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RD Sharma Solutions for Class 9 Maths Chapter 19 Surface Area and Volume of A Right Circular Cylinder

Exercise 19.1 Page No: 19.7

Question 1: 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.

Solution:

Radius of the base of the cylinder = r = 0.7 m (Given)

Curved surface area of cylinder = C.S.A = $4.4m^2$ (Given)

Let 'h' be the height of the cylinder.

We know, curved surface area of a cylinder = $2\pi rh$

Therefore,

$2\pi rh = 4.4$

$2 \times 3.14 \times 0.7 \times h = 4.4$

[using $\pi=3.14$]

or $h = 1$

Therefore the height of the cylinder is 1 m.

Question 2: 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.

Solution:

Height of cylinder (h) = Length of cylindrical pipe = 28 m or 2800 cm (Given)
[1 m = 100 cm]

Diameter of circular end of pipe = 5 cm (given)

Let 'r' be the radius of circular end, then r = diameter/2 = 5/2 cm

We know, Curved surface area of cylindrical pipe = $2\pi rh$

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= 2 x 3.14 x 5/2 x 2800
[using π = 3.14]

= 44000

Therefore, the area of radiating surface is 44000 cm^2.

Question 3: 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.

Solution:
Height of cylindrical pillar (h) = 3.5 m

Radius of circular end of pillar (r) = 50/2 cm = 25 cm = 0.25 m
[As radius = half of the diameter] and [1 m = 100 cm]

Curved surface area of cylindrical pillar = 2πrh

= 2 x 3.14 x 0.25 x 3.5

= 5.5
Curved surface area of cylindrical pillar is 5.5 m.

Find the cost:

Cost of whitewashing $1m^2$ is Rs 12.50 (Given)

Cost of whitewashing 5.5 m^2 area = Rs. 12.50 x 5.5 = Rs. 68.75

Thus the cost of whitewashing the pillar is Rs 68.75.

Question 4: It is required to make a closed cylindrical tank of height 1 m and the base diameter of 140 cm from a metal sheet. How many square meters of the sheet are required for the same?
Solution:

Height of cylindrical tank (h) = 1 m

Base radius of cylindrical tank (r) = diameter/2 = 140/2 cm = 70 cm = 0.7 m

[1 m = 100 cm]

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Now,
Area of sheet required = Total surface area of tank (TSA) = $2\pi r(h + r)$

$=2 \times 3.14 \times 0.7(1 + 0.7)$

$= 7.48$

Therefore, 7.48 m^2 metal sheet is required to make required closed cylindrical tank.

Question 5: A solid cylinder has a total surface area of 462 cm^2. Its curved surface area is one-third of its total surface area. Find the radius and height of the cylinder.

Solution:
Total surface area of a cylinder = 462 cm^2 (Given)

As per given statement:
Curved or lateral surface area = 1/3 (Total surface area)

$\Rightarrow 2\pi rh = 1/3(462)$

$\Rightarrow 2\pi rh = 154$

$\Rightarrow h = 49/2r$ ....(1)
[Using $\pi = 22/7$]

Again,

Total surface area = 462 cm^2

$2\pi r(h + r) = 462$

$2\pi r(49/2r + r) = 462$

or $49 + 2r^2 = 147$

or $2r^2 = 98$

or $r = 7$

Substitute the value of r in equation (1), and find the value of h.
$h = 49/2(7) = 49/14 = 7/2$

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Height (h) = 7/2 cm

Answer: Radius = 7 cm and height = 7/2 cm of the cylinder

Question 6: The total surface area of a hollow cylinder which is open on both the sides is 4620 sq.cm and the area of the base ring is 115.5 sq.cm and height is 7 cm. Find the thickness of the cylinder.

Solution:
Given:
Total surface area of hollow cylinder = 4620 cm^2
Height of cylinder (h) = 7 cm
Area of base ring = 115.5 cm^2

To find: Thickness of the cylinder

Let 'r_1' and 'r_2' are the inner and outer radii of the hollow cylinder respectively.

Then, $\pi r_2^2 - \pi r_1^2 = 115.5$ .....(1)
And,
$2\pi r_1 h + 2\pi r_2 h + 2(\pi r_2^2 - \pi r_1^2) = 4620$

Or $2\pi h (r_1 + r_2) + 2 \times 115.5 = 4620$
(Using equation (1) and h = 7 cm)

or $2\pi 7 (r_1 + r_2) = 4389$

or $\pi (r_1 + r_2) = 313.5$ ....(2)

Again, from equation (1),

$\pi r_2^2 - \pi r_1^2 = 115.5$

or $\pi(r_2 + r_1)(r_2 - r_1) = 115.5$
[using identity: a^2 – b^2 = (a – b)(a + b)]

Using result of equation (2),

$313.5 (r_2 - r_1) = 115.5$

or $r_2 - r_1 = 7/19 = 0.3684$

Therefore, thickness of the cylinder is 7/19 cm or 0.3684 cm.

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Question 7: Find the ratio between the total surface area of a cylinder to its curved surface area, given that height and radius of the tank are 7.5 m and 3.5 m.

Solution:
Height of cylinder (h) = 7.5 m
Radius of cylinder (r) = 3.5 m

We know, Total Surface Area of cylinder (T.S.A) = $2\pi r(r+h)$

And, Curved surface area of a cylinder(C.S.A) = $2\pi rh$

Now, Ratio between the total surface area of a cylinder to its curved surface area is

T.S.A/C.S.A = $2\pi r(r+h)/2\pi rh$

= $(r + h)/h$

= $(3.5 + 7.5)/7.5$

= $11/7.5$

= 22/15 or 22:15

Therefore the required ratio is 22:15.

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Exercise 19.2 Page No: 19.20

Question 1: A soft drink is available in two packs- (i) a tin can with a rectangular base of length 5 cm and width 4 cm, having a height of 15 cm and (ii) a plastic cylinder with circular base of diameter 7 cm and height 10 cm, Which container has greater capacity and by how much?

Solution:
(i) Dimensions of a cubical tin can:
Length (L) = 5 cm
Breadth (B) = 4 cm
Height (H) = 15 cm

Capacity of the tin can = Volume of Tin Can = l x b x h cubic units = (5 x 4 x 15) cm^3 = 300 cm^3

(ii) Radius of the circular end of the plastic cylinder (R) = diametr/2 = 7/2 cm = 3.5 cm

Height of plastic cylinder (H) = 10 cm

Capacity of plastic cylinder = Volume of cylindrical container = $\pi R^2H = 22/7 \times (3.5)^2 \times 10\ cm^3 = 385\ cm^3$

From (i) and (ii) results, the plastic cylinder has greater capacity.

Difference in capacity = (385 – 300) cm^3 = 85 cm^3

Question 2: The pillars of a temple are cylindrically shaped. If each pillar has a circular base of radius 20 cm and height 10 m. How much concrete mixture would be required to build 14 such pillars?

Solution:
In this case, we have to find the volume of the cylinders.

Given:
Radius of the base of a cylinder = 20 cm
Height of cylinder = 10 m = 1000 cm
[1m = 100 cm]
Volume of the cylindrical pillar = πR^2H

= $(22/7 \times 20^2 \times 1000)\ cm^3$

= 8800000/7 cm^3 or 8.87 m^3

Therefore, volume of 14 pillars = 14 x 8.87 m^3 = 17.6 m^3

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Question 3: The inner diameter of a cylindrical wooden pipe is 24 cm and its outer diameter is 28 cm. The length of the pipe is 35 cm. Find the mass of the pipe, if 1 cm^3 of wood has a mass of 0.6 gm.

Solution:
Let r and R be the inner and outer radii of cylindrical pipe.

Inner radius of a cylindrical pipe (r) = 24/2 = 12 cm

Outer radius of a cylindrical pipe (R) = 24/2 = 14 cm

Height of pipe (h) = length of pipe = 35 cm

Mass of pipe = volume x density = $\pi(R^2 - r^2)h$

= $22/7(14^2 - 12^2)35$

= 5720

Mass of pipe is 5720 cm^3

Mass of 1 cm^3 wood = 0.6 gm (Given)

Therefore, mass of 5720 cm^3 wood = 5720 x 0.6 = 3432 gm = 3.432 kg

Question 4: If the lateral surface of a cylinder is 94.2 cm^2 and its height is 5 cm, find:

i) radius of its base (ii) volume of the cylinder
[Use $\pi = 3.141$]

Solution:

Lateral surface of the cylinder = 94.2 cm^2

Height of the cylinder = 5 cm

Let 'r' be the radius.
(i) Lateral surface of the cylinder = 94.2 cm^2
$2\pi rh = 94.2$
or $2 \times 3.14 \times r \times 5 = 94.2$
or r = 3 cm

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(ii) Volume of the cylinder = $\pi r^2 h$
= (3.14 x ^{32} x 5) cm^3
= 141.3 cm^3

Question 5: The capacity of a closed cylindrical vessel of height 1 m is 15.4 liters. How many square meters of the metal sheet would be needed to make it?

Solution:

Given, The capacity of a closed cylindrical vessel of height 1 m is 15.4 liters.

Height of the cylindrical vessel = 15.4 litres = 0.0154 m^3
[1m^3 = 1000 litres]

Let 'r' be the radius of the circular ends of the cylinders, then

$\pi r^2 h$ = 0.0154 m^3
3.14 x r^2 x 1 = 0.0154 m^3
or r = 0.07 m
Again,
Total surface area of a vessel = $2\pi r(r+h)$

= 2(3.14(0.07)(0.07+1)) m^2
= 0.470 m^2

Question 6: A patient in a hospital is given soup daily in a cylindrical bowl of diameter 7 cm. If the bowl is filled with soup to a height of 4 cm, how much soup the hospital has to prepare daily to serve 250 patients?

Solution:
Radius of cylindrical bowl (R) = diameter/2 = 7/2 cm = 3.5 cm
Height = 4 cm
Now,
Volume of soup in 1 bowl = $\pi r^2 h$

= $22/7 \times 3.5^2 \times 4$ cm^3
= 154 cm^3

Volume of soup in 250 bowls = (250 x 154) cm^3
= 38500 cm^3
= 38.5 liters

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Thus, hospital has to prepare 38.5 liters of soup daily in order to serve 250 patients.

Question 7: A hollow garden roller, 63 cm wide with a girth of 440 cm, is made of 4 cm thick iron. Find the volume of the iron.

Solution:
The outer circumference of the roller = 440 cm
Thickness of the roller = 4 cm and
Its height (h) = 63 cm
Let 'R' be the external radius and 'r' be the inner radius of the roller.

Circumference of roller = $2\pi R = 440$
Or $2\pi R = 440$
$2x22/7 \times R = 440$

or $R = 70$

And, inner radius 'r' is given as

$\Rightarrow r = R - 4$

$\Rightarrow r = 70 - 4$

$\Rightarrow r = 66$
Inner radius is 66 cm

Now, volume of the iron is given as

$V = \pi(R^2 - r^2)h$

$V = 22/7\ (70^2 - 66^2)63$

$V = 107712$
Therefore, required volume is 107712 cm^3.

Question 8: A solid cylinder has a total surface area of 231 cm^2. Its curved surface area is 2/3 of the total surface area. Find the volume of the cylinder.

Solution:

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Total surface area = 231 cm^2

As per given statement: Curved surface area = 2/3(Total surface area)

Curved surface area = 2/3 x 231 = 154

So, Curved surface area = 154 cm^2 ...(1)

We know, Curved surface area of cylinder = $2\pi rh + 2\pi r^2$
Or $2\pi rh + 2\pi r^2 = 231$ .....(2)

Here $2\pi rh$ is the curved surface area, so using (1), we have

=> $154 + 2\pi r^2 = 231$

=> $2\pi r^2 = 231 - 154$

=> $2 \times 22/7 \times r^2 = 77$

=> $r^2 = 49/4$

or $r = 7/2$

Find the value of h:

CSA = 154 cm^2

=> $2\pi rh = 154$

=> $2 \times 22/7 \times 7/2 \times h = 154$

=> $h = 154/22$

=> $h = 7$
Now,
Find Volume of the cylinder:
$V = \pi r^2 h$
$= 22/7 \times 7/2 \times 7/2 \times 7$
= 269.5
The volume of the cylinder is 269.5 cm^3

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Question 9: The cost of painting the total outside surface of a closed cylindrical oil tank at 50 paise per square decimetre is Rs 198. The height of the tank is 6 times the radius of the base of the tank. Find the volume corrected to 2 decimal places.

Solution:

Let 'r' be the radius of the tank.

As per given statement: Height (h) = 6(Radius) = 6r dm

Cost of painting for 50 paisa or Rs 1/2 per dm^2 = Rs 198 (Given)

=> $2\pi r(r+h) \times 1/2 = 198$

=> $2\times22/7\times r(r+6r) \times 1/2 = 198$

=> r = 3 dm

And, h = (6 x 3) dm = 18 dm

Now,

Volume of the tank = $\pi r^2h = 22/7\times9\times18 = 509.14\ dm^3$

Question 10: The radii of two cylinders are in the ratio 2 : 3 and their heights are in the ratio 5 : 3. Calculate the ratio of their volumes and the ratio of their curved surfaces.

Solution:

Let the radius of the cylinders be 2x and 3x and the height of the cylinders be 5y and 3y.

$$\frac{\text{(Volume of cylinder 1)}}{\text{(Volume of cylinder 2)}} = \frac{\pi(2x)^2 5y}{\pi(3x)^2 3y} = \frac{20}{27}$$

$$\frac{\text{Surface area of cylinder 1}}{\text{Surface area of cylinder 2}} = \frac{2\pi\times2x\times5y}{2\pi\times3x\times3y} = = \frac{10}{9}$$

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Question 11: The ratio between the curved surface area and the total surface area of a right circular cylinder is 1:2. Find the volume of the cylinder, if its total surface area is 616 cm^2.

Solution:
Total surface area (T.S.A) = 616 cm^2 (given)

Let r be the radius of cylinder and h be the radius of cylinder.

As per given statement:
(curved surface area / (total surface area) = 1/2

or CSA = 12 TSA

CSA = 12 x 616 = 308

=> CSA = 308 cm^2

Now,

TSA = $2\pi rh + 2\pi r^2$

=> 616 = CSA + $2\pi r^2$

=> 616 = 308 + $2\pi r^2$

=> $2\pi r^2$ = 616 – 308

=> $2\pi r^2$ = 308/2π

=> r^2 = 49
or r = 7 cm ...(1)

As, CSA = 308 cm^2
$2\pi rh$ = 308

=> 2 x 22/7 x 7 x h = 308
(using (1))

=> h = 7 cm

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Now,

Volume of cylinder = $\pi r^2 h$

= 22/7 x 7 x 7 x 7

= 1078

Therefore, Volume of cylinder is 1078 cm^2.

Question 12: The curved surface area of a cylinder is 1320 cm^2 and its base had diameter 21 cm. Find the height and volume of the cylinder.

Solution:
Curved surface area of a cylinder = 1320 cm^2
Let, r be the radius of the cylinder and h be the height of the cylinder.

=> r = diameter/2 = 21/2 cm = 10.5 cm

We know, Curved surface area(CSA) = $2\pi rh$

So, $2\pi rh$ = 1320

=> 2x 22/7 x 10.5 x h = 1320

or h = 20 cm

Now,
Volume of cylinder = $\pi r^2 h$

= 22/7 x 10.5 x 10.5 x 20

= 6930

Thus, Volume of cylinder is 6930 cm^2.

Question 13: The ratio between the radius of the base and the height of a cylinder is 2:3. Find the total surface area of the cylinder, if its volume is 1617cm^3.

Solution:

Let, r be the radius of the cylinder and h be the height of the cylinder.

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As per statement: r:h = 2:3

Then, radius = 2x cm and height = 3x cm

Volume of cylinder = $\pi r^2 h$
And Volume of cylinder= 1617 cm^3 (given)

So, $1617 = 22/7 (2x)^2 3x$

$1617 = 22/7 (12 x^3)$

$x^3 = 343/8$

or x = 7/2

or x = 3.5 cm

Now, radius, r = 2 x 3.5 = 7 cm and

Height = 3x = 3 x 3.5 = 10.5 cm

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

= 2 x 22/7 x 7(10.5+7)

= 770
Thus, Total surface area of cylinder is 770 cm^2.

Question 14: A rectangular sheet of paper, 44 cm x 20 cm, is rolled along its length of form cylinder. Find the volume of the cylinder so formed.

Solution:
Length of a rectangular sheet = 44 cm
Height of a rectangular sheet = 20 cm
Now, $2\pi r = 44$
$r = 44/2\pi$
r = 44 x 1/2 x 7/22

or r = 7 cm

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Now,
Volume of cylinder = $\pi r^2 h$

= 22/7 x 7 x 7 x 20

= 3080

So, Volume of cylinder is 3080 cm^3.

Question 15: The curved surface area of cylindrical pillar is 264 m^2 and its volume is 924 m^3. Find the diameter and the height of the pillar.
Solution:

Let, r be the radius of the cylindrical pillar and h be the height of the cylindrical pillar

Curved surface area of cylindrical pillar = CSA = 264 m^2 (Given)

So, $2\pi rh = 264$

or $\pi rh = 132$ ...(1)

Again,
Volume of the cylinder = 924 m^3 (given)

$\pi r^2 h = 924$

or $\pi rh(r) = 924$
Using equation (1)

132 r = 924
or r = 924/132
or r = 7m

Substitute value of r value in equation (1)

22/7 x 7 x h = 132

Or h = 6m

Therefore, diameter = 2r = 2(7) = 14 m and height = 6 m

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Exercise VSAQs

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Question 1: Write the number of surfaces of a right circular cylinder.

Solution:
There are 3 surfaces in a cylinder.

Question 2: Write the ratio of total surface area to the curved surface area of a cylinder of radius r and height h.

Solution:
Ratio of total surface area to the curved surface area of a cylinder of radius r and height h can be written as:

$$\frac{\text{Total surface area of a cylinder}}{\text{Curved surface area of a cylinder}} = \frac{[2\pi r(h+r)]}{2\pi r^2} = \frac{h+r}{r}$$