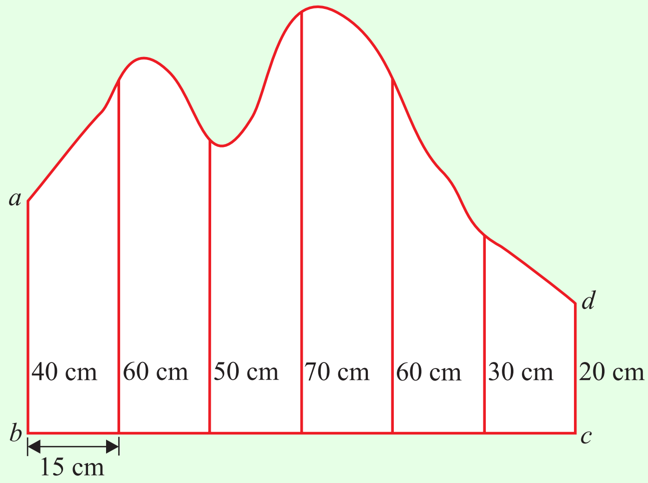
AREA & VOLUME (Q 1, PAPER 2)

1999

1 (a) The area of a square is 36 cm^2.
Find the length of a side of the square.

(b) A sketch of a piece of land *abcd* is shown.

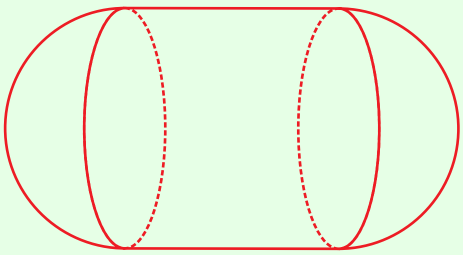


At equal intervals of 15 m along [*bc*], perpendicular measurements of 40 m, 60 m, 50 m, 70 m, 60 m, 30 m and 20 m are made to the top boundary.

Use Simpson's Rule to estimate the area of the piece of land. [See Tables, page 42].

(c) (i) Write down, in terms of π and r, the volume of a hemisphere with radius of length r.

(ii) A fuel storage tank is in the shape of a cylinder with a hemisphere at each end, as shown.



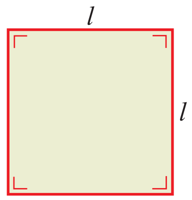
The capacity (internal volume) of the tank is 81π m^3.
The ratio of the capacity of the cylindrical section to the sum of the capacities of the hemispherical ends 5:4.

Calculate the internal radius length of the tank.

SOLUTION

1 (a)

2. SQUARE



l: Length

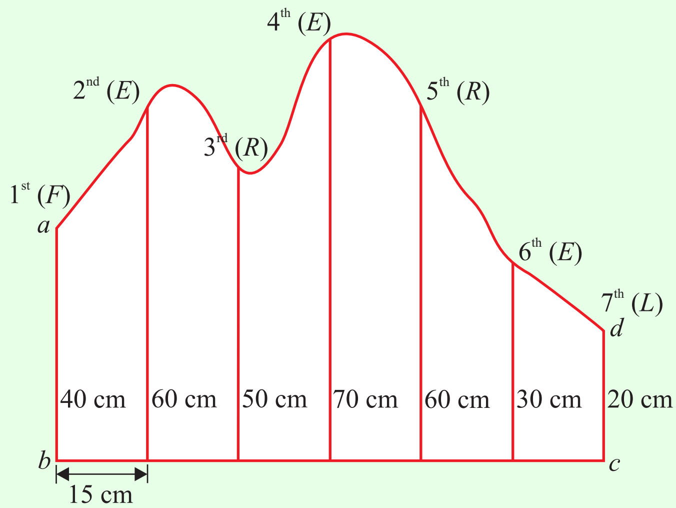
$A = l \times l = l^2$

$P = 4l$ **2**

$A = l^2 \Rightarrow 36 = l^2$

$\therefore l = \sqrt{36} = 6 \text{ cm}$

1 (b)



$A \approx \frac{h}{3}$ [(First + Last) + 4(Evens) + 2(Remaining Odds)] **11**

$h = 15 \text{ cm}$

$A \approx \frac{15}{3}[(40+20)+4(60+70+30)+2(50+60)]$

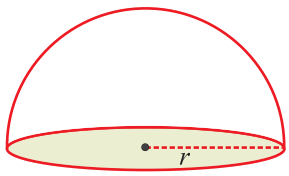
$\Rightarrow A \approx 5[(60)+4(160)+2(110)]$

$\Rightarrow A \approx 5[60+640+220]$

$\therefore A \approx 5[920] = 4600 \text{ cm}^2$

1 (c) (i)

HEMISPHERE



$V = \frac{2}{3}\pi r^3$

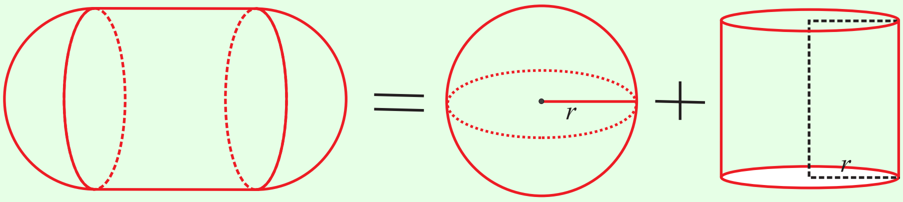
Curved SA: $A = 2\pi r^2$

Total SA: $A = 3\pi r^2$ **16**

$V = \frac{2}{3}\pi r^3$

1 (c) (ii)

The tank is made up of 2 hemispheres (i.e. one sphere) and a cylinder. The radius of the cylinder and the sphere is the same.



Volume of tank $=81\pi \text{ m}^3$

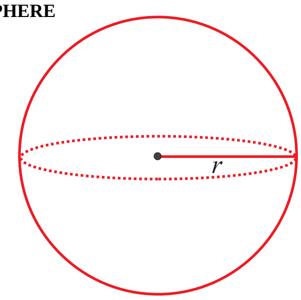
Ratio of the volume of the cylinder to the sphere is 5:4.

5 + 4 = 9.

Therefore, the volume of the sphere is $\frac{4}{9}$ of the overall volume.

Volume of the sphere $=\frac{4}{9}\times 81\pi = 36\pi \text{ m}^3$

SPHERE



$V=\frac{4}{3}\pi r^3$

Curved SA: $A=4\pi r^2$ **15**

Sphere:

$V=\frac{4}{3}\pi r^3 \Rightarrow 36\pi=\frac{4}{3}\pi r^3$

$\Rightarrow \dfrac{36\times 3}{4}=r^3$

$\Rightarrow r^3=27$

$\therefore r=\sqrt[3]{27}=3 \text{ cm}$