

A Rectangle Has A A Perimeter Of 72 Ft. The Length And Width Are Scaled By A Factor 3. 5. What Is The

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Understanding geometric concepts such as perimeter, scaling, and their applications is essential in many fields including architecture, engineering, and everyday problem-solving. In this article, we will explore a specific problem involving a rectangle with a given perimeter, how its dimensions change when scaled by a factor, and how to determine the new measurements. By the end of this guide, you'll have a comprehensive understanding of how to approach such problems, perform calculations accurately, and apply these concepts to practical scenarios.

Understanding the Basic Concepts

Before diving into the problem, it's important to review some fundamental concepts:

What Is Perimeter?

- The perimeter of a rectangle is the total distance around it.
- For a rectangle, perimeter (P) is calculated as:

$$P = 2 \times (\text{length} + \text{width})$$

What Does Scaling Mean?

- Scaling involves increasing or decreasing the size of a shape proportionally.
- When a shape is scaled by a factor, all its linear dimensions (length, width, height) are multiplied by that factor.
- Scaling can affect the area and volume differently:
 - Area scales by the square of the factor.
 - Volume scales by the cube of the factor.

Understanding the Problem Context

- Given a rectangle with a specific perimeter.
- The rectangle's length and width are scaled by a factor of 3.5.
- The goal is to find the new perimeter or other related measurements after scaling.

Step-by-Step Solution Approach

To solve the problem, follow these systematic steps:

1. Find the Original Dimensions

- Use the perimeter formula to find the original length and width.
- Since only the perimeter is given, and the rectangle's dimensions are not specified, assume variables:

Let:

- L = original length
- W = original width
- The perimeter relation:

$$2(L + W) = 72 \text{ ft}$$

2. Express Dimensions in Terms of One Variable

- To proceed, we need to find possible pairs (L, W) that satisfy the perimeter.
- Without additional constraints, the problem might be underdetermined, but typically, such problems assume that the length and width are positive numbers.

3. Determine the Effect of Scaling

- When scaled by a factor of 3.5:
- New length = $L \times 3.5$
- New width = $W \times 3.5$
- The new perimeter (P_{new}) can be calculated as:

$$P_{\text{new}} = 2 \times (L \times 3.5 + W \times 3.5) = 2 \times 3.5 \times (L + W) = 3.5 \times 2 \times (L + W) = 3.5 \times P$$

4. Calculate the New Perimeter

- Since the original perimeter $P = 72 \text{ ft}$:

$$P_{\text{new}} = 3.5 \times 72 \text{ ft} = 252 \text{ ft}$$

- Therefore, after scaling, the rectangle's perimeter is 252 ft.

5. Find the Original Dimensions (Optional)

- To find the original dimensions, choose a convenient value for L or W.
- For example, assume the rectangle is a square ($L = W$):

$$2(L + L) = 72 \rightarrow 4L = 72 \rightarrow L = 18 \text{ ft}$$

- So, original dimensions are:

- Length = 18 ft
- Width = 18 ft

- After scaling:

- New length = $18 \times 3.5 = 63 \text{ ft}$
- New width = $18 \times 3.5 = 63 \text{ ft}$

- Confirming the new perimeter:

$$P_{\text{new}} = 2(63 + 63) = 2 \times 126 = 252 \text{ ft}$$

Additional Insights and Applications

Understanding how scaling impacts measurements is crucial in various real-world scenarios.

Implications of Scaling in Architecture and Design

- When creating scale models, knowing how dimensions change helps ensure accurate representations.
- For example, scaling a building plan by a factor of 3.5 increases all linear measurements proportionally, affecting the perimeter, area, and volume accordingly.

Effects on Area and Volume

- Area scales by the square of the scale factor:

$$\text{Area}_{\text{new}} = (\text{scale factor})^2 \times \text{original area}$$

- Volume scales by the cube of the scale factor:

$$\text{Volume}_{\text{new}} = (\text{scale factor})^3 \times \text{original volume}$$

Practical Example

- Suppose the original rectangle has an area of $A = L \times W$.
- After scaling, the new area becomes:

$$A_{\text{new}} = (L \times 3.5) \times (W \times 3.5) = (3.5)^2 \times L \times W = 12.25 \times A$$

This illustrates how scaling affects different properties of a shape, which is vital in engineering and manufacturing.

Frequently Asked Questions (FAQs)

Q1: How do I find the original dimensions if only the perimeter is given?

- Without additional information, you cannot determine a unique pair of dimensions. You need more data, such as aspect ratio or specific length or width.

Q2: What if the rectangle is not a square?

- You can assign one dimension and solve for the other using the perimeter formula. The solution involves multiple possibilities unless constrained by additional information.

Q3: How does scaling affect the area and volume?

- Area scales by the square of the scale factor.
- Volume scales by the cube of the scale factor.

Q4: Can I apply this scaling concept to other shapes?

- Yes, the principles of scaling apply to all geometric shapes, affecting their dimensions, area, and volume accordingly.

Conclusion

In summary, when dealing with a rectangle having a perimeter of 72 ft, and its dimensions are scaled by a factor of 3.5, the new perimeter becomes 252 ft. This calculation hinges on understanding the basic perimeter formula and the effects of scaling. Recognizing how linear dimensions influence area and volume is essential for accurate modeling and design in various fields. Whether you're designing

a building, creating a scale model, or solving math problems, mastering these concepts ensures precision and confidence in your calculations.

By applying these systematic approaches, you can confidently tackle similar problems involving rectangles, scaling, and other geometric transformations. Remember, understanding the underlying principles empowers you to solve complex problems efficiently and accurately.

Frequently Asked Questions

A rectangle has a perimeter of 72 ft. If the length and width are scaled by a factor of 3.5, what is the new perimeter?

The new perimeter is 252 ft. Scaling both dimensions by 3.5 multiplies the perimeter by 3.5, so $72 \text{ ft} \times 3.5 = 252 \text{ ft}$.

Given a rectangle with a perimeter of 72 ft, how do you find its original length and width?

Let the length be L and width be W . Since perimeter $P = 2(L + W)$, then $L + W = 36 \text{ ft}$. Additional information is needed to find individual dimensions.

If the length and width of a rectangle are scaled by 3.5, how does this affect its area?

The area increases by a factor of 3.5 squared, which is 12.25 times the original area.

What is the formula to find the perimeter of a rectangle?

Perimeter $P = 2 \times (\text{length} + \text{width})$.

How do you calculate the new dimensions of a rectangle after scaling by a factor of 3.5?

Multiply both the original length and width by 3.5 to get the new dimensions.

If the original perimeter is 72 ft, what are the possible original lengths and widths?

Any pair of positive numbers L and W satisfying $2(L + W) = 72$, or $L + W = 36 \text{ ft}$, are possible. For example, $L=20 \text{ ft}$ and $W=16 \text{ ft}$.

What is the importance of scaling factors in similar geometric

figures?

Scaling factors determine how dimensions, perimeter, and area change proportionally between similar figures.

After scaling a rectangle's dimensions by 3.5, what is the new perimeter if the original perimeter was 72 ft?

The new perimeter is $72 \text{ ft} \times 3.5 = 252 \text{ ft}$.

Can the original length and width be determined from the perimeter alone?

No, additional information about either length or width is needed to determine their specific values.

If the original rectangle's length is 20 ft, what is its width?

Since $2(L + W) = 72$, then $L + W = 36$. With $L=20 \text{ ft}$, $W = 36 - 20 = 16 \text{ ft}$.

Additional Resources

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Understanding the Problem: A Foundation for Geometric Calculation

In the realm of geometry, understanding the properties and relationships of shapes is fundamental. The problem at hand involves a rectangle with a known perimeter, and the subsequent scaling of its length and width by a specific factor. The question posed is: after scaling, what are the new dimensions or perimeter? To accurately determine this, we need to first understand the foundational elements involved—perimeter, dimensions, and scaling—and then methodically work through the calculations.

Deciphering the Original Rectangle: Dimensions and Perimeter

Perimeter of a Rectangle

The perimeter (P) of a rectangle is the total length around the shape, calculated as:

$$P = 2 \times (L + W)$$

where L is the length and W is the width.

Given that the original perimeter is 72 feet, we can express this as:

$$2(L + W) = 72$$

Dividing both sides by 2:

$$L + W = 36$$

This equation establishes a relationship between the length and width of the original rectangle, but it doesn't specify their individual values. Therefore, the original rectangle could have various combinations of length and width, as long as their sum equals 36 feet.

Implication of the Unknown Dimensions

Since the problem doesn't specify the ratio of length to width, the most we can do is express one dimension in terms of the other:

$$W = 36 - L$$

This relationship forms the basis for subsequent calculations when applying the scaling factor.

The Concept of Scaling: How Dimensions Change

What Does Scaling Mean?

Scaling involves enlarging or reducing a shape proportionally by a certain factor. When a rectangle's dimensions are scaled by a factor (k) , both length and width are multiplied by (k) :

$$L_{\text{new}} = L \times k$$

$$W_{\text{new}} = W \times k$$

In this case, the scaling factor is 3.5.

Why is Scaling Important?

Scaling is fundamental in fields like architecture, manufacturing, and design, where proportional adjustments are common. Understanding how perimeters and areas change with scaling helps in planning and resource estimation.

Applying the Scaling Factor: Calculating the New Dimensions

Scaling the Dimensions

Given the original dimensions (L) and (W) , the scaled dimensions become:

$$L' = L \times 3.5$$

$$W' = W \times 3.5$$

Since $(L + W = 36)$, the sum of the scaled dimensions will be:

$$[L' + W' = (L + W) \times 3.5 = 36 \times 3.5 = 126]$$

Calculating the New Perimeter

The perimeter of the scaled rectangle is:

$$[P' = 2 \times (L' + W')]$$

Substituting the sum of scaled dimensions:

$$[P' = 2 \times 126 = 252 \text{ feet}]$$

Thus, regardless of the original dimensions, as long as the initial perimeter is 72 feet and the scaling factor is 3.5, the new perimeter will be 252 feet.

Verifying the Calculation: An Alternative Approach

Direct Calculation of the New Perimeter

Alternatively, since perimeter scales linearly with the dimensions:

$$[P' = P \times k]$$

where (P) is the original perimeter, and (k) is the scaling factor.

Applying the known values:

$$[P' = 72 \times 3.5 = 252 \text{ feet}]$$

This confirms our previous result, showing the simplicity and consistency of linear scaling in perimeter calculations.

Implications and Real-World Applications

Practical Significance

Understanding how scaling affects a rectangle's perimeter is vital in real-world scenarios such as:

- Construction and Architecture: When enlarging plans or models, knowing how perimeter and area change helps in material estimation.
- Manufacturing: Scaling designs proportionally ensures that the product maintains its shape and proportions while adjusting size.
- Landscaping: Expanding a garden or plot requires calculations to estimate fencing or boundary costs accurately.

Limitations and Considerations

While perimeter scales linearly, area scales with the square of the scaling factor:

$$\text{Area}_{\text{new}} = \text{Area}_{\text{original}} \times k^2$$

This means that a small change in the scaling factor results in a significant change in area, which is crucial for planning purposes.

Summary: Key Takeaways and Mathematical Insights

- The original rectangle has a perimeter of 72 feet, leading to the relationship $(L + W = 36)$.
- When both dimensions are scaled by a factor of 3.5, the new perimeter becomes 252 feet.
- The perimeter scales linearly with the dimensions, simplifying calculations.
- The actual individual dimensions of the original rectangle can vary, but the scaled perimeter remains consistent with the scaling factor.

Conclusion: The Power of Mathematical Reasoning

This problem exemplifies the elegance and practicality of mathematical reasoning in solving geometric questions. By understanding the foundational relationships—perimeter, dimensions, and scaling—we can efficiently determine the effects of proportional adjustments. Whether in academic contexts or real-world applications, these principles form the backbone of precise measurements and informed decision-making, emphasizing the importance of a solid grasp of geometry and scaling concepts.

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