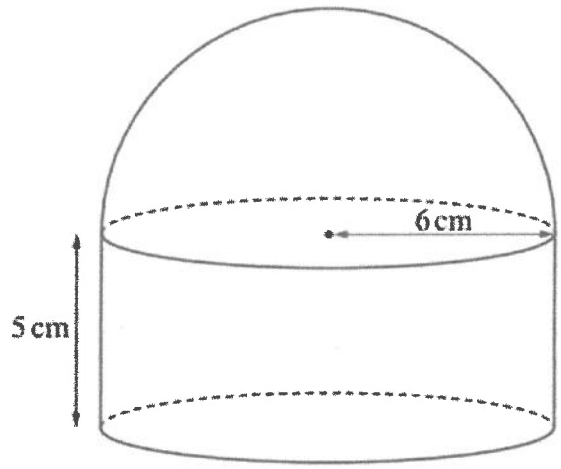
16



NOT TO SCALE

The diagram shows a solid made by joining a hemisphere to a cylinder.
The radius of both the hemisphere and the cylinder is 6 cm.
The height of the cylinder is 5 cm.

Find the **total** surface area of the solid.
Give your answer in terms of π.

Hemisphere:

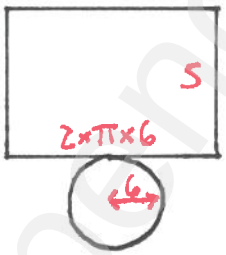
$A = \frac{1}{2} \times 4\pi r^2$

$= 2\pi \times 6^2$

$= 2\pi \times 36$

$= 72\pi \text{ cm}^2$

Cylinder:



circle: $\pi \times 6^2$

$= 36\pi$

rectangle: $2 \times \pi \times 6 \times 5$

$= 60\pi$

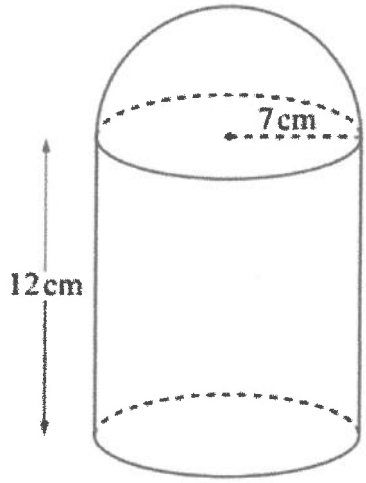
$36\pi + 60\pi = 96\pi \text{ cm}^2$

S.A. $= 72\pi + 96\pi$

$= 168\pi$

168π ..... cm² [4]

18



NOT TO SCALE

The diagram shows a solid made from a cylinder and a hemisphere, both of radius 7 cm.
The cylinder has length 12 cm.

Work out the total surface area of the solid.
[The surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]

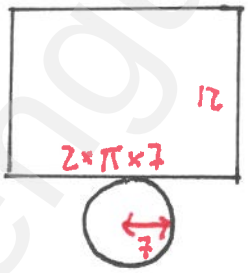
Hemisphere:

$A = \frac{1}{2} \times 4\pi r^2$

$= 2\pi \times 7^2$

$= 98\pi \text{ cm}^2$

Cylinder:



Circle: $\pi \times 7^2$

$= 49\pi$

Rectangle:

$2 \times \pi \times 7 \times 12$

$= 168\pi$

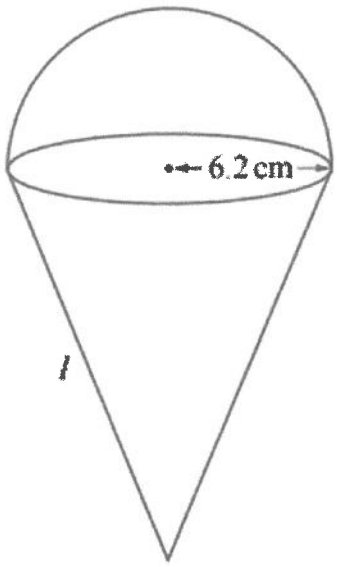
$49\pi + 168\pi = 217\pi \text{ cm}^2$

Total S.A.: $98\pi + 217\pi$

$= 315\pi$ cm² [4]

(or 990 cm² to 3sf)

23



NOT TO SCALE

The diagram shows a solid metal shape made from a cone and a hemisphere, both with radius 6.2 cm. The total surface area of the solid shape is 600 cm^2.

Calculate the slant height, l, of the cone.
[The surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]

Hemisphere:

$A = \frac{1}{2} \times 4\pi r^2$

$= 2\pi \times 6.2^2$

$= 241.526$

Area of cone:

$600 - 241.526 = 358.474$

$A = \pi rl$:

$A = \pi rl$

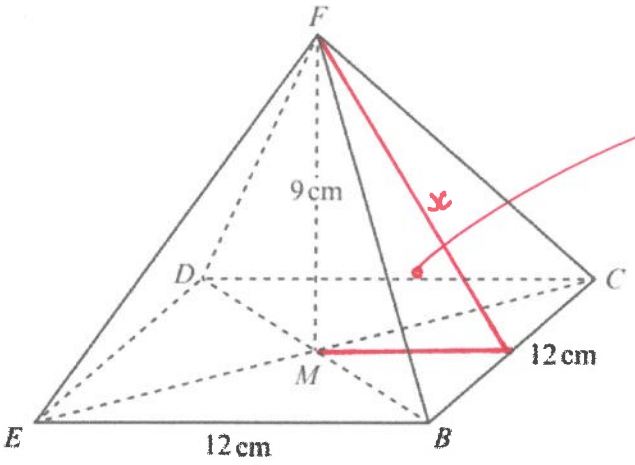
$358.474 = \pi \times 6.2 \times l$

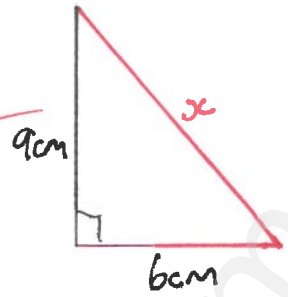
$\div 6.2\pi \quad \div 6.2\pi$

$l = 18.40$ cm

$l =$ 18.4 cm [4]

4 (a)





$6^2 + 9^2 = x^2$

$36 + 81 = x^2$

$117 = x^2$

$x = \sqrt{117}$

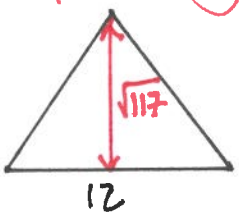
The diagram shows a pyramid with a square base $BCDE$.
The diagonals CE and BD intersect at M, and the vertex F is directly above M.
$BE = 12$ cm and $FM = 9$ cm.

(ii) Calculate the total surface area of the pyramid.

Area of base:

$12 \times 12 = 144 \text{ cm}^2$

Area of 4 triangles:



$A = \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 12 \times \sqrt{117}$

$= 6\sqrt{117}$

Total surface area:

$144 + 4 \times 6\sqrt{117}$

$= 144 + 24\sqrt{117}$

$= 242.95$

243 cm^2 [5]

12 A cone has sloping edge 12 cm and base radius 5 cm.

Calculate the **total** surface area of the cone.

Circle:

$A = \pi r^2$

$= \pi \times 5^2$

$= 25\pi$

Curved surface area:

$A = \pi r l$

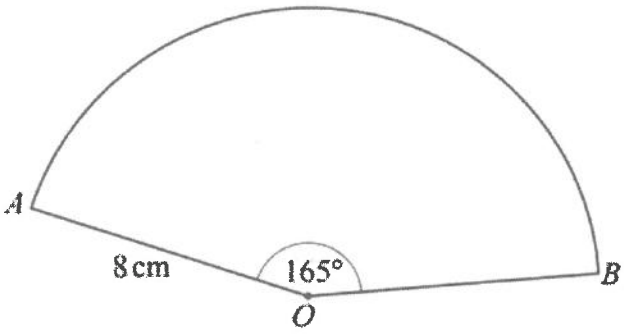
$= \pi \times 5 \times 12$

$= 60\pi$

Total S.A.: $25\pi + 60\pi$

$= 85\pi = 267$ cm^2 [2]

9



NOT TO SCALE

The diagram shows a sector of a circle with centre O, radius 8 cm and sector angle 165°.

(b) The surface area of a sphere is the same as the area of the sector.

Calculate the radius of the sphere.
[The surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]

Area of Sector:

$$A = \frac{165}{360} \times \pi r^2$$

$$= \frac{11}{24} \times \pi \times 8^2$$

$$= \frac{88}{3}\pi$$

Area of sphere:

$$A = 4\pi r^2$$

$$\frac{88}{3}\pi = 4\pi r^2$$

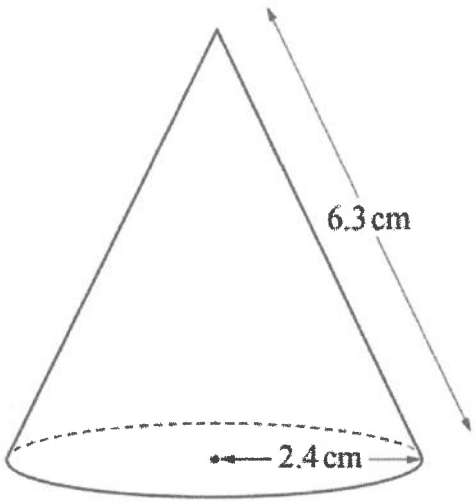
$\div 4\pi$ $\div 4\pi$

$$\frac{22}{3} = r^2$$

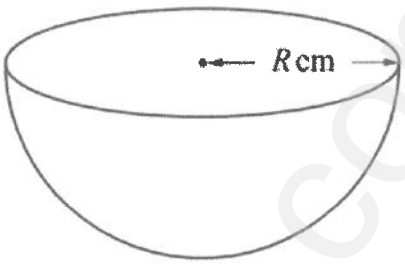
$$r = \sqrt{\frac{22}{3}}$$

$$= 2.71 \text{ cm}$$

3 (a)



NOT TO SCALE



The diagram shows a solid cone and a solid hemisphere.
The cone has radius 2.4 cm and slant height 6.3 cm.
The hemisphere has radius R cm.
The **total** surface area of the cone is equal to the **total** surface area of the hemisphere.

Calculate the value of R.

[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]
[The curved surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]

Cone:

Circle: $A = \pi r^2$

$= \pi \times 2.4^2$

$= \frac{144}{25}\pi$

curved surface:

$A = \pi r l$

$= \pi \times 2.4 \times 6.3$

$= \frac{378}{25}\pi$

S.A. of cone:

$\frac{144}{25}\pi + \frac{378}{25}\pi = \frac{522}{25}\pi$

Hemisphere:

Circle: $A = \pi R^2$

curved area: $A = \frac{1}{2} \times 4\pi R^2$

$= 2\pi R^2$

Total: $\pi R^2 + 2\pi R^2 = 3\pi R^2$

$3\pi R^2 = \frac{522}{25}\pi$

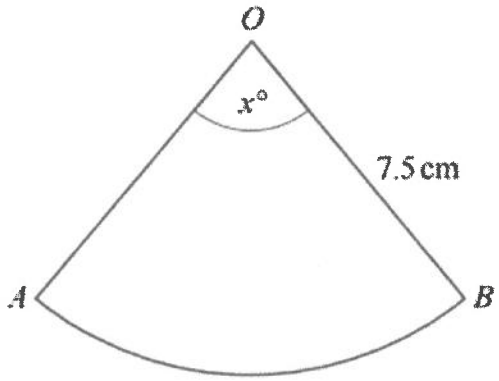
$\div 3\pi \quad \div 3\pi$

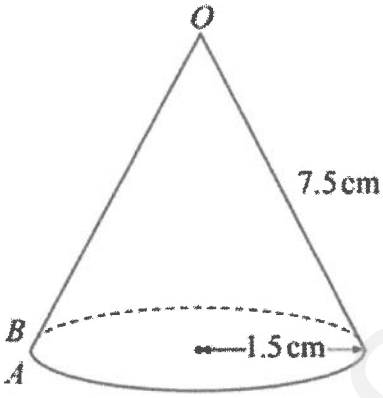
$R^2 = \frac{174}{25}$

$R = \sqrt{\frac{174}{25}}$

$R =$ 2.64 [4]

4 (a)





NOT TO SCALE

The diagram shows a sector of a circle that is made into a cone by joining OA to OB.
The sector angle is $x°$ and the radius of the sector is 7.5 cm.
The base radius of the cone is 1.5 cm.

Calculate the value of x.

Curved surface area:

$A = \pi r l$

$= \pi \times 1.5 \times 7.5$

$= 11.25\pi$ ← = area of sector

Area of sector:

$A = \frac{x}{360} \times \pi r^2$

$11.25\pi = \frac{x}{360} \times \pi \times 7.5^2$

$\times 360 \quad \times 360$

$4050\pi = 56.25\pi x$

$\div 56.25\pi \quad \div 56.25\pi$

$x = 72°$

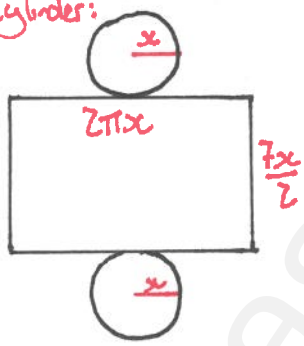
(d) A solid cylinder has radius x cm and height $\frac{7x}{2}$ cm.

The surface area of a sphere with radius R cm is equal to the total surface area of the cylinder.

Find an expression for R in terms of x.

[The surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]

Cylinder:



2 circles:

$A = \pi x^2$

Rectangle:

$A = 2\pi x \times \frac{7x}{2}$

$= 7\pi x^2$

S.A. of cylinder:

$\pi x^2 + 7\pi x^2 = 8\pi x^2$

S.A. of sphere:

$A = 4\pi R^2$

$8\pi x^2 = 4\pi R^2$

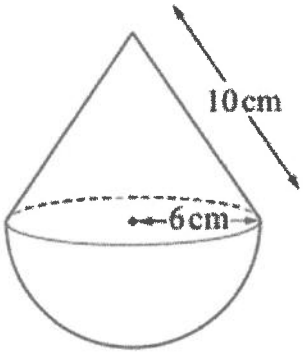
$\div 4\pi \quad \div 4\pi$

$2x^2 = R^2$

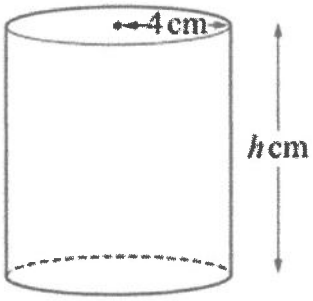
$R = \sqrt{2x^2}$

$R =$ ..... $\sqrt{2}x$ ..... [3]

13



Solid *A*



Solid *B*

NOT TO SCALE

The diagram shows solid *A* and solid *B*.
Solid *A* is made from a hemisphere and a cone each with radius 6 cm.
The cone has sloping edge 10 cm.
Solid *B* is a cylinder with radius 4 cm and height *h* cm.

The **total** surface area of solid *A* is equal to the **total** surface area of solid *B*.

(a) Work out the value of *h*.

A: top: $A = \pi r l$

$= \pi \times 6 \times 10$

$= 60\pi$

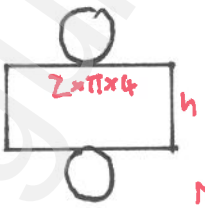
bottom: $A = \frac{1}{2} \times 4\pi r^2$

$= 2\pi \times 6^2$

$= 72\pi$

Total: $60\pi + 72\pi = 132\pi$

B:



Circles: $\pi \times 4^2$

$= 16\pi$

rectangle: $2 \times \pi \times 4 \times h$

$= 8\pi h$

Total S.A:

$2 \times 16\pi + 8\pi h$

$= 32\pi + 8\pi h$

$32\pi + 8\pi h = 132\pi$

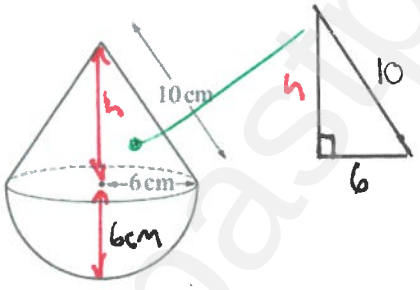
$-32\pi \quad -32\pi$

$8\pi h = 100\pi$

$\div 8\pi \quad \div 8\pi$

$h = 12.5\text{cm}$

(b) Work out the height of solid *A*.



$h^2 + 6^2 = 10^2$

$h^2 + 36 = 100$

$-36 \quad -36$

$h^2 = 64$

$h = \sqrt{64}$

$= 8\text{cm}$

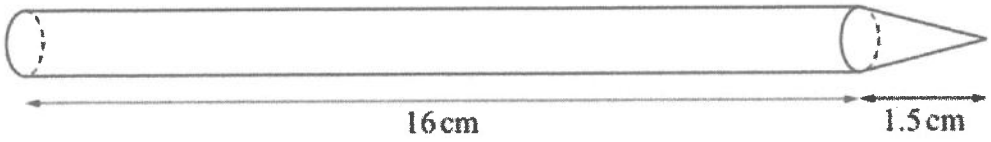
Total height

$= 8 + 6$

$= 14\text{cm}$

14 cm [3]

8 (a)

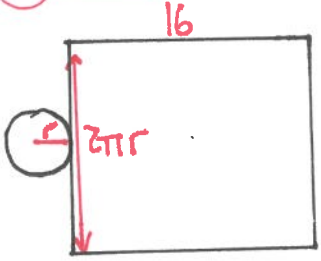


NOT TO SCALE

The diagram shows a solid made from a cylinder and a cone.
The height of the cylinder is 16 cm and the height of the cone is 1.5 cm.
The radius of the cylinder and the base radius of the cone are each 0.35 cm.

(i) Calculate the total surface area of the solid.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]

Cylinder.



Circle:

$A = \pi r^2$

$= \pi \times 0.35^2$

$= 0.38485$

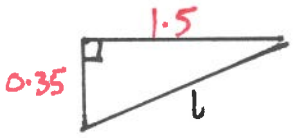
rectangle:

$A = 2\pi r \times 16$

$= 2\pi \times 0.35 \times 16$

$= 35.186$

Cone: Use pythagoras to find slant height:



$0.35^2 + 1.5^2 = l^2$

$2.3725 = l^2$

$l = 1.54$

Curved surface area:

$A = \pi r l$

$= \pi \times 0.35 \times 1.54$

$= 1.693$

Total surface area: $= 0.38485 + 35.186 + 1.693$

$= 37.26$

37.3 ..... cm^2 [5]

(d) A solid cone has radius $3R$ cm and slant height $9R$ cm.
A solid cylinder has radius x cm and height $7x$ cm.
The **total** surface area of the cone is equal to the **total** surface area of the cylinder.

Given that $R = kx$, find the value of k.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]

Cone:

Circle:

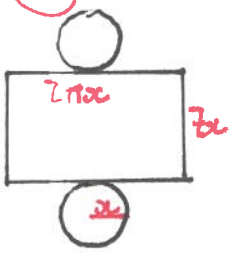
$A = \pi r^2$
$= \pi \times (3R)^2$
$= 9\pi R^2$

Curved surface:

$A = \pi rl$
$= \pi \times 3R \times 9R$
$= 27\pi R^2$

Total S.A. of cone: $9\pi R^2 + 27\pi R^2$
$= 36\pi R^2$

Cylinder:



2 circles:

$A = \pi r^2$
$= \pi x^2$

Rectangle:

$A = 2\pi x \times 7x$
$= 14\pi x^2$

Total S.A. of cylinder:

$2 \times \pi x^2 + 14\pi x^2 = 16\pi x^2$

Cone : cylinder:

$36\pi R^2 = 16\pi x^2$
$36\pi (kx)^2 = 16\pi x^2$
$\div 36\pi$ $\div 36\pi$
$k^2 x^2 = \frac{4}{9}x^2$

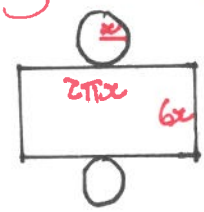
$k^2 = \frac{4}{9}$
$k = \frac{2}{3}$

(c) A solid cylinder has radius x and height $6x$.
A sphere of radius r has the same surface area as the total surface area of the cylinder.

Show that $r^2 = \frac{7}{2}x^2$.

[The surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]

Cylinder:



2 circles:

$A = \pi x^2$

Rectangle:

$A = 2\pi x \times 6x$
$= 12\pi x^2$

Total S.A. of cylinder:

$2 \times \pi x^2 + 12\pi x^2 = 14\pi x^2$

Sphere: $A = 4\pi r^2$

$14\pi x^2 = 4\pi r^2$
$\div 4\pi$ $\div 4\pi$

$\frac{7}{2}x^2 = r^2$

[4]