

A Cylinder Has A Cross-section Circumference Of 56cm. The Height Of The Cylinder Is 3.2cm. Calculate

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Understanding the properties of cylinders is fundamental in geometry, especially when dealing with real-world applications such as manufacturing, construction, and design. In this comprehensive article, we will explore how to determine various dimensions of a cylinder given specific measurements, specifically focusing on a cylinder with a cross-sectional circumference of 56cm and a height of 3.2cm. We will break down the calculations step-by-step, explain the mathematical principles involved, and discuss the importance of these measurements in practical scenarios. Whether you're a student preparing for exams or a professional applying geometric formulas in your work, this guide will provide valuable insights into cylinder measurements.

Understanding Cylinder Geometry

Before delving into calculations, it's essential to understand the basic geometry of a cylinder.

What Is a Cylinder?

A cylinder is a three-dimensional shape characterized by:

- Two parallel circular bases of equal size
- A curved surface connecting the bases
- A specific height, which is the distance between the two bases

Key Dimensions of a Cylinder

The main measurements involved include:

- Radius (r): The distance from the center of the circular base to its edge
- Diameter (d): The distance across the circle through its center, $d = 2r$
- Circumference (C): The perimeter of the circular base, $C = 2\pi r$
- Height (h): The perpendicular distance between the bases
- Surface Area and Volume: Calculated using the radius and height

Given Data and Objectives

In our specific problem:

- Cross-section circumference (C) = 56cm
- Height (h) = 3.2cm

The goal is to calculate:

1. The radius of the cylinder's base
2. The diameter of the base
3. The surface area
4. The volume of the cylinder

Step 1: Calculating the Radius of the Cylinder

The first step is to determine the radius, which is essential for further calculations.

Using the Circumference Formula

Recall that the circumference of a circle is given by:

$$C = 2\pi r$$

Where:

- C = circumference
- r = radius
- $\pi \approx 3.1416$

Rearranging for r :

$$r = \frac{C}{2\pi}$$

Calculating the Radius

Plugging in the known value:

$$r = \frac{56 \text{ cm}}{2 \times 3.1416}$$

$$r = \frac{56}{6.2832}$$

$$r \approx 8.91 \text{ cm}$$

Key Point:

The radius of the cylinder's base is approximately 8.91 cm.

Step 2: Calculating the Diameter of the Base

The diameter is straightforward once the radius is known:

$$d = 2r$$

Calculating:

$$\begin{aligned}d &= 2 \times 8.91 \\d &\approx 17.82 \text{ cm}\end{aligned}$$

Summary:

- Diameter $d \approx 17.82 \text{ cm}$

Step 3: Calculating the Surface Area of the Cylinder

The surface area (SA) combines the areas of both circular bases and the curved surface.

Surface Area Formula

$$SA = 2\pi r^2 + 2\pi r h$$

Where:

- $2\pi r^2$ accounts for the two circular bases
- $2\pi r h$ accounts for the curved surface area

Calculating Each Part

1. Area of two bases:

$$\begin{aligned}2\pi r^2 &= 2 \times 3.1416 \times (8.91)^2 \\&= 6.2832 \times 79.49 \\&\approx 500.48 \text{ cm}^2\end{aligned}$$

2. Curved surface area:

$$\begin{aligned}2\pi r h &= 6.2832 \times 8.91 \times 3.2 \\&= 6.2832 \times 28.512 \\&\approx 179.04 \text{ cm}^2\end{aligned}$$

Total Surface Area:

$$SA \approx 500.48 + 179.04 \approx 679.52 \text{ cm}^2$$

Key Point:

The surface area of the cylinder is approximately 679.52 cm^2 .

Step 4: Calculating the Volume of the Cylinder

The volume measures the space occupied within the cylinder, essential in applications like storage and manufacturing.

Volume Formula

$$V = \pi r^2 h$$

Using the previously calculated radius:

$$V = 3.1416 \times (8.91)^2 \times 3.2$$

$$V = 3.1416 \times 79.49 \times 3.2$$

$$V \approx 3.1416 \times 254.37$$

$$V \approx 798.94 \text{ cm}^3$$

Summary:

- The volume of the cylinder is approximately 798.94 cm³.

Practical Applications of Cylinder Measurements

Understanding how to calculate these dimensions has widespread applications across various industries:

Manufacturing and Packaging

- Designing cans, bottles, and tubes
- Ensuring capacity matches specifications
- Calculating material requirements for production

Construction and Engineering

- Designing pillars, pipes, and columns
- Calculating load-bearing capacities based on volume and surface area
- Material estimation and cost analysis

Science and Education

- Teaching geometric principles
- Conducting experiments involving volume and surface area
- Developing models for real-world objects

Summary of Key Calculations

- Radius: approximately 8.91 cm
- Diameter: approximately 17.82 cm
- Surface Area: approximately 679.52 cm²
- Volume: approximately 798.94 cm³

Conclusion

Calculating the dimensions of a cylinder from its circumference and height involves fundamental geometric formulas. By understanding the relationships between circumference, radius, diameter, surface area, and volume, you can accurately determine all essential measurements of a cylinder. This knowledge is invaluable in various practical contexts, from designing consumer products to engineering structures. Remember, precise calculations ensure optimal design, material efficiency, and functionality in real-world applications involving cylindrical shapes.

Keywords for SEO Optimization:

- Cylinder measurements
- How to calculate cylinder dimensions
- Cylinder surface area formula
- Cylinder volume calculation
- Cross-section circumference of a cylinder
- Practical applications of cylinder geometry
- Geometry formulas for cylinders
- Engineering and manufacturing calculations
- Cylindrical object specifications
- Mathematical problems involving cylinders

Frequently Asked Questions

What is the radius of a cylinder with a cross-section circumference of 56 cm?

The radius can be found using the formula for circumference: $C = 2\pi r$. So, $r = C / (2\pi) = 56 / (2 \times 3.1416) \approx 8.91$ cm.

How do you calculate the volume of a cylinder with a given radius and height?

The volume V of a cylinder is given by $V = \pi r^2 h$. Using the radius of approximately 8.91 cm and height 3.2 cm, $V \approx 3.1416 \times (8.91)^2 \times 3.2$.

What is the surface area of this cylinder?

Surface area $A = 2\pi r(h + r)$. Substituting $r \approx 8.91$ cm and $h = 3.2$ cm, $A \approx 2 \times 3.1416 \times 8.91 \times (3.2 + 8.91)$.

If the height of the cylinder increases to 5 cm, how does that

affect the volume?

The volume increases proportionally with height. New volume $V = \pi r^2 \times 5 \text{ cm}$, which is larger than with height 3.2 cm.

Can you find the lateral surface area of the cylinder?

Yes. Lateral surface area = $2\pi rh$. Using $r \approx 8.91 \text{ cm}$ and $h = 3.2 \text{ cm}$, lateral area $\approx 2 \times 3.1416 \times 8.91 \times 3.2$.

What is the significance of the cross-section circumference in calculating the cylinder's dimensions?

The cross-section circumference helps determine the radius of the cylinder's base, which is essential for calculating volume and surface area.

How accurate is the approximation of the radius when using 3.1416 for π ?

Using 3.1416 for π provides a very close approximation, with a negligible margin of error for most practical calculations.

Additional Resources

A Cylinder Has A Cross-section Circumference Of 56cm. The Height Of The Cylinder Is 3.2cm. Calculate

Understanding the properties and measurements of a cylinder is fundamental in various fields such as engineering, architecture, manufacturing, and even in everyday tasks. When given specific dimensions like the circumference of the cross-section and the height, one can determine other key attributes such as the radius, volume, and surface area. This article provides a comprehensive guide to calculating these parameters based on the given data: a circumference of 56 cm and a height of 3.2 cm. We will explore the step-by-step process, explain the relevant formulas, and discuss the applications and implications of these calculations.

Understanding the Given Data

Before delving into calculations, it is essential to interpret the provided information correctly.

- Circumference of Cross-section: 56 cm
- Height of Cylinder: 3.2 cm

The cross-section of a cylinder, when cut perpendicular to its height, is a circle. The circumference of this circle is given as 56 cm. The height is the length of the cylinder from one base to the other along

its central axis.

Calculating the Radius of the Cylinder

The first step in analyzing the cylinder is to find its radius, which is crucial for further calculations such as volume and surface area.

Formula for Circumference of a Circle

The circumference (C) of a circle relates to its radius (r) through the formula:

$$C = 2\pi r$$

Given:

$$C = 56, \text{ cm}$$

Rearranged to solve for (r) :

$$r = \frac{C}{2\pi}$$

Calculating the Radius

Using the approximation $(\pi \approx 3.1416)$:

$$r = \frac{56}{2 \times 3.1416} = \frac{56}{6.2832} \approx 8.91, \text{ cm}$$

Result: The radius of the cylinder's cross-section is approximately 8.91 cm.

Calculating the Volume of the Cylinder

The volume (V) of a cylinder is given by the formula:

$$V = \pi r^2 h$$

Where:

- (r) is the radius (≈ 8.91 cm)
- (h) is the height (3.2 cm)

Step-by-step Calculation

First, calculate (r^2) :

$$r^2 = (8.91)^2 \approx 79.45, \text{cm}^2$$

Then, multiply by (π) :

$$\pi r^2 \approx 3.1416 \times 79.45 \approx 249.45, \text{cm}^2$$

Finally, multiply by the height:

$$V = 249.45 \times 3.2 \approx 798.24, \text{cm}^3$$

Result: The volume of the cylinder is approximately 798.24 cubic centimeters.

Calculating the Surface Area of the Cylinder

The surface area (SA) of a cylinder includes both the lateral surface area and the area of the two circular bases:

$$SA = 2\pi r h + 2\pi r^2$$

Where:

- $(2\pi r h)$ is the lateral surface area
- $(2\pi r^2)$ is the total area of the two bases

Calculations

- Lateral Surface Area:

$$2\pi r h = 2 \times 3.1416 \times 8.91 \times 3.2 \approx 2 \times 3.1416 \times 8.91 \times 3.2$$

Calculating step-by-step:

$$\begin{aligned} 2 \times 3.1416 &= 6.2832 \\ 6.2832 \times 8.91 &\approx 56.03 \\ 56.03 \times 3.2 &\approx 179.3, \text{ cm}^2 \end{aligned}$$

- Area of Two Bases:

$$2\pi r^2 = 2 \times 3.1416 \times 79.45 \approx 2 \times 249.45 = 498.9, \text{ cm}^2$$

- Total Surface Area:

$$SA \approx 179.3 + 498.9 = 678.2, \text{ cm}^2$$

Result: The total surface area of the cylinder is approximately 678.2 square centimeters.

Applications and Real-World Implications

Calculating the dimensions of a cylinder based on initial parameters has numerous practical applications:

- Manufacturing: Ensuring components fit within specified volume and surface area constraints.

- Packaging: Designing cylindrical containers with precise capacity.
- Engineering: Analyzing stress and material usage for cylindrical structures.
- Science: Calculations related to liquid storage, fluid dynamics, and more.

Understanding how to manipulate and derive these measurements allows professionals to optimize designs, improve efficiency, and reduce costs.

Features, Pros, and Cons

Features of the Calculation Process:

- Relies on fundamental geometric formulas
- Provides comprehensive insights into the cylinder's properties
- Applicable in various practical contexts

Pros:

- Straightforward calculations using standard formulas
- Can be adapted to different dimensions easily
- Enhances understanding of three-dimensional shapes

Cons:

- Assumes perfect geometric shapes; real-world objects may have imperfections
- Requires accurate initial measurements; any errors propagate through calculations
- Limited to cylinders with uniform cross-sections

Conclusion

By starting with the given circumference and height of a cylinder, we can accurately determine its radius, volume, and surface area through fundamental geometric formulas. In this particular case, the radius is approximately 8.91 cm, the volume about 798.24 cm³, and the total surface area approximately 678.2 cm². These calculations are vital in numerous fields, enabling precise design and analysis of cylindrical objects. Mastery of such geometric computations enhances both academic understanding and practical application, facilitating more efficient and effective solutions in engineering, manufacturing, and everyday problem-solving.

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