

The Length Of A Rectangle Is 3 Inches More Than Its Width. If The Perimeter Is 42 Inches, Find The Dimensions

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Understanding the dimensions of a rectangle is fundamental in geometry, especially when solving real-world problems involving length, width, and perimeter. In this article, we will explore a specific problem where the length of a rectangle exceeds its width by 3 inches, and the total perimeter is given as 42 inches. We will walk through the steps to find the exact measurements of the rectangle, explain the underlying concepts, and provide tips to solve similar problems efficiently.

Understanding the Problem

Before diving into calculations, let's break down the problem statement:

- The length (L) of the rectangle is 3 inches more than its width (W).
- The perimeter (P) of the rectangle is 42 inches.
- The goal is to find the dimensions of the rectangle, i.e., the length and the width.

This problem involves basic algebra and understanding how the perimeter relates to length and width.

Key Concepts and Formulas

1. Rectangle Dimensions

- The rectangle has two pairs of equal sides:
- Two lengths (L)
- Two widths (W)

2. Perimeter of a Rectangle

- The perimeter is the total distance around the rectangle.
- The formula for perimeter (P) is:

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

- Given the perimeter, we can set up an equation to relate length and width.

3. Relationship Between Length and Width

- The problem states:

$$\begin{aligned} & \backslash[\\ L &= W + 3 \\ & \backslash] \end{aligned}$$

- This allows us to substitute and express everything in terms of one variable.

Step-by-Step Solution

Step 1: Write the perimeter formula with known relationships

- Given:

$$\begin{aligned} & \backslash[\\ P &= 42 \\ & \backslash] \end{aligned}$$

- Using the perimeter formula:

$$\begin{aligned} & \backslash[\\ 42 &= 2 \times (L + W) \\ & \backslash] \end{aligned}$$

- Substitute $(L = W + 3)$:

$$\begin{aligned} & \backslash[\\ 42 &= 2 \times ((W + 3) + W) \\ & \backslash] \end{aligned}$$

Step 2: Simplify the equation

- Combine like terms inside parentheses:

$$\begin{aligned} & \backslash[\\ 42 &= 2 \times (2W + 3) \\ & \backslash] \end{aligned}$$

- Distribute the 2:

$$\begin{aligned} & \backslash[\\ 42 &= 4W + 6 \\ & \backslash] \end{aligned}$$

Step 3: Solve for W

- Subtract 6 from both sides:

$$\begin{aligned} & \backslash[\end{aligned}$$

$$42 - 6 = 4W$$

\]

\[

$$36 = 4W$$

\]

- Divide both sides by 4:

\[

$$W = \frac{36}{4} = 9$$

\]

Step 4: Find L using the relationship

- Recall:

\[

$$L = W + 3$$

\]

- Substitute $(W = 9)$:

\[

$$L = 9 + 3 = 12$$

\]

Final Dimensions of the Rectangle

- Width (W): 9 inches

- Length (L): 12 inches

These measurements satisfy the given perimeter and the relationship between length and width.

Verification of the Solution

It's crucial to verify that the found dimensions meet all the conditions:

- Check the perimeter:

\[

$$P = 2 \times (L + W) = 2 \times (12 + 9) = 2 \times 21 = 42 \text{ inches}$$

\]

- The perimeter matches the given value, confirming the solution's accuracy.

Applications of the Problem and Conceptual Insights

Understanding how to approach problems involving the dimensions of geometric

shapes is valuable in many fields, including architecture, engineering, and design.

Real-World Applications Include:

- Designing rectangular plots of land with specific perimeter constraints.
- Calculating materials needed for framing or fencing.
- Developing layouts for rectangular rooms or objects.

Key Takeaways:

- Establish relationships between variables to simplify the problem.
- Use algebraic substitution to reduce the problem to a single variable.
- Always verify your solutions against the original problem conditions.

Tips for Solving Similar Problems

- Identify relationships clearly: Recognize how the dimensions relate (e.g., length is a certain amount more than width).
- Translate words into algebra: Convert statements into equations carefully.
- Write down known formulas: In this case, the perimeter formula is essential.
- Substitute and simplify: Reduce the problem to a manageable algebraic equation.
- Verify your answer: Plug your solutions back into the original formulas.

Additional Practice Problems

To reinforce learning, consider attempting these similar problems:

1. The length of a rectangle is twice its width. If the perimeter is 48 inches, find the dimensions.
2. A rectangle has a length 5 inches less than twice its width, and its perimeter is 60 inches. Find the width and length.
3. The width of a rectangle is 4 inches less than its length. If the perimeter is 36 inches, find the dimensions.

By practicing these variations, you'll strengthen your understanding of relating dimensions and perimeter.

Conclusion

In conclusion, solving for the dimensions of a rectangle given specific relationships and perimeter involves setting up algebraic equations based on the known formulas. In this particular problem, we found that the rectangle measures 12 inches in length and 9 inches in width, satisfying both the relationship between length and width and the perimeter condition. Mastery of these concepts enhances problem-solving skills in geometry and prepares you for tackling more complex spatial problems.

Remember: Always verify your solutions, understand the relationships involved, and practice with varied problems to build confidence and

proficiency.

Frequently Asked Questions

How do you set up an equation to find the dimensions of a rectangle where the length is 3 inches more than the width and the perimeter is 42 inches?

Let the width be W inches. Then, the length is $W + 3$ inches. The perimeter P of a rectangle is $2(\text{length} + \text{width})$, so $42 = 2(W + (W + 3))$. Solving this equation will give the dimensions.

What is the first step to find the width of the rectangle in this problem?

The first step is to express the length in terms of the width, which is $L = W + 3$, then write the perimeter formula as $42 = 2(W + L)$.

How do you solve for the width after setting up the equation?

Substitute $L = W + 3$ into the perimeter formula: $42 = 2(W + W + 3)$. Simplify to $42 = 2(2W + 3)$, then divide both sides by 2 to get $21 = 2W + 3$, and finally solve for W .

What is the value of the width of the rectangle in this problem?

Solving $21 = 2W + 3$ gives $18 = 2W$, so $W = 9$ inches.

How do you find the length of the rectangle once you know the width?

Since $\text{length} = W + 3$, substitute $W = 9$ inches to get $\text{length} = 9 + 3 = 12$ inches.

What are the dimensions of the rectangle based on the calculations?

The rectangle's dimensions are a width of 9 inches and a length of 12 inches.

How can you verify that the dimensions satisfy the perimeter condition?

Calculate the perimeter using the dimensions: $2(9 + 12) = 2(21) = 42$ inches, which matches the given perimeter.

What is the importance of setting up the correct equation in solving this problem?

Setting up the correct equation ensures that the relationships between the dimensions are accurately represented, leading to the correct solution.

Can this method be used for similar problems with different perimeter or length differences?

Yes, this approach can be adapted by adjusting the expressions for length and perimeter, making it a versatile method for solving various rectangle dimension problems.

Additional Resources

Rectangle Dimensions Problem: An In-Depth Analysis and Solution Guide

When it comes to understanding geometric concepts, especially those involving rectangles, the ability to translate word problems into algebraic expressions is an essential skill. Today, we delve into a classic problem: "The length of a rectangle is 3 inches more than its width. If the perimeter is 42 inches, find the dimensions." This problem not only tests our algebraic reasoning but also offers insights into how geometric properties relate to algebraic equations. Let's explore this scenario comprehensively, dissecting each component to understand the underlying principles and the steps to arrive at the solution.

Understanding the Problem: Breaking Down the Scenario

Before jumping into calculations, it's crucial to fully grasp what the problem states and what it asks us to find. The problem provides three key pieces of information:

- Relationship between length and width:
 - The length (L) is 3 inches more than the width (W).
 - Mathematically, this is expressed as:
$$L = W + 3$$
- Perimeter of the rectangle:
 - The perimeter (P) equals 42 inches.
 - Recall that the perimeter of a rectangle is given by:
$$P = 2(L + W)$$
 - So, in this case:
$$2(L + W) = 42$$
- What we need to find:
 - The dimensions of the rectangle, specifically the length and width.

This setup prompts us to translate a real-world word problem into a mathematical framework, which involves identifying variables, establishing

relationships, and applying relevant formulas.

Step-by-Step Approach to the Solution

To solve the problem systematically, we'll follow a structured approach:

1. Assign Variables

- Let's denote the width of the rectangle as (W) inches.
- Since the length is 3 inches more than the width, (L) can be expressed as:

$$[L = W + 3]$$

2. Write the Perimeter Equation

Given that the perimeter $(P = 42)$ inches, and the perimeter formula is:

$$[P = 2(L + W)]$$

Substitute (L) with $(W + 3)$:

$$[42 = 2(W + 3 + W)]$$

Simplify inside the parentheses:

$$[42 = 2(2W + 3)]$$

3. Solve for the Width (W)

Distribute the 2:

$$[42 = 4W + 6]$$

Subtract 6 from both sides:

$$[42 - 6 = 4W]$$

$$[36 = 4W]$$

Divide both sides by 4:

$$[W = \frac{36}{4}]$$

$$[W = 9]$$

4. Find the Length (L)

Recall:

$$[L = W + 3]$$

Substitute $(W = 9)$:

$$[L = 9 + 3 = 12]$$

Final Dimensions of the Rectangle

Having determined the values of (W) and (L) :

- Width: 9 inches
- Length: 12 inches

These dimensions satisfy both the given relationship and the perimeter condition.

Verification: Confirming the Solution

It's always prudent to verify our solution to ensure accuracy.

- Calculate the perimeter using the found dimensions:

$$[P = 2 (L + W) = 2 (12 + 9) = 2 (21) = 42]$$

- The perimeter matches the problem statement, confirming our calculations.
- Check the relationship between length and width:

$$[L = W + 3 = 9 + 3 = 12]$$

- The relationship holds true.

Thus, the solution is verified.

Additional Insights and Practical Applications

Understanding how to approach such problems has practical implications beyond classroom exercises. From designing rectangular garden plots to manufacturing packaging boxes, knowing how dimensions relate to perimeter and other properties is essential.

Real-World Applications:

- Design and Construction: Calculating dimensions for materials based on perimeter constraints.
- Interior Design: Determining furniture dimensions within space limitations.
- Manufacturing: Ensuring components fit within specified size parameters.

Tips for Solving Similar Problems:

- Identify the Variables: Clearly assign symbols to unknown quantities.
- Translate Relationships: Express relationships in algebraic form.

- Use Relevant Formulas: Recall and apply geometric formulas pertinent to the shape.
- Solve Step-by-Step: Break down the problem into manageable steps for clarity.
- Verify Your Solutions: Always check your work to prevent errors.

Conclusion: Mastering the Art of Word Problems

The problem of determining a rectangle's dimensions given a perimeter and a relationship between length and width exemplifies how algebra and geometry intertwine. By carefully translating words into equations, systematically solving, and verifying results, one can confidently approach similar problems across various contexts.

Understanding the process not only enhances mathematical proficiency but also fosters problem-solving skills applicable in many real-world situations. Whether you're a student aiming for mastery or a professional applying these principles, approaching such problems with a structured mindset ensures success and deepens your comprehension of the geometric world around you.

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