

A Right Rectangular Prism Has Edge Lengths Of $3\frac{1}{2}$ Ft, $2\frac{1}{4}$ Ft, And $4\frac{1}{3}$ Ft. Safara Wants To Completely

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Understanding the dimensions and properties of geometric shapes like the right rectangular prism is essential in various fields, including architecture, interior design, packaging, and education. In this article, we will explore the details of a specific right rectangular prism with edges measuring $3\frac{1}{2}$ feet, $2\frac{1}{4}$ feet, and $4\frac{1}{3}$ feet, and discuss how Safara plans to utilize or modify this shape for her project. We will delve into calculating volume, surface area, and other relevant measurements to provide a comprehensive understanding of this geometric figure.

What Is a Right Rectangular Prism?

A right rectangular prism, also known as a rectangular box or cuboid, is a three-dimensional geometric shape with six rectangular faces. It is characterized by three dimensions: length, width, and height. These dimensions are perpendicular to each other, meaning the edges meet at right angles.

Characteristics of a Right Rectangular Prism

- Six rectangular faces
- Opposite faces are congruent rectangles
- Edges meet at right angles
- Three dimensions: length, width, height

Common Uses of Rectangular Prisms

- Packaging boxes

- Building blocks in construction
- Storage containers
- Design elements in architecture and furniture

Dimensions of the Prism: Given Measurements

The problem states that the right rectangular prism has edges measuring:

- $3 \frac{1}{2}$ feet (which is 3.5 ft)
- $2 \frac{1}{4}$ feet (which is 2.25 ft)
- $4 \frac{1}{3}$ feet (which is approximately 4.333 ft)

To work effectively with these measurements, it's helpful to convert all mixed fractions into improper fractions or decimal form for easier calculations.

Conversions of Edge Lengths

- $3 \frac{1}{2} \text{ ft} = 3.5 \text{ ft}$
- $2 \frac{1}{4} \text{ ft} = 2.25 \text{ ft}$
- $4 \frac{1}{3} \text{ ft} \approx 4.333 \text{ ft}$

Understanding these dimensions allows us to compute the volume, surface area, and other properties necessary for Safara's project.

Calculating the Volume of the Prism

The volume of a right rectangular prism is calculated using the formula:

$$V = \text{length} \times \text{width} \times \text{height}$$

Using the given measurements, the volume calculation becomes:

$$V = 3.5 \times 2.25 \times 4.333$$

Step-by-Step Calculation

1. Multiply 3.5 by 2.25:

$$3.5 \times 2.25 = 7.875$$

2. Multiply the result by 4.333:

$$7.875 \times 4.333 \approx 34.118$$

Result: The volume of the prism is approximately 34.12 cubic feet.

Importance of Volume Calculation

Knowing the volume helps Safara determine:

- How much material is needed to build or package within this space
- The capacity of storage or shipping containers
- Space planning for interior design or construction

Calculating the Surface Area

Surface area is the total area covered by all six faces of the prism. The formula for the surface area of a right rectangular prism is:

$$SA = 2(lw + lh + wh)$$

Where:

- $(l) = \text{length}$
- $(w) = \text{width}$
- $(h) = \text{height}$

Using the given dimensions:

$$[SA = 2 (3.5 \times 2.25 + 3.5 \times 4.333 + 2.25 \times 4.333)]$$

Calculating Each Term

- $(3.5 \times 2.25 = 7.875)$
- $(3.5 \times 4.333 \approx 15.165)$
- $(2.25 \times 4.333 \approx 9.75)$

Sum of these:

$$[7.875 + 15.165 + 9.75 = 32.79]$$

Multiply by 2:

$$[2 \times 32.79 = 65.58]$$

Result: The surface area is approximately 65.58 square feet.

Uses of Surface Area Calculation

- Determining the amount of material needed for covering or painting
- Estimating costs for surface treatments
- Planning insulation or protective coatings

Practical Applications for Safara

Safara's goal could involve various projects, such as constructing a storage box, designing a display case, or planning a space layout. Depending on her objectives, understanding the measurements and properties of this prism is crucial.

Possible Objectives Safara Might Have

1. Building a storage container with precise volume capacity
2. Determining material quantities for construction or manufacturing
3. Designing an interior layout that fits within the given dimensions
4. Creating packaging solutions that maximize space efficiency

Step-by-Step Guide for Safara's Project

If Safara is planning to build or modify this prism, here are the key steps she should follow:

1. Confirm Dimensions

- Double-check the edge lengths for accuracy
- Convert mixed fractions to decimal or improper fractions

2. Calculate Volume

- Use the volume formula
- Ensure calculations are precise for capacity planning

3. Calculate Surface Area

- Use the surface area formula
- Determine material requirements

4. Adjust Dimensions if Needed

- Consider scaling the prism up or down depending on project needs
- Recalculate volume and surface area post-adjustment

5. Material and Cost Estimation

- Based on surface area, estimate material costs
- Plan for additional features like insulation, paint, or finishes

Additional Considerations

While the calculations above provide a solid foundation, Safara should also consider:

Material Selection

- Different materials have varying thicknesses and costs
- The choice affects the overall weight and durability

Structural Integrity

- Ensure the dimensions support the intended use
- Reinforce corners or edges if necessary

Design and Aesthetics

- Decide on finishes or coverings
- Incorporate design features that enhance appearance or functionality

Conclusion

Understanding the dimensions and properties of a right rectangular prism with edges measuring $3\frac{1}{2}$ ft, $2\frac{1}{4}$ ft, and $4\frac{1}{3}$ ft allows Safara to effectively plan her project. By calculating the volume (~ 34.12 cubic feet) and surface area (~ 65.58 square feet), she can determine material requirements, storage capacity, and design considerations. Whether building a storage container, designing a display case, or planning space layouts, these measurements serve as foundational data. Accurate calculations and thoughtful planning ensure the success of Safara's project, optimizing both function and aesthetics. Embracing the principles of geometry and measurement not only facilitates practical outcomes but also enhances problem-solving skills applicable across various disciplines.

Frequently Asked Questions

What is the volume of the right rectangular prism with edges $3\frac{1}{2}$ ft, $2\frac{1}{4}$ ft, and $4\frac{1}{3}$ ft?

First, convert all measurements to improper fractions: $3\frac{1}{2} = \frac{7}{2}$, $2\frac{1}{4} = \frac{9}{4}$, $4\frac{1}{3} = \frac{13}{3}$. Multiply these:

$(\frac{7}{2}) \times (\frac{9}{4}) \times (\frac{13}{3}) = \frac{(7 \times 9 \times 13)}{(2 \times 4 \times 3)} = \frac{(819)}{(24)}$. Simplify: $819 \div 3 = 273$, $24 \div 3 = 8$, so volume = $\frac{273}{8}$ cubic feet, which is $34 \frac{1}{8} \text{ ft}^3$.

How do you find the surface area of a right rectangular prism with given edge lengths?

To find the surface area, calculate the area of all six faces: 2 times the area of each pair of opposite faces. For edges a, b, and c, the formula is $2(ab + ac + bc)$. Plug in the values and compute accordingly.

What is the total surface area of the prism with edges $3 \frac{1}{2} \text{ ft}$, $2 \frac{1}{4} \text{ ft}$, and $4 \frac{1}{3} \text{ ft}$?

Convert to improper fractions: $a = \frac{7}{2}$, $b = \frac{9}{4}$, $c = \frac{13}{3}$. Calculate each product: $ab = (\frac{7}{2}) \times (\frac{9}{4}) = \frac{63}{8}$, $ac = (\frac{7}{2}) \times (\frac{13}{3}) = \frac{91}{6}$, $bc = (\frac{9}{4}) \times (\frac{13}{3}) = \frac{117}{12}$. Find common denominators, sum, then multiply by 2: surface area = $2(\frac{63}{8} + \frac{91}{6} + \frac{117}{12})$ = total in square feet after simplifying.

If Safara wants to paint the entire surface of the prism, how much area does she need to cover?

She needs to cover the surface area of the prism, which is calculated as $2(ab + ac + bc)$. Using the previous calculations, she should sum the face areas and multiply by 2 to find the total area to be painted.

What is the height, width, and length of the prism based on the given edge lengths?

The edges $3 \frac{1}{2} \text{ ft}$, $2 \frac{1}{4} \text{ ft}$, and $4 \frac{1}{3} \text{ ft}$ can be considered as length, width, and height. Exact assignment depends on the orientation, but all are the dimensions of the prism.

How can I convert mixed numbers to improper fractions for calculating the volume?

To convert mixed numbers to improper fractions, multiply the whole number by the denominator, add the numerator, and place over the original denominator. For example, $3 \frac{1}{2} = \frac{(3 \times 2 + 1)}{2} = \frac{7}{2}$.

Are there any shortcuts to calculating the volume of a rectangular prism with fractional edge lengths?

Yes, converting mixed numbers to improper fractions first simplifies multiplication. Then, multiply numerators and denominators separately, and simplify the resulting fraction.

What is the significance of calculating the volume and surface area of a prism in practical applications?

Calculating volume helps determine capacity or how much space is inside, useful for storage or packing. Surface area is important for painting, wrapping, or insulation purposes.

What steps should Safara follow to completely package or wrap the prism?

Safara should first find the total surface area to determine how much wrapping material is needed, then measure and cut the material accordingly, ensuring all sides are covered without gaps.

Additional Resources

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In the world of geometry and practical design, understanding the dimensions and volume of three-dimensional objects is essential. Whether planning a construction project, customizing storage solutions, or simply exploring mathematical concepts, precise calculations play a vital role. Recently, Safara embarked on a project involving a right rectangular prism—a common three-dimensional shape characterized by six rectangular faces, twelve edges, and eight vertices. Her goal: to fully understand and utilize the prism's dimensions for her specific needs. This article delves into the mathematical intricacies of the prism, exploring how to determine its volume and surface area, and how these calculations can inform real-world applications.

Understanding the Dimensions of the Prism

Before diving into calculations, it's crucial to comprehend the significance of the given dimensions. The prism has three edge lengths:

- $3\frac{1}{2}$ feet
- $2\frac{1}{4}$ feet
- $4\frac{1}{3}$ feet

These measurements represent the length, width, and height of the prism, although their specific assignment can vary depending on context. For clarity, let's assign:

- Length (L) = $3\frac{1}{2}$ ft

- Width (W) = $2 \frac{1}{4}$ ft

- Height (H) = $4 \frac{1}{3}$ ft

Expressing these mixed fractions as improper fractions simplifies calculations:

- $3 \frac{1}{2} = \frac{23}{2}$

- $2 \frac{1}{4} = \frac{9}{4}$

- $4 \frac{1}{3} = \frac{13}{3}$

This conversion is a foundational step, ensuring precision in subsequent mathematical operations.

Calculating the Volume of the Prism

The volume of a right rectangular prism is determined by the product of its three edge lengths:

$$\text{Volume} = L \times W \times H$$

Using the improper fractions:

$$\text{Volume} = \frac{23}{2} \times \frac{9}{4} \times \frac{13}{3}$$

Step 1: Multiply the numerators and denominators separately:

$$\text{Volume} = \frac{7 \times 9 \times 13}{2 \times 4 \times 3}$$

Calculating numerator:

$$7 \times 9 = 63$$

$$63 \times 13 = 819$$

Calculating denominator:

$$2 \times 4 = 8$$

$$8 \times 3 = 24$$

Thus,

$$\text{Volume} = \frac{819}{24}$$

Step 2: Simplify the fraction:

Divide numerator and denominator by their greatest common divisor (GCD). Both 819 and 24 are divisible by 3:

$$- 819 \div 3 = 273$$

$$- 24 \div 3 = 8$$

Resulting in:

$$\text{Volume} = \frac{273}{8} \text{ cubic feet}$$

Step 3: Convert to mixed number for better interpretability:

Dividing 273 by 8:

$$- 8 \times 34 = 272$$

$$- 273 - 272 = 1$$

So,

$$\frac{273}{8} = 34 \frac{1}{8} \text{ cubic feet}$$

Conclusion: The prism's volume is $34 \frac{1}{8}$ cubic feet. This measurement indicates the total three-dimensional space occupied by the prism, which is vital for storage or material estimation.

Determining the Surface Area

While volume tells us about capacity, the surface area informs us about the total exterior surface that needs covering or finishing. The surface area (SA) of a rectangular prism is calculated as:

$$SA = 2(LW + LH + WH)$$

Applying the assigned dimensions:

$$- LW = \frac{7}{2} \times \frac{9}{4}$$

$$- LH = \frac{7}{2} \times \frac{13}{3}$$

$$- WH = \frac{9}{4} \times \frac{13}{3}$$

Step 1: Calculate each product:

1. LW :

$$\left[\frac{7}{2} \times \frac{9}{4} = \frac{7 \times 9}{2 \times 4} = \frac{63}{8} \right]$$

2. (LH):

$$\left[\frac{7}{2} \times \frac{13}{3} = \frac{7 \times 13}{2 \times 3} = \frac{91}{6} \right]$$

3. (WH):

$$\left[\frac{9}{4} \times \frac{13}{3} = \frac{9 \times 13}{4 \times 3} = \frac{117}{12} \right]$$

Step 2: Simplify each product:

- ($\frac{63}{8}$) remains as is.
- ($\frac{91}{6}$) remains as is.
- ($\frac{117}{12}$):

Divide numerator and denominator by 3:

$$\left[\frac{117 \div 3}{12 \div 3} = \frac{39}{4} \right]$$

Step 3: Sum these areas:

$$\left[\begin{aligned} SA_{\text{components}} &= \frac{63}{8} + \frac{91}{6} + \frac{39}{4} \\ \end{aligned} \right]$$

To add these, find a common denominator. The denominators are 8, 6, and 4. The least common denominator (LCD) is 24.

Convert each fraction:

- ($\frac{63}{8} = \frac{63 \times 3}{8 \times 3} = \frac{189}{24}$)
- ($\frac{91}{6} = \frac{91 \times 4}{6 \times 4} = \frac{364}{24}$)
- ($\frac{39}{4} = \frac{39 \times 6}{4 \times 6} = \frac{234}{24}$)

Sum:

$$\left[\frac{189 + 364 + 234}{24} = \frac{787}{24} \right]$$

Step 4: Calculate total surface area:

$$\left[SA = 2 \times \frac{787}{24} = \frac{1574}{24} \right]$$

Simplify numerator and denominator by dividing by 2:

$$\left[\frac{1574 \div 2}{24 \div 2} = \frac{787}{12} \right]$$

Express as a mixed number:

Divide 787 by 12:

$$- 12 \times 65 = 780$$

$$- 787 - 780 = 7$$

So,

$$\left[\frac{787}{12} = 65 \frac{7}{12} \right]$$

Final result: The surface area of the prism is $65 \frac{7}{12}$ square feet.

Practical Applications and Implications for Safara

Understanding the volume and surface area of the right rectangular prism is more than an academic exercise; it has tangible implications for Safara's project. Here's how these calculations translate into real-world applications:

Material Quantification and Cost Estimation

Knowing the surface area enables Safara to determine how much material she needs to cover or coat the exterior of the prism. For example, if she plans to paint, wallpaper, or apply a protective coating, the surface area informs her of the total amount of material required. Similarly, for insulation or cladding, accurate surface measurements help in cost estimation and procurement.

Storage and Space Optimization

The volume calculation reveals how much capacity the prism offers—crucial for storage solutions, packaging, or spatial planning. If Safara intends to use this prism-shaped container for storing items, understanding its capacity ensures she can plan accordingly, avoiding overpacking or underutilization.

Design and Construction Considerations

In construction or manufacturing, precise dimensions guide the fabrication process. Accurate measurements prevent material wastage and ensure structural integrity. For Safara, knowing the exact volume and surface area ensures her design specifications are met, whether she's building a custom box, creating a display case, or planning a modular storage system.

Additional Mathematical Insights

Beyond the basic calculations, understanding the relationships between these measurements offers deeper mathematical insights:

- **Surface Area-to-Volume Ratio:** This ratio impacts thermal properties and material efficiency. For the prism, the ratio is approximately:

$$\left[\frac{65 \frac{7}{12}}{34 \frac{1}{8}} \right]$$

Expressed as improper fractions:

$$\left[\frac{\frac{787}{12}}{\frac{273}{8}} = \frac{787}{12} \times \frac{8}{273} = \frac{787 \times 8}{12 \times 273} \right]$$

Calculating numerator:

$$- 787 \times 8 = 6296$$

Calculating denominator:

$$- 12 \times 273 = 3276$$

Simplify:

$$\left[\frac{6296}{3276} \right]$$

Divide numerator and denominator by 4:

$$- 6296$$

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