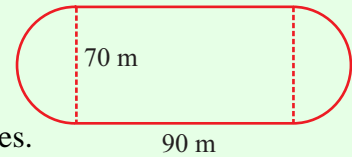## AREA & VOLUME (Q 1, PAPER 2)

2001

1 (a) A running track is made up of two straight parts
and two semicircular parts as shown in the diagram.
The length of each of the straight parts is 90 metres.
The diameter of each of the semicircular parts is 70 metres.
Calculate the length of the track correct to the nearest metre.

70 m

90 m

(b) The sketch shows a flood caused by a leaking underground pipe that runs from
a to b.

10 m   8 m   7 m

a x m x m x m x m b

3 m   4 m   2 m
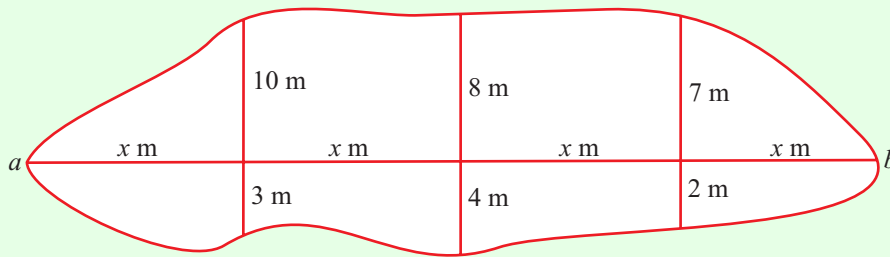
At equal intervals of x m along $[ab]$ perpendicular measurements are made to the
edges of the flood. The measurements to the top edge are 10 m, 8 m and 7 m. The
measurements to the bottom edge are 3 m, 4 m and 2 m. At a and b the
measurements are 0 m.

Using Simpson's Rule the area of the flood is estimated to be 672 m².

Find x and hence, write down the length of the pipe.

(c) Sweets, made from a chocolate mixture, are in the shape of solid spherical balls.
The diameter of each sweet is 3 cm.
36 sweets fit exactly in a rectangular box which has internal height 3 cm.
(i) The base of the box is a square. How many sweets are there in each row?

(ii) What is the internal volume of the box?

(iii) The 36 sweets weigh 675 grammes.
What is the weight of 1 cm³ of the chocolate mixture? Give your answer correct
to one decimal place.

SOLUTION

1 (a)

6. **CIRCLE**
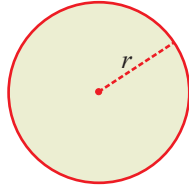
L: Length of Circumference
r: Radius

$$L = 2\pi r \quad \text{.......} \quad \mathbf{7}$$
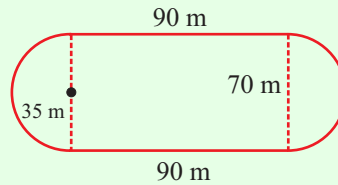
$$A = \pi r^2 \quad \text{.......} \quad \mathbf{8}$$

PERIMETER OF THE TRACK:

Straight parts = 90 m + 90 m = 180 m

Two half-circles = Full circle: $r = 35$ m

$L = 2\pi r \Rightarrow L = 2\pi(35)$

$\therefore L = 70\pi = 219.9$ m

Perimeter $P = 180 + 219.9 = 400$ m

90 m

70 m

35 m

90 m

1 (b)

2nd (E) 3rd (R) 4th (E)

1st (F)

13 m   12 m   9 m

5th (L)

a x m x m x m x m b
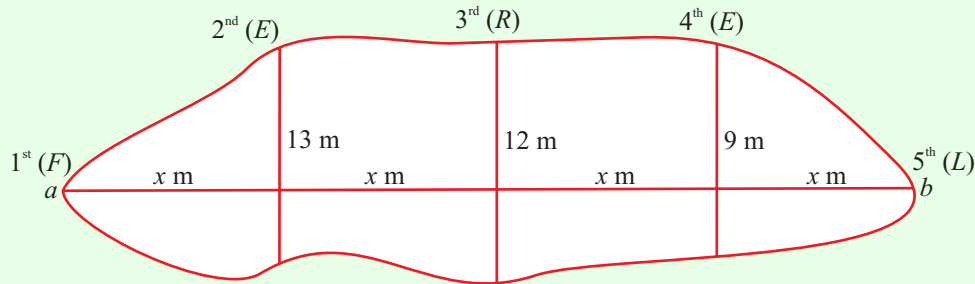
$$A \approx \frac{h}{3}\,[(\text{First} + \text{Last}) + 4(\text{Evens}) + 2(\text{Remaining Odds})] \quad \text{.......} \quad \mathbf{11}$$

$h = x, \ A = 672$ m^2

$672 \approx \frac{x}{3}[(0+0) + 4(13+9) + 2(12)]$

$\Rightarrow 672 \approx \frac{x}{3}[0 + 4(22) + 2(12)]$

$\Rightarrow 672 \approx \frac{x}{3}[88 + 24]$

$\Rightarrow 672 \approx \frac{x}{3}[112]$
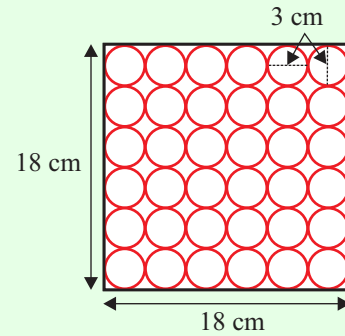
$\Rightarrow \dfrac{672 \times 3}{112} \approx x$

$\therefore x \approx 18$ m

Length of pipe $= 4 \times 18$ m $= 72$ m

1 (c) (i)
A diagram is drawn looking down on top of the
rectangular box with square base.
No. of sweets in each row = 6

3 cm

18 cm

18 cm

1 (c) (ii)

RECTANGULAR SOLID

h

b

l

l: Length
b: Breadth
h: Height

$V = l \times b \times h$

Surface Area $A = 2(lb + bh + lh)$

······· **12**

$V = l \times b \times h = 18 \times 18 \times 3 = 972$ cm^2

1 (c) (iii)

SPHERE

r

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

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

······· **15**

Calculate the volume of the 36 sweets: $r = \frac{3}{2}$ cm

$V = 36 \times \frac{4}{3}\pi r^3 \Rightarrow V = 36 \times \frac{4}{3}\pi \left(\frac{3}{2}\right)^3$

$\therefore V = 508.9$ cm^3

Weight of 1 cm^3 of mixture $= \dfrac{675}{508.9}$ g $= 1.3$ g