

Mathematics

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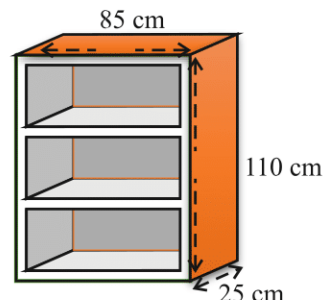
(Chapter - 13)(Surface Areas and Volumes)

(Class - 9)

Exercise 13.9 (Optional)

Question 1:

A wooden bookshelf has external dimensions as follows: Height = 110 cm, Depth = 25 cm, Breadth = 85 cm (see Figure). The thickness of the plank is 5 cm everywhere. The external faces are to be polished and the inner faces are to be painted. If the rate of polishing is 20 paise per cm^2 and the rate of painting is 10 paise per cm^2 , find the total expenses required for polishing and painting the surface of the bookshelf.



Answer 1:

Dimensions of bookshelf:

Length $L = 110$ cm, Breadth $B = 85$ cm and Height $H = 25$ cm.

The thickness of the plank = 5 cm

Therefore, the internal dimensions of bookshelf:

Length $l = 110 - 5 - 5 = 100$ cm, breadth $b = 85 - 5 - 5 = 75$ cm and height $h = 25 - 5 = 20$ cm.

The outer surface area of bookshelf = $LB + 2(BH + HL)$

$$= 110 \times 85 + 2(85 \times 25 + 25 \times 110)$$

$$= 9350 + 9750 = 19100 \text{ cm}^2$$

Area of borders = $4(75 \times 5) + 2(110 \times 5)$

$$= 1500 + 1100 = 2600 \text{ cm}^2$$

Total area to be polished = $19100 + 2600 = 21700 \text{ cm}^2$

Cost of polishing at the rate of 20 paise per $\text{cm}^2 = ₹ 21700 \times 0.20 = ₹ 4340$

The inner surface area of bookshelf = $lb + 2(bh + hl)$

$$= 100 \times 75 + 2(75 \times 20 + 20 \times 100) = 7500 + 7000 = 14500 \text{ cm}^2$$

Area of two planks = $4(75 \times 20) = 6000 \text{ cm}^2$

Internal area that is covered by planks = $4(5 \times 20) + 2(5 \times 75) = 400 + 750 = 1150 \text{ cm}^2$

Therefore, the total area to be painted = $14500 + 6000 - 1150 = 19350 \text{ cm}^2$

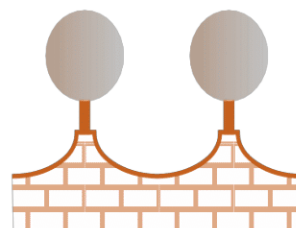
Cost of painting at the rate of 10 paise per $\text{cm}^2 = ₹ 19350 \times 0.10 = ₹ 1935$

Therefore, the total cost of painting and polishing = $₹ 4340 + ₹ 1935 = ₹ 6275$

Hence, the total expenses for polishing and painting the surface of the bookshelf is ₹ 6275.

Question 2:

The front compound wall of a house is decorated by wooden spheres of diameter 21 cm, placed on small supports as shown in Figure. Eight such spheres are used for this purpose, and are to be painted silver. Each support is a cylinder of radius 1.5 cm and height 7 cm and is to be painted black. Find the cost of paint required if silver paint costs 25 paise per cm^2 and black paint costs 5 paise per cm^2 .



Answer 2:

Radius of sphere $R = 21/2 = 10.5$ cm

Radius of cylindrical support $r = 1.5$ cm and height $h = 7$ cm

Surface area of sphere = $4\pi R^2$

$$= 4 \times \frac{22}{7} \times 10.5 \times 10.5$$

$$= 4 \times 22 \times 1.5 \times 10.5$$

$$= 1386 \text{ cm}^2$$

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Area of hidden surface by cylindrical support = πr^2

$$= \frac{22}{7} \times 1.5 \times 1.5$$

$$= 7.07 \text{ cm}^2$$

Total area of 1 sphere for silver painting = $1386 - 7.07 = 1378.93 \text{ cm}^2$

Therefore, the total area of 8 sphere for silver painting = $8 \times 1378.93 = 11031.44 \text{ cm}^2$

Total cost of painting at the rate of 25 paise per $\text{cm}^2 = ₹ 11031.44 \times 0.25 = ₹ 2757.86$

Radius of cylindrical support $r = 1.5 \text{ cm}$ and height $h = 7 \text{ cm}$

The curved surface area of cylindrical part = $2\pi rh$

$$= 2 \times \frac{22}{7} \times 1.5 \times 7$$

$$= 2 \times 22 \times 1.5$$

$$= 66 \text{ cm}^2$$

Total area of 1 cylindrical support for black painting = 66 cm^2

Therefore, the total area of 8 cylindrical support for black painting = $8 \times 66 = 528 \text{ cm}^2$

Cost of painting at the rate of 5 paise per $\text{cm}^2 = ₹ 528 \times 0.05 = ₹ 26.40$

Therefore, the total cost of painting = $₹ 2757.86 + ₹ 26.40 = ₹ 2784.26$

Hence, the total cost of silver and black painting is ₹ 2784.26.

Question 3:

The diameter of a sphere is decreased by 25%. By what per cent does its curved surface area decrease?

Answer 3:

Let the diameter of sphere be $2R$.

Therefore, the radius = R

Surface area of sphere = $4\pi R^2$

If the diameter is decreased by 25%, the new diameter $2R'$

$$= 2R - 25\% \text{ of } 2R$$

$$= 2R - 2R \times \frac{25}{100}$$

$$= 2R - \frac{1}{2}R = \frac{3}{2}R$$

Radius of new sphere = $R' = \frac{3}{4}R$

Surface area of new sphere = $4\pi(R')^2 = 4\pi\left(\frac{3}{4}R\right)^2 = \frac{9}{4}\pi R^2$

Decrease in surface area = $4\pi R^2 - \frac{9}{4}\pi R^2 = \frac{7}{4}\pi R^2$

So, the percent decrease in surface area = $\frac{\frac{7}{4}\pi R^2}{4\pi R^2} \times 100 = \frac{7}{16} \times 100 = 43.75$

Hence, the surface area of new sphere is decreased by 43.75 %.