# Mathematics

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## (Chapter – 13) (Surface Areas and Volumes)

(Class – IX)

### EXERCISE 13.2

**Q.1.** *The curved surface area of a right circular cylinder of height* 14 *cm is* 88 $cm^2$. *Find the diameter of the base of the cylinder.*

**Sol.** Here, $h$ = 14 cm, curved, surface area = 88 $cm^2$, $r$ = ?

Curved surface area of the cylinder = $2\pi rh$

$$\Rightarrow 88 = 2 \times \frac{22}{7} \times r \times 14$$

$$\Rightarrow 88 = 44 \times 2 \times r$$

$$\Rightarrow r = \frac{88}{44 \times 2} = 1$$

Hence, base diameter of the cylinder = 1 × 2cm = 2 cm **Ans.**

**Q.2.** *It is required to make a closed cylindrical tank of height* 1 *m and base diameter* 140 *cm from a metal sheet. How many square metres of the sheet are required for the same?.*

**Sol.** Here, $h$ = 1 m, $r = \frac{140}{2}$ cm = 70 cm = 0.7 m

Total surface area of the cylinder = $2\pi r\ (h + r)$

$$= 2 \times \frac{22}{7} \times 0.7\ (1 + 0.7)\ m^2$$

$$= 44 \times 0.1 \times 1.7\ m^2 = 7.48\ m^2$$

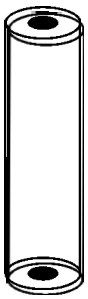
Hence, 7.48 $m^2$ of sheet is required **Ans.**

**Q.3.** *A metal pipe is* 77 *cm long. The inner diameter of a cross section is* 4 *cm, the outer diameter being* 4.4 *cm (see figure). Find its.*

*(i) inner curved surface area,*

*(ii) outer curved surface area,*

*(iii) total surface area.*



**Sol.** Here, $h$ = 77 cm,

Outer radius (R) = $\frac{4.4}{2}$ cm = 2.2 cm,

Inner radius ($r$) = $\frac{4}{2}$ cm = 2 cm

(i) Inner curved surface area of the pipe

$$= 2\pi rh$$

$$= 2 \times \frac{22}{7} \times 2 \times 77\ cm^2$$

$$= 2 \times 22 \times 22\ cm^2 = \mathbf{968\ cm^2}\ \textbf{Ans.}$$

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(ii) Outer curved surface area of the pipe = $2\pi Rh$

$= 2 \times \frac{22}{7} \times 2.2 \times 77 \text{ cm}^2 = 44 \times 24.2 \text{ cm}^2$

**$= 1064.80 \text{ cm}^2$ Ans.**

(iii) Total surface area of the pipe = inner curved surface area + outer curved surface area + areas of the two base rings.

$= 2\pi rh + 2\pi Rh + 2\pi (R^2 - r^2)$

$= 968 \text{ cm}^2 + 1064.80 \text{ cm}^2 + 2 \times \frac{22}{7} [(2.2)^2 - 2^2] \text{ cm}^2$

$= 2032.80 \text{ cm}^2 + 5.28 \text{ cm}^2$ **$= 2038.08 \text{ cm}^2$ Ans.**

**Q.4.** *The diameter of a roller is* 84 *cm and its length is* 120 *cm. It takes* 500 *complete revolutions to move once over to level a playground. Find the area of the playground in* $m^2$.

**Sol.** Radius of the roller ($r$) = $\frac{84}{2}$ cm = 42 cm

Length of the roller ($h$) = 120 cm

Curved surface area of the roller = $2\pi rh$

$= 2 \times \frac{22}{7} \times 42 \times 120 \text{ cm}^2 = 44 \times 720 \text{ cm}^2 = 31680 \text{ cm}^2$

$\therefore$ area covered by the roller in 1 revolution = $31680 \text{ cm}^2$

$\therefore$ area covered by the roller in 500 revolutions = $31680 \times 500 \text{ cm}^2$

$= 15840000 \text{ cm}^2$

Hence, area of the playground = $\frac{15840000}{100 \times 100} \text{ m}^2$ **$= 1584 \text{ m}^2$ Ans.**

**Q.5.** *A cylindrical pillar is* 50 *cm in diameter and* 3.5 *m in height. Find the cost of painting the curved surface of the pillar at the rate of Rs* 12.50 *per* $m^2$.

**Sol.** Here, $r = \frac{50}{2}$ cm = 25 cm = 0.25 m, $h$ = 3.5 m

Curved surface area of the pillar = $2\pi rh$

$= 2 \times \frac{22}{7} \times 0.25 \times 3.5 \text{ m}^2 = 5.5 \text{ m}^2$

Cost of painting 1 $\text{m}^2$ = Rs 12.50

$\therefore$ Total cost of painting the curved surface of the pillar

= Rs $12.50 \times 5.5$ **= Rs 68.75 Ans.**

**Q.6.** *Curved surface area of a right circular cylinder is* 4.4 $m^2$. *If the radius of the base of the cylinder is* 0.7 *m, find its height.*

**Sol.** Curved surface area of the cylinder = 4.4 $\text{m}^2$, $r$ = 0.7 m, $h$ = ?

Curved surface area of the cylinder = $2\pi rh$.

$\Rightarrow \quad 4.4 = 2 \times \frac{22}{7} \times 0.7 \times h$

$\Rightarrow \quad h = \frac{4.4}{4.4} = 1$

Hence, height of the cylinder is 1 m **Ans.**

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**Q.7.** *The inner diameter of a circular well is* 3.5 *m. It is* 10 *m deep. Find*
*(i) its inner curved surface area,*
*(ii) the cost of plastering this curved surface at the rate of Rs* 40 *per* $m^2$.

**Sol.** Here, $r = \frac{3.5 \text{ m}}{2}$, $h = 10$ m

(i) Inner curved surface area of the well

$= 2\pi rh = 2 \times \frac{22}{7} \times \frac{3.5}{2} \times 10\text{m}^2$

$= 22 \times 5 \text{ m}^2$ **$= 110 \text{ m}^2$ Ans.**

(ii) Cost of plastering 1 $m^2$ = Rs 40

$\therefore$ Cost of plastering the curved surface area of the well

= Rs $110 \times 40$ **= Rs 4400 Ans.**

**Q.8.** *In a hot water heating system. there is a cylindrical pipe of length* 28 *m and diameter* 5 *cm. Find the total radiating surface in the system.*

**Sol.** Here, $r = \frac{5}{2}$ cm = 2.5 cm = 0.025 m, $h = 28$ m.

Total radiating surface in the system = total surface area of the cylinder

$= 2\pi\, r(h + r)$

$= 2 \times \frac{22}{7} \times 0.025\ (28 + 0.025)\ \text{m}^2$

$= \frac{44 \times 0.025 \times 28.025}{7}\ \text{m}^2$ **$= 4.4 \text{ m}^2$ (approx) Ans.**

**Q.9.** *Find*
*(i) the lateral or curved surface area of a closed cylindrical petrol storage tank that is* 4.2 *m in diameter and* 4.5 *m high.*
*(ii) how much steel was actually used, if* $\frac{1}{12}$ *of the steel actually used was wasted in making the tank.*

**Sol.** Here, $r = \frac{4.2}{2}$ m = 2.1 m, $h = 4.5$ m

(i) Curved surface area of the storage tank = $2\pi rh$

$= 2 \times \frac{22}{7} \times 2.1 \times 4.5\ \text{m}^2$ **$= 59.4 \text{ m}^2$ Ans.**

(ii) Total surface area of the tank = $2\pi r\ (h + r)$

$= 2 \times \frac{22}{7} \times 2.1\ (4.5 + 2.1)\ \text{m}^2$

$= 44 \times 0.3 \times 6.6\ \text{m}^2 = 87.12\ \text{m}^2$

Let the actual area of steel used be $x$ $m^2$.

Area of steel wasted $= \frac{1}{12}$ of $x\ \text{m}^2 = \frac{x}{12}\ \text{m}^2$. ... (i)

$\therefore$ area of the steel used in the tank $= \left(x - \frac{x}{12}\right)\text{m}^2 = \frac{11}{12}\ x\ \text{m}^2$

$\Rightarrow 87.12 = \frac{11}{12}\ x$

$\Rightarrow \quad x = \frac{87.12 \times 12}{11} = 95.04\ \text{m}^2$

Hence, 95.04 $m^2$ of steel was actually used **Ans.**

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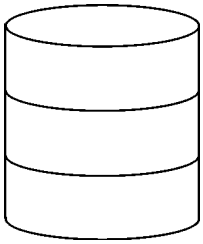
**Q.10.** *In the figure, you see the frame of a lampshade. It is to be covered with a decorative cloth. The frame has a base diameter of 20 cm and height of 30 cm. A margin of 2.5 cm is to be given for folding it over the top and bottom of the frame. Find how much cloth is required for covering the lampshade.*



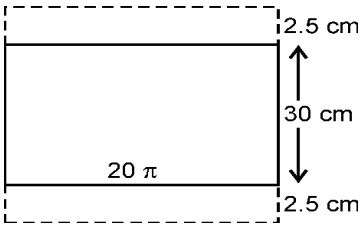
**Sol.** Here, $r = \frac{20}{2}$ cm = 10 cm

Height = 30 cm

Circumference of the base of the frame = $2\pi r$

$= 2\pi \times 10$ cm $= 20\pi$ cm

Height of the frame = 30 cm




Height of the cloth needed for covering the frame (including the margin) = (30 + 2.5 + 2.5) cm = 35 cm

Also, breadth of the cloth = circumference of the base of the frame.

∴ Area of the cloth required for covering the lampshade = length × breadth

$= 35 \times 20\pi$ cm$^2$ $= 35 \times 20 \times \frac{22}{7}$ cm$^2$ **= 2200 cm$^2$ Ans.**

**Q.11.** *The students of a Vidyalaya were asked to participate in a competition for making and decorating penholders in the shape of a cylinder with a base, using cardboard. Each penholder was to be of radius 3 cm and height 10.5 cm. The Vidyalaya was to supply the competitors with cardboard. If there were 35 competitors, how much cardboard was required to be bought for the competition?*

**Sol.** Here, $r = 3$ cm, $h = 10.5$ cm

The penholders have only one base i.e., these are open at one end.

Total surface area of 1 penholder

$= 2\pi rh + \pi r^2 = \pi r\,(2h + r)$

$= \frac{22}{7} \times 3\,(2 \times 10.5 + 3)$ cm$^2$

$= \frac{22}{7} \times 3 \times 24$ cm$^2$

Total surface area of 35 penholders $= \frac{22}{7} \times 3 \times 24 \times 35$ cm$^2$ $= 7920$ cm$^2$

Hence, 7920 cm$^2$ of cardboard is needed **Ans.**