1

Given that the surface area of a sphere is $49\pi \text{ cm}^2$

find the volume of the sphere.
Give your answer correct to the nearest integer.

..... cm^3

(Total for Question 1 is 3 marks)

2 A solid is made from a hemisphere and a cylinder.
The plane face of the hemisphere coincides with the upper plane face of the cylinder.

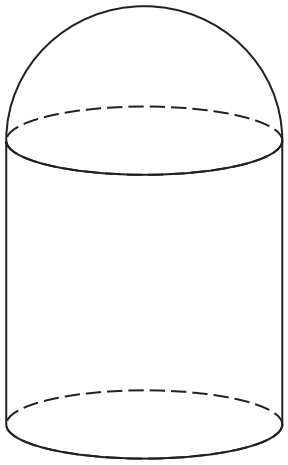


Diagram **NOT** accurately drawn

The hemisphere and the cylinder have the same radius.

The ratio of the radius of the cylinder to the height of the cylinder is 1 : 3

Given that the solid has volume $792\pi\,\text{cm}^3$
work out the height of the solid.

..... cm

(Total for Question 2 is 5 marks)

3 A solid is made from a cone and a hemisphere.

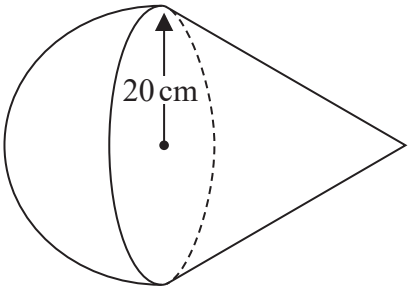


Diagram **NOT** accurately drawn

The circular plane face of the hemisphere coincides with the circular base of the cone.
The radius of the hemisphere and the radius of the circular base of the cone are both 20 cm.

The curved surface area of the cone is $580\pi \text{ cm}^2$

The volume of the solid is $k\pi \text{ cm}^3$

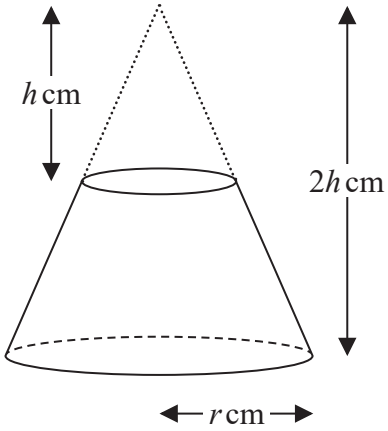
Work out the exact value of k

$k =$ .....

(Total for Question 3 is 5 marks)

4 The diagram shows a frustum of a cone and a sphere.

The frustum is made by removing a small cone from a large cone.
The cones are similar.



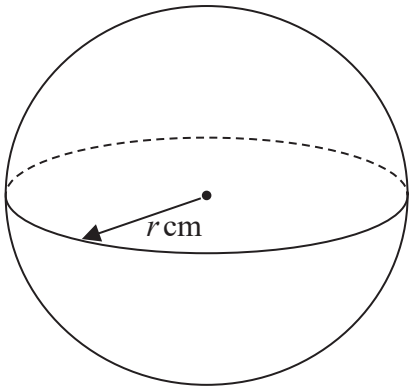


Diagram **NOT** accurately drawn

The height of the small cone is h cm.
The height of the large cone is $2h$ cm.
The radius of the base of the large cone is r cm.

The radius of the sphere is r cm.

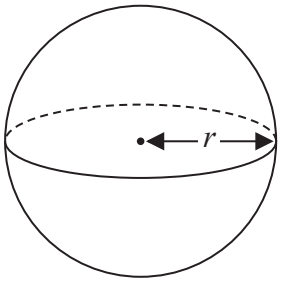
Given that the volume of the frustum is equal to the volume of the sphere,

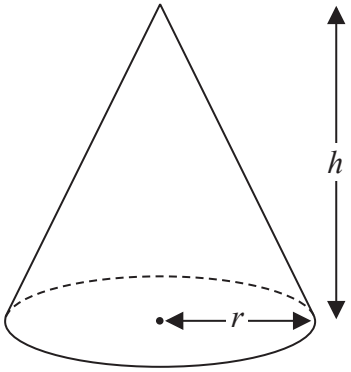
find an expression for r in terms of h.
Give your expression in its simplest form.

$r =$ .....

(Total for Question 4 is 5 marks)

5 Here is a solid sphere and a solid cone.





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

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

All measurements are in cm.

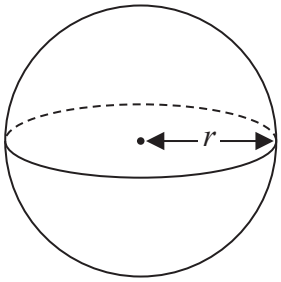
The volume of the sphere is equal to the volume of the cone.

(a) Find $r : h$
Give your answer in its simplest form.

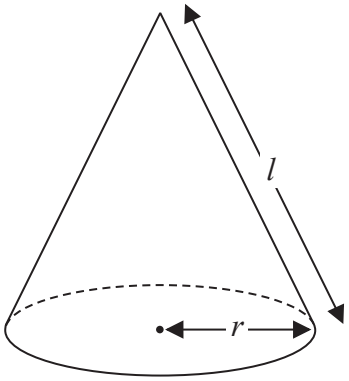
.....

(2)

Here is a different solid sphere and a different solid cone.



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



Curved area of cone = $\pi r l$

All measurements are in cm.

The surface area of the sphere is equal to the **total** surface area of the cone.

(b) Find $r : h$

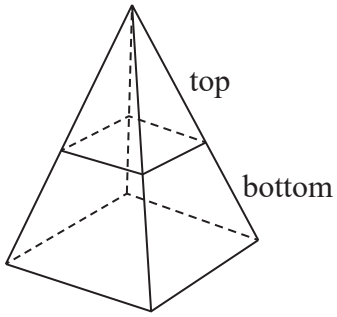
Give your answer in the form $1 : \sqrt{n}$ where n is an integer.

.....

(4)

(Total for Question 5 is 6 marks)

6 The pyramid **P** is formed from two parts made of different materials.



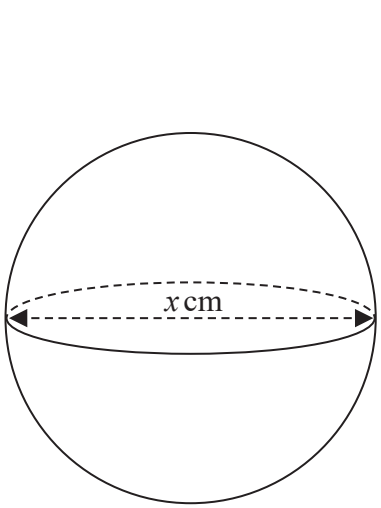
The top part of **P** has a mass of 92.8 g and is made from material with a density of 2.9 g/cm^3
The bottom part of **P** has a mass of 972.8 g
The average density of **P** is 4.7 g/cm^3

Calculate the volume of the top part of **P** as a percentage of the total volume of **P**.
Give your answer correct to 1 decimal place.
You must show all your working.

.....%

(Total for Question 6 is 5 marks)

7 The diagram shows a sphere of diameter x cm and a pyramid $ABCDE$ with a horizontal rectangular base $BCDE$.



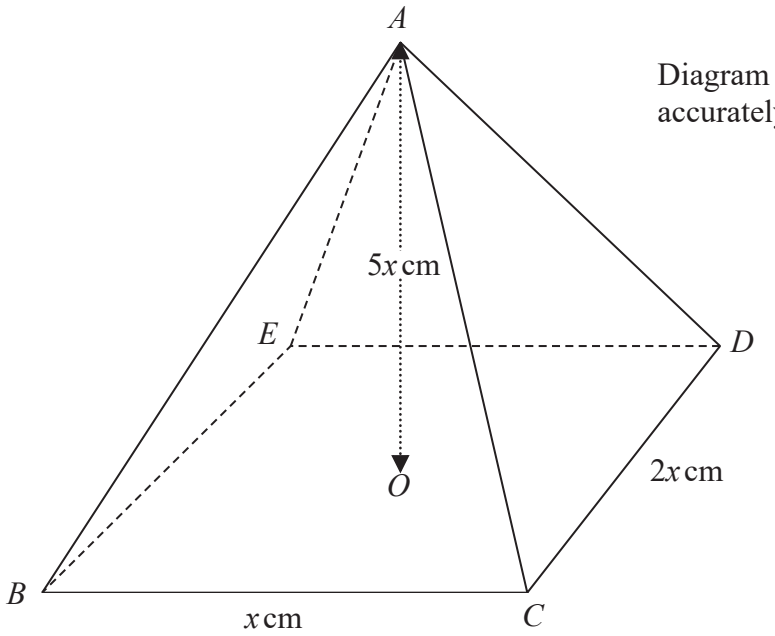


Diagram **NOT** accurately drawn

The vertex A of the pyramid is vertically above the centre O of the base so that $AB = AC = AD = AE$.

$BC = x$ cm, $CD = 2x$ cm and $AO = 5x$ cm.

The volume of the sphere is 288π cm^3

Calculate the total surface area of the pyramid.
Give your answer correct to the nearest cm^2

..... cm^2

(Total for Question 7 is 6 marks)

8 The diagram shows a solid cone and a solid sphere.

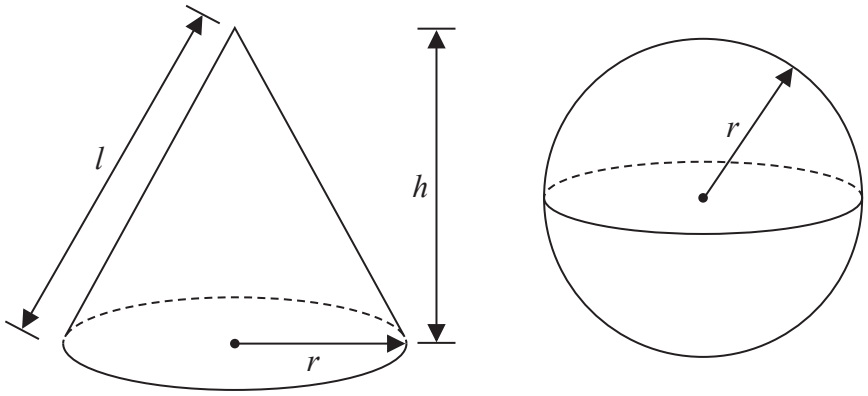


Diagram **NOT** accurately drawn

The cone has base radius r, slant height l and perpendicular height h
The sphere has radius r

The base radius of the cone is equal to the radius of the sphere.

Given that

$$k \times \text{volume of the cone} = \text{volume of the sphere}$$

show that the **total** surface area of the cone can be written in the form

$$\pi r^2 \left(\frac{k + \sqrt{k^2 + a}}{k} \right)$$

where a is a constant to be found.

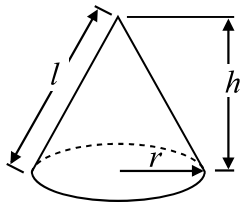
(Total for Question 8 is 6 marks)

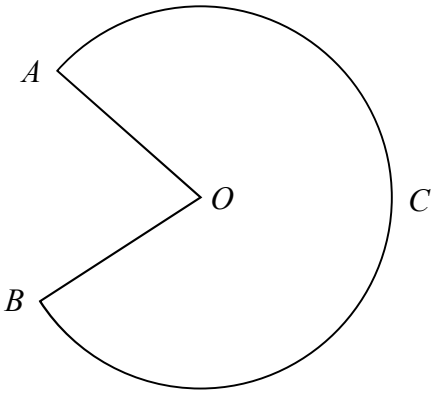
9 The diagram shows a sector $OACB$ of a circle with centre O.
The point C is the midpoint of the arc AB.

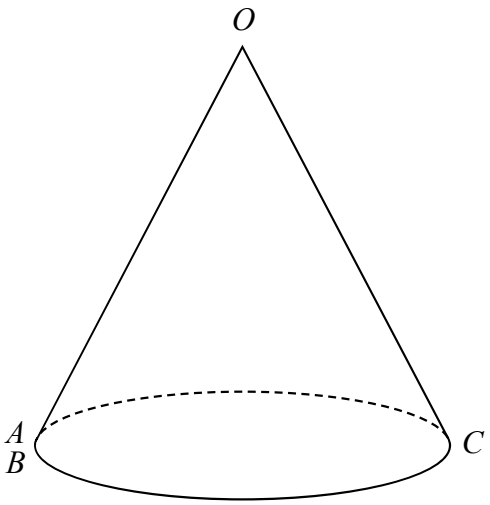
The diagram also shows a hollow cone with vertex O.
The cone is formed by joining OA and OB.

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

Curved surface area of cone = πrl







The cone has volume 56.8 cm^3 and height 3.6 cm.

Calculate the size of angle AOB of sector $OACB$.
Give your answer correct to 3 significant figures.
You must show all your working.

°

.....

(Total for Question 9 is 5 marks)

10 Here is a sector, AOB, of a circle with centre O and angle $AOB = x°$

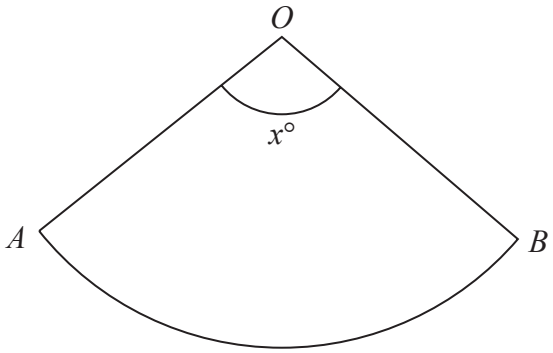


Diagram **NOT** accurately drawn

The sector can form the curved surface of a cone by joining OA to OB.

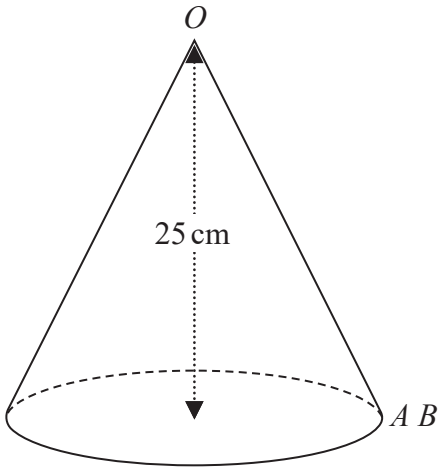


Diagram **NOT** accurately drawn

The height of the cone is 25 cm.
The volume of the cone is 1600 cm^3

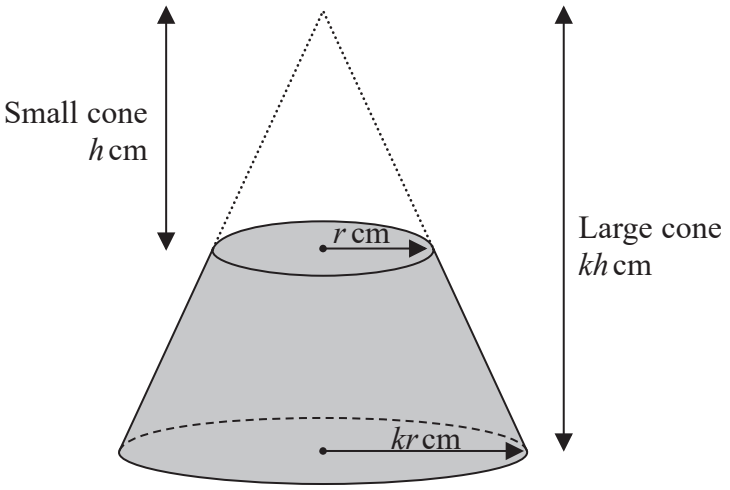
Work out the value of x.
Give your answer correct to the nearest whole number.

$x =$ .....

(Total for Question 10 is 6 marks)

11 The diagram shows a frustum of a cone, and a sphere.

The frustum, shown shaded in the diagram, is made by removing the small cone from the large cone.
The small cone and the large cone are similar.



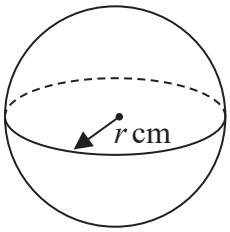


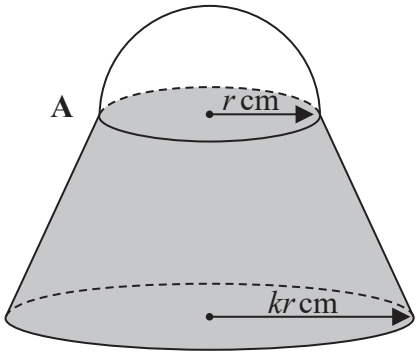
Diagram **NOT** accurately drawn

The height of the small cone is h cm and the radius of the base of the small cone is r cm.
The height of the large cone is kh cm and the radius of the base of the large cone is kr cm.
The radius of the sphere is r cm.

The sphere is divided into two hemispheres, each of radius r cm.

Solid **A** is formed by joining one of the hemispheres to the frustum.
The plane face of the hemisphere coincides with the upper plane face of the frustum, as shown in the diagram below.

Solid **B** is formed by joining the other hemisphere to the small cone that was removed from the large cone.
The plane face of the hemisphere coincides with the plane face of the base of the small cone, as shown in the diagram below.



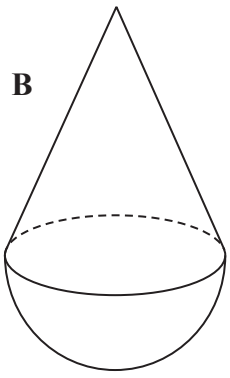


Diagram **NOT** accurately drawn

The volume of solid **A** is 6 times the volume of solid **B**.

Given that $k > \sqrt[3]{7}$

find an expression for h in terms of k and r

$h =$ .....

(Total for Question 11 is 6 marks)