks)

- 13 The diagram shows a solid cylinder with radius 3 m.

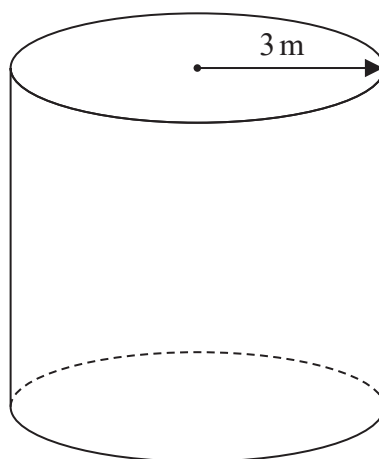


Diagram **NOT**  
accurately drawn

The volume of the cylinder is  $72\pi \text{ m}^3$

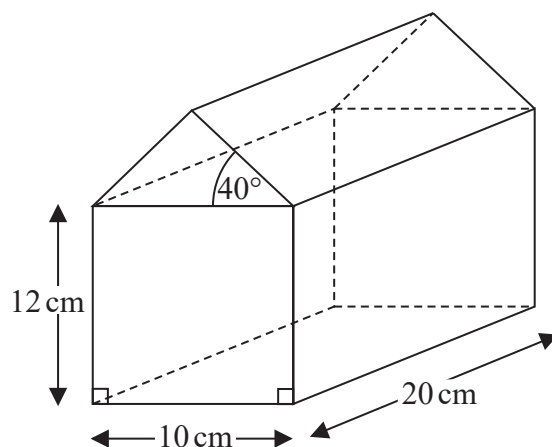
Calculate the **total** surface area of the cylinder.  
Give your answer correct to 3 significant figures.

..... $\text{m}^2$

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(Total for Question 13 is 5 marks)

- 14 The diagram shows a prism.



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

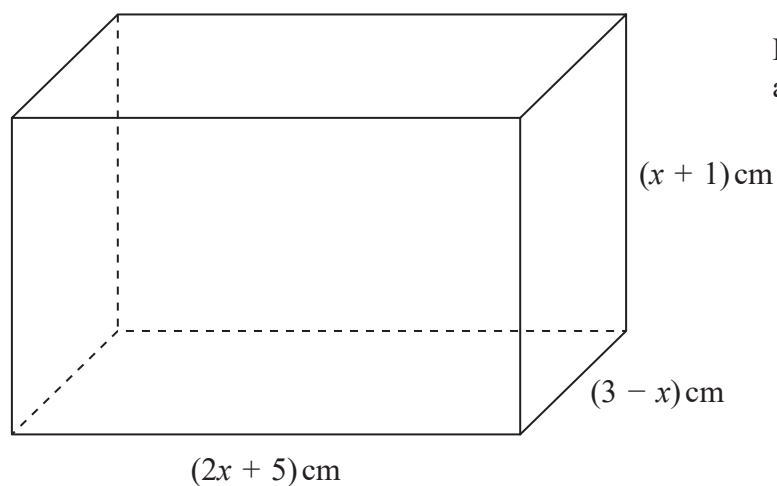
Work out the volume of the prism.

Give your answer correct to 3 significant figures.

.....  $\text{cm}^3$

(Total for Question 14 is 5 marks)

15



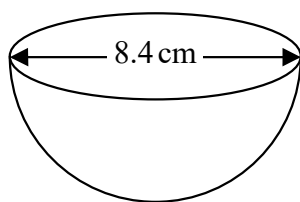
The diagram shows a cuboid of volume  $V \text{ cm}^3$

Show that  $V = 15 + 16x - x^2 - 2x^3$

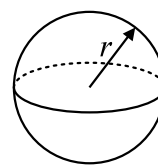
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(Total for Question 15 is 3 marks)

- 16 The diagram shows a hemisphere with diameter 8.4 cm.



$$\text{Volume of sphere} = \frac{4}{3} \pi r^3$$



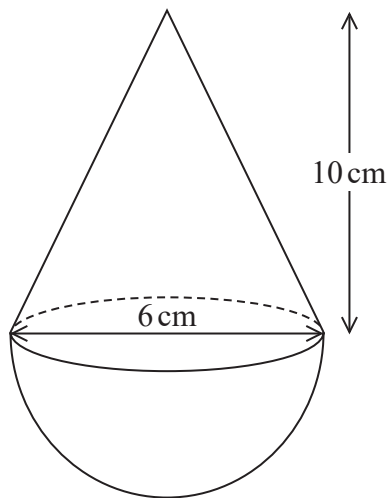
Work out the volume of the hemisphere.  
Give your answer correct to 3 significant figures.

..... cm<sup>3</sup>

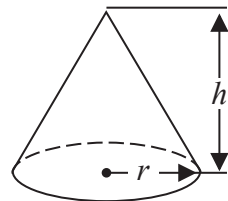
(Total for Question 16 is 2 marks)



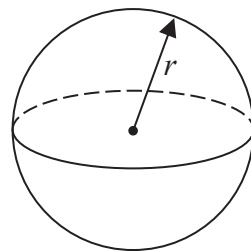
- 17 The diagram shows a solid shape.  
The shape is a cone on top of a hemisphere.



$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$



$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$



The height of the cone is 10 cm.  
The base of the cone has a diameter of 6 cm.  
The hemisphere has a diameter of 6 cm.

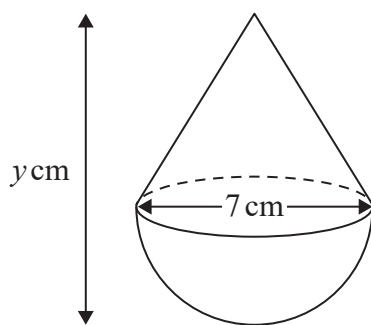
The total volume of the shape is  $k\pi \text{ cm}^3$ , where  $k$  is an integer.

Work out the value of  $k$ .

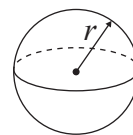
$k = \dots\dots\dots$

(Total for Question 17 is 4 marks)

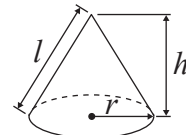
18 A solid cone is joined to a solid hemisphere to make the solid **T** shown below.



$$\text{Volume of sphere} = \frac{4}{3} \pi r^3$$



$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$



The diameter of the base of the cone is 7 cm.

The diameter of the hemisphere is 7 cm.

The total volume of **T** is  $120\pi \text{ cm}^3$

The total height of **T** is y cm.

- (a) Calculate the value of y.  
Give your answer correct to 3 significant figures.

$$y = \dots\dots\dots (4)$$

The diameter of the base of the cone and the diameter of the hemisphere are both increased by the same amount.

Assuming the total volume of **T** does not change,

- (b) explain the effect this would have on your answer to part (a).

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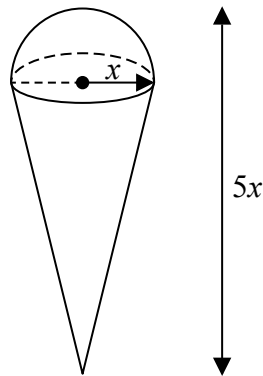
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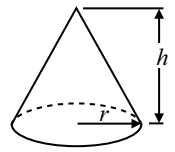
(1)

(Total for Question 18 is 5 marks)

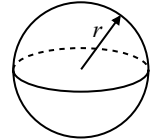
19 A solid is made by putting a hemisphere on top of a cone.



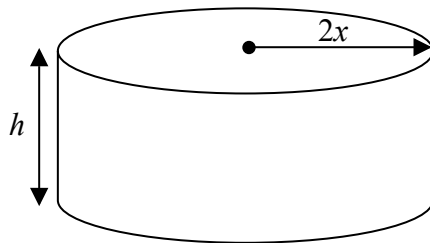
Volume of cone =  $\frac{1}{3}\pi r^2 h$



Volume of sphere =  $\frac{4}{3}\pi r^3$



The total height of the solid is  $5x$   
 The radius of the base of the cone is  $x$   
 The radius of the hemisphere is  $x$

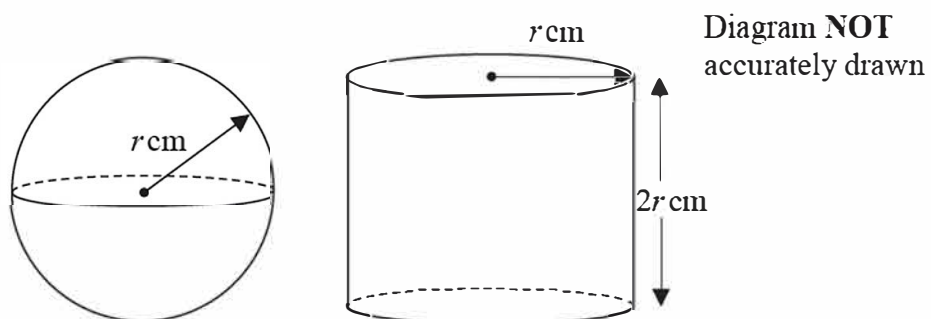


A cylinder has the same volume as the solid.  
 The cylinder has radius  $2x$  and height  $h$   
 All measurements are in centimetres.

Find a formula for  $h$  in terms of  $x$   
 Give your answer in its simplest form.

(Total for Question 19 is 5 marks)

20 Here are a solid sphere and a solid cylinder.



The radius of the sphere is  $r \text{ cm}$ .

The radius of the cylinder is  $r \text{ cm}$ .

The height of the cylinder is  $2r \text{ cm}$ .

The total surface area of the cylinder is  $k\pi \text{ cm}^2$

(a) Find an expression for  $k$  in terms of  $r$ .

(b) Show that the ratio

total surface area of the cylinder : total surface area of the sphere

is the same as the ratio

volume of the cylinder : volume of the sphere

(3)

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**(Total for Question 20 is 5 marks)**

- 21 A frustum is made by removing a small cone from a large cone.  
The cones are mathematically similar.

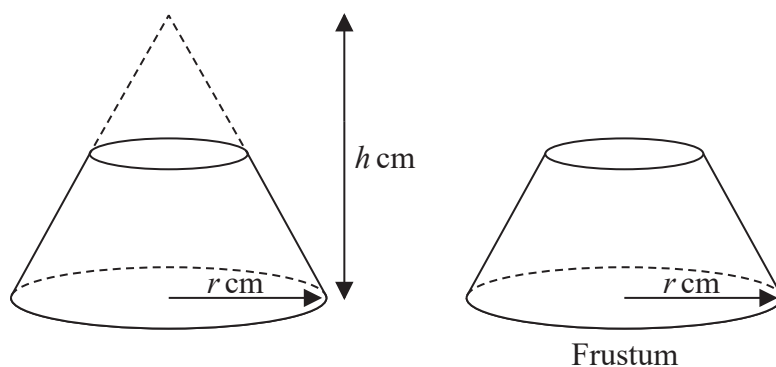


Diagram **NOT**  
accurately drawn

The large cone has base radius  $r$  cm and height  $h$  cm.

Given that

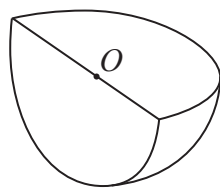
$$\frac{\text{volume of frustum}}{\text{volume of large cone}} = \frac{98}{125}$$

find an expression, in terms of  $h$ , for the height of the frustum.

..... cm

(Total for Question 21 is 4 marks)

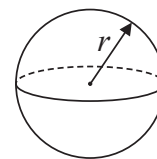
**22** Shape **S** is one quarter of a solid sphere, centre  $O$ .



Shape **S**

$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

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



The volume of **S** is  $576\pi \text{ cm}^3$

Find the surface area of **S**.

Give your answer correct to 3 significant figures.

You must show your working.

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

(Total for Question 22 is 5 marks)

**23** The total surface area of a solid hemisphere is equal to the curved surface area of a cylinder.

The radius of the hemisphere is  $r$  cm.

The radius of the cylinder is twice the radius of the hemisphere.

Given that

$$\text{volume of hemisphere} : \text{volume of cylinder} = 1 : m$$

find the value of  $m$ .

$$m =$$

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**(Total for Question 23 is 4 marks)**