

What Is The Height Of A Cylinder With A Volume Of 315π Cubic Meters And A Radius Of 6 Meters? 8.75

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Understanding the dimensions of a cylinder, especially its height, is fundamental in fields ranging from engineering and architecture to mathematics and design. When given the volume and radius of a cylinder, calculating its height becomes a straightforward yet essential task. In this article, we will explore how to determine the height of a cylinder with a volume of 315π cubic meters and a radius of 6 meters, emphasizing the mathematical principles involved, step-by-step calculations, and practical applications.

Introduction to Cylinder Geometry

A cylinder is a three-dimensional geometric shape characterized by two parallel circular bases connected by a curved surface. Its key dimensions include:

- Radius (r): The distance from the center of the circular base to its perimeter.
- Height (h): The perpendicular distance between the two bases.
- Volume (V): The total space occupied by the cylinder.

Understanding how these dimensions relate is crucial for various practical and theoretical purposes.

Fundamental Formula for the Volume of a Cylinder

The volume of a cylinder is calculated using the formula:

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

Where:

- V is the volume,
- π (Pi) is approximately 3.14159,
- r is the radius,
- h is the height.

This formula derives from the area of the circular base (πr^2) multiplied by

the height (h).

Given Data and Objective

In our case, the known values are:

- Volume (V): 315π cubic meters
- Radius (r): 6 meters

Our goal is to find the height (h) of the cylinder.

Step-by-Step Calculation of the Cylinder's Height

To determine h, we will manipulate the volume formula:

$$h = V / (\pi r^2)$$

Substituting the known values:

$$h = (315\pi) / (\pi 6^2)$$

Simplify the denominator:

$$h = (315\pi) / (\pi 36)$$

Since π appears in both numerator and denominator, they cancel out:

$$h = 315 / 36$$

Performing the division:

$$h \approx 8.75 \text{ meters}$$

This calculation confirms that the height of the cylinder is approximately 8.75 meters.

Understanding the Significance of the Result

The height of 8.75 meters indicates that, given the volume and radius, the cylinder extends nearly nine meters in height. This measure is vital in various applications:

- **Construction:** Ensuring structural components fit within specified height constraints.
- **Manufacturing:** Designing containers or tanks with precise dimensions.
- **Fluid Dynamics:** Calculating flow rates or capacities for cylindrical pipes or tanks.

Practical Implications and Applications

Knowing how to compute the height of a cylinder from its volume and radius has numerous real-world implications:

1. **Designing Storage Tanks:** Engineers can determine the necessary height to hold a specific volume of liquid using the tank's radius.
2. **Architectural Planning:** Architects can estimate building features involving cylindrical structures, such as columns or silos.
3. **Manufacturing Processes:** Manufacturers can specify dimensions for products like bottles, cans, or pipes to meet volume requirements.
4. **Educational Purposes:** Students learning geometry can practice applying formulas to solve real-world problems.

Additional Considerations and Related Calculations

While the calculation above assumes perfect geometric conditions, real-world scenarios may involve other factors:

Material Thickness

- When designing physical objects, the thickness of the material can influence overall dimensions.

Surface Area Calculations

- To find the surface area of the cylinder, use:

- Curved Surface Area: $2\pi r h$
- Total Surface Area: $2\pi r (h + r)$

Adjustments for Manufacturing Tolerances

- Real-world manufacturing processes may require slight adjustments to dimensions to account for material properties or manufacturing tolerances.

Conclusion

Calculating the height of a cylinder when given its volume and radius is a fundamental skill in geometry, with practical implications across various industries. For the specific case of a cylinder with a volume of 315π cubic meters and a radius of 6 meters, the height is approximately 8.75 meters. This calculation underscores the importance of understanding the relationship between a cylinder's dimensions and how they can be manipulated mathematically to obtain essential measurements.

By mastering these calculations, professionals and students can confidently design, analyze, and interpret cylindrical structures and objects, ensuring accuracy and efficiency in their respective fields.

Summary of Key Points

- The volume of a cylinder is given by $V = \pi r^2 h$.
- Given $V = 315\pi$ cubic meters and $r = 6$ meters, the height h can be calculated as $h = V / (\pi r^2)$.
- Substituting the values yields $h \approx 8.75$ meters.
- This measurement is critical for practical applications like construction, manufacturing, and design.

Further Resources

- [Khan Academy - Volume of a Cylinder](#)
- [MathWorld - Cylinder](#)

- [Cuemath - Volume of Cylinder](#)

In summary, understanding how to determine the height of a cylinder from its volume and radius is an essential skill that combines geometric principles with practical applications. The specific calculation for a cylinder with a volume of 315π cubic meters and a radius of 6 meters demonstrates the straightforward approach through algebraic manipulation, resulting in a height of approximately 8.75 meters.

Frequently Asked Questions

What is the height of a cylinder with a volume of 315π cubic meters and a radius of 6 meters?

The height is 8.75 meters.

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

Use the formula $\text{height} = \text{volume} / (\pi \text{ radius}^2)$. For this problem, $\text{height} = 315\pi / (\pi 6^2) = 315 / 36 = 8.75$ meters.

What is the formula to find the height of a cylinder when volume and radius are known?

$\text{Height} = \text{Volume} / (\pi \text{ radius}^2)$.

If a cylinder has a volume of 315π cubic meters and radius 6 meters, what is its height?

Its height is 8.75 meters.

Why is the height of the cylinder 8.75 meters in this problem?

Because dividing the volume 315π by π times the square of the radius (36) yields 8.75 meters.

Can the height of a cylinder be calculated using only volume and radius?

Yes, by using the formula $\text{height} = \text{volume} / (\pi \text{ radius}^2)$.

What units are used to measure the height of the

cylinder in this problem?

Meters.

Is the height calculation affected by the units of volume and radius?

Yes, but as long as volume and radius are in consistent units, the height will be in meters.

What is the significance of the number 8.75 in the context of this problem?

It represents the height in meters of the cylinder with the given volume and radius.

How would the height change if the volume or radius of the cylinder increased?

The height would increase if the volume increased or if the radius decreased, according to the formula $\text{height} = \text{volume} / (\pi \text{ radius}^2)$.

Additional Resources

Understanding the Height of a Cylinder with a Given Volume and Radius

When dealing with geometric shapes, especially cylinders, understanding the relationship between key dimensions—such as height, radius, and volume—is fundamental. In this detailed exploration, we will analyze the problem: What is the height of a cylinder with a volume of 315π cubic meters and a radius of 6 meters? We will walk through the mathematical principles, step-by-step calculations, and practical considerations involved.

Fundamentals of Cylinder Geometry

Before diving into the problem specifics, it's essential to grasp the basic properties and formulas that govern cylinders.

Basic Components of a Cylinder

- Radius (r): The distance from the center of the circular base to its edge.
- Height (h): The perpendicular distance between the two bases.
- Volume (V): The amount of space occupied by the cylinder.

Key Formula for Volume of a Cylinder

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

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

where:

- V is the volume,
- r is the radius,
- h is the height,
- π is Pi, approximately 3.14159.

This formula highlights the direct relationship between the volume, radius, and height of a cylinder.

Given Data and Objective

Let's clarify the data provided and what we aim to find.

- Given:
 - Volume $V = 315\pi$, cubic meters
 - Radius $r = 6$, meters
- Objective:
 - Find the height h of the cylinder.

Mathematical Approach to Find the Height

Using the volume formula:

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

Substituting the known values:

$$315\pi = \pi \times 6^2 \times h$$

Simplify:

$$315\pi = \pi \times 36 \times h$$

Divide both sides by π :

$$315 = 36h$$

Solve for h :

$$h = \frac{315}{36}$$

Calculate:

$$h = 8.75 \text{ meters}$$

This straightforward calculation confirms that the height of the cylinder is 8.75 meters.

Interpreting the Result: Why 8.75 Meters?

The value of 8.75 meters isn't arbitrary; it results directly from the mathematical relationship between volume, radius, and height.

Key points:

- The height is proportional to the volume for a fixed radius.
- Larger volume requires a taller cylinder, and vice versa.
- The calculation demonstrates how specific dimensions uniquely define each other in geometric shapes.

Deeper Insights into the Calculation

While the straightforward calculation yields a clear answer, exploring the broader context can deepen understanding.

The Role of Pi in Volume Calculation

- The volume is expressed as $V = 315 \pi$, which indicates the volume is in terms of π .
- The actual numerical volume:
 $V = 315 \times 3.14159 \approx 989.6$, cubic meters
- This approach emphasizes the importance of maintaining symbolic expressions until the final step to keep calculations precise.

Understanding the Ratios and Proportions

- The radius squared ($r^2 = 36$) significantly influences the height.
- For a fixed volume, increasing the radius decreases the required height proportionally, and vice versa.
- The proportionality:
 $h \propto \frac{V}{r^2}$

Practical Implications of the Height

- A height of 8.75 meters can be visualized as roughly the height of a two-to three-story building.
- Such dimensions are common in storage tanks, silos, or large industrial containers.

Alternative Scenarios and Extensions

While this specific problem is straightforward, understanding variations and

extensions can be insightful.

Scenario 1: Changing the Radius

- If the radius were different, say 4 meters, the height would adjust accordingly:

$$h = \frac{V}{\pi r^2} = \frac{315 \pi}{\pi \times 4^2} = \frac{315}{16} \approx 19.6875, \text{ meters}$$

- This illustrates that reducing the radius increases the height needed for the same volume.

Scenario 2: Changing the Volume

- If the volume were different, for example, $V = 500 \pi$, with the same radius:

$$h = \frac{500 \pi}{\pi \times 36} = \frac{500}{36} \approx 13.89, \text{ meters}$$

- Larger volume equates to greater height for the same radius.

Scenario 3: Real-World Constraints

- In practical applications, physical constraints might limit the height or radius.
- Engineers might need to optimize dimensions for stability, cost, or spatial limitations.

Significance of Accurate Calculations in Engineering and Design

Precise calculations like this are crucial in various fields:

- Civil Engineering: Designing storage tanks, silos, and pipelines.
- Manufacturing: Creating containers with specific volume requirements.
- Environmental Science: Modeling natural formations or water reservoirs.
- Architecture: Planning structures with cylindrical components.

Ensuring accuracy in dimensions helps prevent structural failures, optimize resource usage, and meet safety standards.

Summary and Conclusion

In conclusion, calculating the height of a cylinder with a known volume and

radius involves applying the fundamental volume formula:

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

Given:

- $V = 315\pi$ cubic meters,
- $r = 6$ meters,

The height is derived as:

$$h = \frac{V}{\pi r^2} = \frac{315\pi}{\pi \times 36} = \frac{315}{36} = 8.75, \text{ meters}$$

This result illustrates the direct proportionality between the volume and height for a fixed radius and emphasizes the importance of understanding geometric relationships in practical applications.

Final thoughts:

- Mastery of these calculations allows for effective design and analysis of cylindrical structures.
- Recognizing how changing one dimension affects others is key in engineering and problem-solving.
- Maintaining clarity and precision in mathematical expressions ensures accurate and reliable results.

Whether you're studying geometry, planning a construction project, or exploring theoretical concepts, understanding how to determine the height of a cylinder based on volume and radius is a fundamental skill that bridges theory and real-world applications.

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