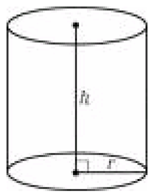
Indian Math Online – Solution Explanation
Surface Area Of Right Circular Cylinder

Right circular Cylinder

A solid which has a curved surface as its lateral surface and a uniform circular cross section is known as a cylinder.
Or, A right circular cylinder is a cylinder whose base is circular and perpendicular to its sides.

Right circular objects around us are - Facility equipment, such as the reactor vessel, oil storage tanks, and water storage tanks.



Right circular cylinder

A right circular cylinder has two plane ends which are circular in shape. These two circular regions are congruent (same radius, r) and parallel to each other and are called the bases of the cylinder.

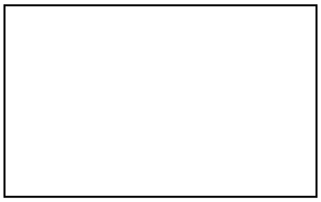
The line joining the centers of these two circular planes is the axis of the cylinder.

The distance between the circular planes is the height (h) of the cylinder.

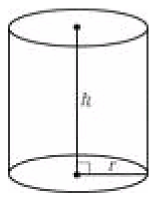
In fact, by a right circular cylinder we mean a hollow right circular cylinder. The part of the space enclosed by a right circular cylinder is called its interior. A right circular cylinder along with its interior is called a right circular cylindrical region, which is generally referred to as a solid right circular cylinder.

The right circular cylinder can be generated by rotating one of the sides of a rectangle by its sides.

Length



Width



Right circular cylinder

The length of rectangle is equal to the circumference of circular plane = $2\pi r$
The width of the rectangle is equal to the height (h) of the cylinder.

$\therefore$ The area of the curved surface of the cylinder = area of the rectangle
= length × width
= $2\pi r \times h$
= **$2\pi rh$ sq. units**

Total surface area of the cylinder = area of curved surface + 2 × base area
= $2\pi rh + 2\pi r^2$
= **$2\pi r(h + r)$ sq. units**

Examples:

Q.1. The lateral/ curved surface area of a right circular cylinder of height 35 inches is 220 inches^2. Find its radius.
(Given, $\pi = 22/7$)
Explanation: Height of the cylinder (h) = 35 inches
Curved surface area of the cylinder = 220 inches^2
$2\pi rh$ = 220 inches^2
$\Rightarrow 2 \times \frac{22}{7} \times r \times 35 = 220$
$\Rightarrow r = \frac{220 \times 7}{2 \times 22 \times 35} = 1$ inch
The radius of the cylinder is 1 inch.

Q.2. Find the total surface area of a right circular cylinder of base radius 5 inches and height 12 inches.
(Given, $\pi = 3.14$)
Explanation: Radius of base of a cylinder (r) = 5 inches
Height of the cylinder (h) = 12 inches
Total surface area of the cylinder = $2\pi r\,(h + r)$
$= 2 \times 3.14 \times 5 \times (12 + 5)$
$= 533.8$ inches^2
The total surface area of the cylinder is 533.8 inches^2.

Q. 3. An iron pipe is 14 inches long and its diameter measures 6 inches. Find the cost of painting the lateral surface of the pipe at the rate of \$0.25/ inches^2. (Given, $\pi = 22/7$)
Explanation:

A pipe is cylindrical in shape

Length of the iron pipe (h) = 14 inches
Diameter of the pipe = 6 inches
$\therefore$Radius of the pipe (r) = 3 inches
Lateral surface are of the pipe = $2\pi rh$
$= 2 \times 22/7 \times 14 \times 3$
$= 264$ inches^2
Rate of painting = \$0.25/inches^2
$\therefore$Cost of painting the pipe of area 264 inches2 = 264 × \$0.25 = \$66
It cost \$66.00 to paint the iron pipe.

Q.4. The diameter of a roller is 28 inches and its length is 3 ft. It takes 300 complete revolutions to move once over to level a play ground. Find the area of the playground. (Given, π = 22/7)

Explanation:

A roller is cylindrical in shape

Diameter of the roller = 28 inches
Length of the roller = 3 ft = 36 inches
Only the lateral surface area is considered when it is moved on the lawn.
Lateral surface area of the roller = 2πrh

$$= \frac{2 \times 22 \times 28 \times 36}{7 \times 2}$$

$= 3168$ inches^2

Since 1 ft = 12inches, 1 ft^2 = 12 × 12 = 144 inches^2

∴ 3168 inches^2 = 3168/144 = 22 ft^2

In one revolution the area of the play ground covered by the roller = 22 ft^2

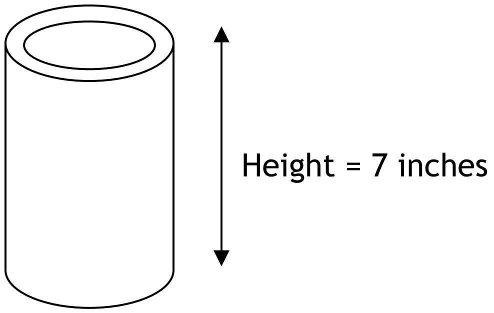
The roller takes 300 complete revolutions to move once over to level a play ground.

Therefore, the area of the playground = 22 × 300 = 6600 ft^2

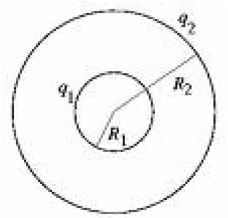
The playground has an area of 6600 ft^2.

Q.5. The difference between outside and inside surface areas of a metallic open pipe 7 inches long is 44 inches^2. Find the difference between the outer and inner radii of the pipe.

Explanation: Length of the pipe (h) = 7 inches



Let the inner radius is R_1 and outer radius R_2



The figure above shows the cross section of the pipe.

The difference in outer and inner surface area = $2\pi R_2 h - 2\pi R_1 h$

$= 2\pi h\,(R_2 - R_1)$

Now, $2\pi h\,(R_2 - R_1) = 44$ inches^2

$\Rightarrow R_2 - R_1 = \dfrac{44 \times 7}{2 \times 22 \times 7} = 1$

The difference between outer and inner radii is 1 inch.