

. A Rectangles Length Is Twice Its Width. Its Perimeter Is 156 Meters. What Is The Rectangles Length?

A Rectangle's Length Is Twice Its Width. Its Perimeter Is 156 Meters. What Is The Rectangle's Length?

Understanding the dimensions of rectangles is fundamental in geometry, especially when given specific relationships between sides and other measurements such as perimeter. In this article, we will explore how to determine the length of a rectangle when its length is twice its width and the total perimeter is known to be 156 meters. We will break down the problem systematically, introduce relevant formulas, and demonstrate the step-by-step solution process.

Understanding the Problem Statement

Before diving into calculations, it is crucial to interpret the problem correctly.

Restating the Problem

- The rectangle has a length that is twice its width.
- The perimeter of the rectangle is 156 meters.
- The goal is to find the length of the rectangle.

Key Information and What Is Being Asked

- Relationship between length and width: $\text{Length} = 2 \times \text{Width}$.
- Total perimeter: 156 meters.
- Required: The value of the length.

Fundamental Concepts and Formulas

To solve the problem, we need to understand some basic formulas related to rectangles.

Perimeter of a Rectangle

The perimeter (P) of a rectangle is the total distance around it, given by:

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

- Where:
- length = L
- width = W

Expressing the Dimensions

Given the relationship:

$$L = 2W$$

we can substitute this into the perimeter formula to express everything in terms of W or L.

Step-by-Step Solution Process

Now, let's approach the problem methodically.

Step 1: Write the perimeter formula with variables

$$156 = 2 \times (L + W)$$

Substituting $(L = 2W)$:

$$156 = 2 \times (2W + W)$$

Step 2: Simplify the equation

$$156 = 2 \times (3W)$$
$$156 = 6W$$

Step 3: Solve for W (Width)

$$W = \frac{156}{6} = 26$$

Step 4: Find the Length (L)

Recall:

$$L = 2W$$
$$L = 2 \times 26 = 52$$

Therefore, the length of the rectangle is 52 meters.

Verification of the Solution

To ensure the correctness of our answer, let's verify the calculation.

Check the perimeter with the found dimensions

- Width (W) = 26 meters
- Length (L) = 52 meters

Calculate:

$$P = 2 \times (L + W) = 2 \times (52 + 26) = 2 \times 78 = 156 \text{ meters}$$

Since the calculated perimeter matches the given perimeter, the solution is verified.

Additional Considerations

While the problem is straightforward, it is helpful to consider related aspects.

Alternative Approach: Using Variables First

- Define variables and set up equations before substitution.
- For example:
 1. Let (W) be the width.
 2. Then $(L = 2W)$.
 3. Substitute into perimeter formula:
$$156 = 2 \times (2W + W) \rightarrow 156 = 6W$$
 4. Solve for (W) , then find (L) .

Common Mistakes to Avoid

- Mixing up the relationship between length and width.
- Forgetting to double the sum when calculating perimeter.
- Miscalculating the substitution step.

Real-World Applications of Such Problems

Understanding such problems is not only academic but also practical in various fields.

Design and Construction

- Calculating fencing length for a rectangular garden.
- Determining dimensions for materials in construction projects.

Manufacturing and Packaging

- Designing rectangular products where specific dimensional ratios are required.
- Calculating material requirements based on perimeter constraints.

Architecture and Engineering

- Planning rectangular structures with specific perimeter requirements.

Summary and Key Takeaways

- When given a relationship between sides of a rectangle and the perimeter, set up an algebraic equation.
- Substitute the relationship into the perimeter formula to express the perimeter in terms of a single variable.
- Solve for the unknown dimension, then find the other using the given relationship.
- Always verify your solution by plugging the values back into the original perimeter formula.

In this problem, the rectangle's length is 52 meters when its width is 26 meters, given that the perimeter is 156 meters and the length is twice the width.

Final Thoughts

Mastering such algebraic problems enhances problem-solving skills and deepens understanding of geometric relationships. It demonstrates the importance of translating word problems into mathematical equations and systematically solving them. Whether in academic settings or real-world scenarios, these skills are invaluable for analyzing and designing solutions efficiently.

Frequently Asked Questions

How do you find the length of a rectangle when its width and perimeter are known?

You set up equations based on the given relationships, such as the perimeter formula and the ratio between length and width, then solve for the unknowns.

What is the formula for the perimeter of a rectangle?

The perimeter of a rectangle is given by $P = 2(\text{length} + \text{width})$.

If a rectangle's length is twice its width, how can you express its perimeter in terms of its width?

Let the width be w ; then the length is $2w$. The perimeter is $2(2w + w) = 2(3w) = 6w$.

Given the perimeter is 156 meters, how do you find the width of the rectangle?

Set $6w = 156$, then solve for w : $w = 156 / 6 = 26$ meters.

What is the length of the rectangle if its width is 26 meters?

Since the length is twice the width, $\text{length} = 2 \times 26 = 52$ meters.

Why does setting up equations help in solving rectangle problems with given ratios and perimeters?

Equations allow you to express unknown dimensions in terms of known quantities, making it easier to solve for specific measurements.

Can the methods used here be applied to other shapes with similar ratio and perimeter problems?

Yes, similar algebraic methods can be applied to other geometric shapes with known ratios and perimeter or area constraints.

What is the key takeaway when solving for dimensions of a rectangle with a ratio and perimeter given?

The key is to express all unknowns in terms of one variable using the ratio, then substitute into the perimeter formula and solve for that variable.

Additional Resources

A Rectangle's Length Is Twice Its Width. Its Perimeter Is 156 Meters. What Is The Rectangle's Length?

Understanding the dimensions of geometric shapes is fundamental not only in academic contexts but also in real-world applications such as construction, design, and engineering. One common problem involves determining the length and width of a rectangle given specific conditions. Today, we explore a classic example: a rectangle where the length is twice its width, and the perimeter measures 156 meters. By dissecting this problem step-by-step, we aim to provide clarity on how to approach such geometric puzzles with precision and confidence.

Understanding the Basics: What Defines a Rectangle?

Before diving into the problem, it's essential to revisit the fundamental properties of a rectangle:

Key Properties:

- Opposite sides are equal in length.
- All angles are right angles (90 degrees).
- Perimeter is the total distance around the rectangle, calculated as the sum of all sides.

In this problem, the focus is on the dimensions—length and width—and how they relate to each other and the perimeter.

Decoding the Problem Statement

The problem provides two critical pieces of information:

1. Relationship between length and width:

- The length (L) is twice the width (W).
- Mathematically, this can be expressed as:

$$L = 2W$$

2. Perimeter of the rectangle:

- The total perimeter (P) equals 156 meters.
- The perimeter formula for a rectangle is:

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

The goal is to find the value of the length (L).

Formulating the Mathematical Equations

Given the information, we can set up equations to solve for W and then find L.

Step 1: Express perimeter in terms of W

Using the perimeter formula and the relation $(L = 2W)$:

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

$$156 = 2 \times (L + W)$$

Substitute $(L = 2W)$:

$$156 = 2 \times (2W + W)$$

Step 2: Simplify the equation

$$156 = 2 \times (3W)$$

$$156 = 6W$$

Step 3: Solve for W

$$W = \frac{156}{6} = 26$$

Step 4: Find L

Recall $(L = 2W)$:

$$L = 2 \times 26 = 52$$

Therefore, the length of the rectangle is 52 meters.

Verifying the Solution

Verification is a critical step to ensure the solution aligns with the problem conditions.

Step 1: Check the dimensions

- Width $(W = 26)$ meters
- Length $(L = 52)$ meters

Step 2: Calculate the perimeter

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\[
P = 2 \times (L + W) = 2 \times (52 + 26) = 2 \times 78 = 156
\]
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The calculated perimeter matches the given perimeter, confirming the correctness of our solution.

Real-World Applications and Implications

Understanding how to determine dimensions from given constraints has practical applications across various fields:

Construction and Architecture

- When designing a rectangular plot or room with specific perimeter constraints, knowing how length and width relate is essential for material estimation and layout planning.

Manufacturing

- Cutting fabric or materials into rectangular pieces where the dimensions relate proportionally ensures efficient use of resources.

Urban Planning

- Estimating boundary lengths and dimensions of plots or zones based on perimeter data aids in accurate mapping and resource allocation.

Educational Context

- Such problems serve as foundational exercises in algebra, helping students develop problem-solving skills and an understanding of proportional relationships.

Extensions and Variations of the Problem

While this problem considers a simple relationship, real-world scenarios often involve more complex conditions:

1. Different Ratios

- What if the length is three times the width?
- How does the solution change?

2. Additional Constraints

- If the rectangle must fit within certain area limits, how would that affect dimensions?

3. Three-Dimensional Extensions

- Extending 2D rectangle problems into 3D structures, such as rectangular prisms, introduces volume considerations.

4. Non-Perimeter Constraints

- Problems involving area, diagonal length, or other properties can add layers of complexity.

Conclusion: Mastering the Geometric Puzzle

The problem of determining a rectangle's length when given a proportional relationship and perimeter exemplifies the power of algebraic reasoning in geometry. By translating word problems into equations, simplifying, and verifying, we develop a structured approach that can be applied to countless real-world situations. In this particular case, the rectangle's length is 52 meters, a straightforward yet insightful result that underscores the elegance of mathematical problem-solving. Whether in academic exercises or practical applications, mastering such problems enhances analytical thinking and fosters a deeper appreciation for the interconnectedness of shapes and measurements.

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