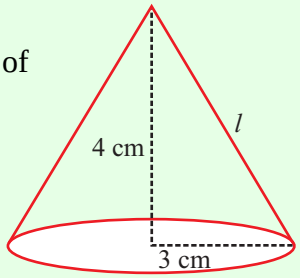
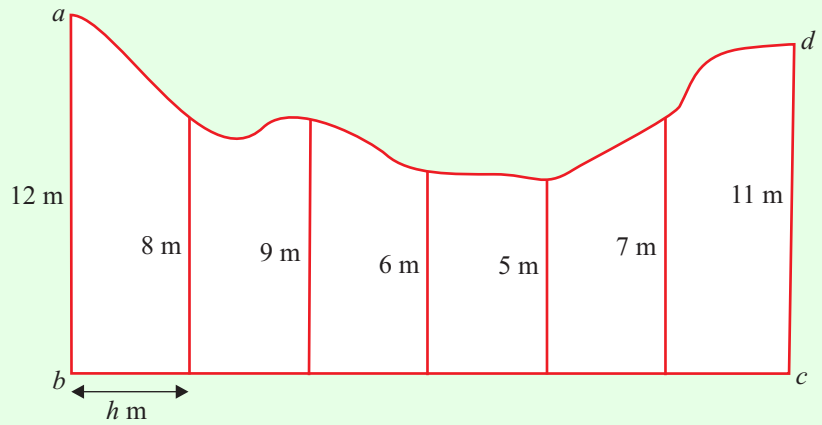
Area & Volume (Q 1, Paper 2)

1997

1 (a) Find the slant height, l, of a cone which has perpendicular height of 4 cm and base with radius of length 3 cm.
Write down the curved surface area of the cone in terms of π.



(b) The diagram shows a sketch of a piece of paper abcd with one uneven edge. At equal intervals of h cm along [bc], perpendicular measurements of 12 cm, 8 cm, 9 cm, 6 cm, 5 cm, 7 cm and 11 cm are made to the top edge.



Use Simpson's Rule the area of the piece of paper is estimated to be 180 cm^2. Calculate the value of h. [See Tables, page 42.]

(c) Find the volume of a solid sphere which has radius of length 2.1 cm. Give your answer correct to the nearest cm^3. Take $\frac{22}{7}$ as an approximation of π.

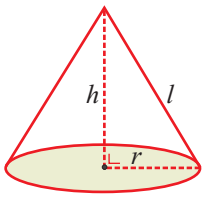
This sphere and a solid cube with edge of length 3 cm are completely submerged in water in a cylinder. The cylinder has radius of length r cm.

Both the sphere and the cube are then removed from the cylinder. The water level drops by 4 cm. Find r, correct to one place of decimals. [Take $\pi = \frac{22}{7}$.]

SOLUTION

1 (a)

CONE



$V = \frac{1}{3}\pi r^2 h$

Curved SA: $A = \pi rl$

Total SA: $A = \pi rl + \pi r^2$

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You can use Pythagoras on the cone: $l^2 = r^2 + h^2$

$h = 4$ cm, $r = 3$ cm

$l^2 = r^2 + h^2 \Rightarrow l^2 = 3^2 + 4^2$

$\Rightarrow l^2 = 9 + 16 = 25$

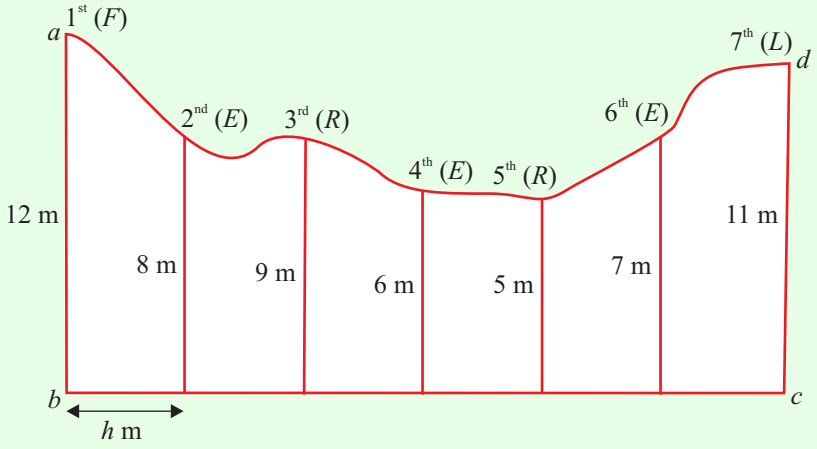
$\therefore l = \sqrt{25} = 5$ cm

Curved Surface Area:

$A = \pi rl \Rightarrow A = \pi(3)(5)$

$\therefore A = 15\pi$ cm^2

1 (b)



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

$A = 180$ cm^2

$180 = \frac{h}{3}[(12 + 11) + 4(8 + 6 + 7) + 2(9 + 5)]$

$\Rightarrow 180 = \frac{h}{3}[(23) + 4(21) + 2(14)]$

$\Rightarrow 180 = \frac{h}{3}[23 + 84 + 28]$

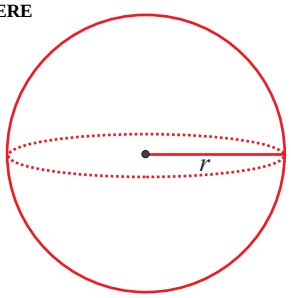
$\Rightarrow 180 = \frac{h}{3}[135]$

$\Rightarrow 180 = h[45]$

$\therefore h = \frac{180}{45} = 4$ cm

1 (c)

SPHERE



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

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

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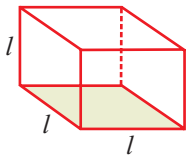
$r = 2.1$ cm, $\pi = \frac{22}{7}$

$V = \frac{4}{3}\pi r^3 \Rightarrow V = \frac{4}{3}(\frac{22}{7})(2.1)^3$

$\therefore V = 39$ cm^3

CUBE



l: Length

$V = l^3$

Surface Area $A = 6l^2$

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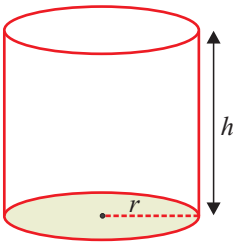
CYLINDER



$V = \pi r^2 h$

Curved SA: $A = 2\pi rh$

Total SA: $A = 2\pi rh + 2\pi r^2$

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Firstly, find the total volume of the sphere and cube.

CUBE: l = 3 cm

$V = l^3 \Rightarrow V = (3)^3 = 27$ cm^3

Total volume of sphere and cube = 39 + 27 = 66 cm^3

When the sphere and cube are removed from a cylinder of water, the height h falls by 4 cm.
The volume of this cylinder of water equals the volume of the sphere and cube.

r = ?, h = 4 cm, V = 66 cm^3

$V = \pi r^2 h \Rightarrow 66 = (\frac{22}{7})r^2(4)$

$$\Rightarrow r^2 = \frac{66 \times 7}{22 \times 4} = \frac{21}{4}$$

$\therefore r = \sqrt{\frac{21}{4}} = 2.3$ cm