

A Rectangle With A Length Of $X - 4$ And A Width Of 8 Has A Perimeter Of 34. What Is The Value Of X ?

Understanding the Problem: A Rectangle With Specific Dimensions and Perimeter

The Given Information

We are presented with a rectangle that has a length described as $X - 4$ and a width of 8. Additionally, the perimeter of this rectangle is given as 34. The goal is to find the value of X .

Breaking Down the Problem

To solve for X , we need to understand the relationships between the dimensions of the rectangle and its perimeter. The key components are:

- Length: $X - 4$
- Width: 8
- Perimeter: 34

Given these, the main task involves translating the perimeter formula into an algebraic equation involving X , then solving for X .

Perimeter Formula for a Rectangle

Understanding the Formula

The perimeter (P) of a rectangle is the total distance around the rectangle, which can be calculated using the formula:

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

This formula sums the lengths of all sides, with each pair being equal.

Applying the Formula to the Given Dimensions

Given the dimensions:

- Length = $X - 4$
- Width = 8

The perimeter becomes:

$$34 = 2 \times [(X - 4) + 8]$$

Formulating the Equation

Step-by-Step Derivation

1. Write the perimeter formula with the given dimensions:
2. Substitute the known values:

$$34 = 2 \times [(X - 4) + 8]$$

3. Combine like terms inside the brackets:

$$34 = 2 \times (X - 4 + 8)$$

4. Simplify inside the parentheses:

$$34 = 2 \times (X + 4)$$

5. Distribute the 2:

$$34 = 2X + 8$$

6. Isolate the variable term:

$$2X = 34 - 8$$

$$2X = 26$$

7. Divide both sides by 2 to solve for X:

$$X = 13$$

Interpreting the Solution

The Value of X

The solution indicates that $X = 13$.

Verifying the Result

To ensure the solution is correct, substitute $X = 13$ back into the original dimensions and check the perimeter:

- Calculate length: $X - 4 = 13 - 4 = 9$
- Width remains 8

Now, compute the perimeter:

$$P = 2 \times (\text{length} + \text{width}) = 2 \times (9 + 8) = 2 \times 17 = 34$$

The calculation confirms the perimeter is indeed 34, matching the original problem statement.

Additional Insights and Considerations

Understanding the Variable X

- The variable X represents an unknown, which, based on the problem, must be a real number satisfying the perimeter condition.
- In this context, X signifies a length component that, once determined, helps describe the rectangle's dimensions.

Implications of the Solution

- The length of the rectangle is 9 units (since $X - 4 = 13 - 4 = 9$).
- The width remains constant at 8 units.
- The dimensions are consistent with the perimeter requirement, validating the solution.

Alternative Perspectives and Extensions

What if the Perimeter Were Different?

If the perimeter had a different value, the process would involve setting up the same equation but with the new perimeter value, then solving for X .

Exploring Other Variable Relationships

Suppose the problem involved different expressions for the length or width, or additional constraints like area. In such cases, multiple equations could be established to solve for X .

Practical Applications

- Designing rectangles with specific perimeters and variable lengths in architecture or manufacturing.
- Calculating dimensions when constraints are given, useful in geometry, engineering, and construction projects.

Summary and Key Takeaways

To conclude, the problem of finding the value of X in a rectangle with a length of $X - 4$, a width of 8, and a perimeter of 34 involves setting up and solving a straightforward algebraic equation. The key steps include understanding the perimeter formula, substituting the given dimensions, simplifying, and solving for the variable. The final answer, $X = 13$, satisfies all conditions, verified by calculating the perimeter with these dimensions.

Final Remarks

Mastering such problems enhances understanding of geometric relationships and algebraic problem-solving skills. These foundational concepts are vital across various fields, from pure mathematics to practical engineering applications.

Frequently Asked Questions

How do you set up an equation to find the value of X in the rectangle problem?

You use the perimeter formula for a rectangle, which is 2 times the length plus 2 times the width. Given the length as $X - 4$ and width as 8, set up the equation: $2(X - 4) + 2(8) = 34$.

What is the first step to solve for X in the given problem?

First, expand the equation: $2X - 8 + 16 = 34$, which simplifies to $2X + 8 = 34$.

How do you isolate X in the equation $2X + 8 = 34$?

Subtract 8 from both sides to get $2X = 26$, then divide both sides by 2 to find $X = 13$.

Why is it important to verify the solution for X in the rectangle perimeter problem?

Verifying ensures that the calculated value of X makes sense within the context of the problem, confirming that the length and perimeter are consistent with the given data.

What is the length of the rectangle when X equals 13?

The length is $X - 4$, so when X is 13, the length is $13 - 4 = 9$ units.

Additional Resources

A Rectangle With A Length Of $X - 4$ And A Width Of 8 Has A Perimeter Of 34. What Is The Value Of X?

Understanding the intricacies of geometric problems often serves as a foundation for both academic success and practical application. One such problem involves calculating an unknown dimension of a rectangle based on its perimeter—a fundamental concept in geometry that finds relevance in fields ranging from architecture to engineering. Today, we delve into a specific problem: determining the value of X in a rectangle with a length of $X - 4$ and a width of 8, given that its perimeter is 34 units. This problem, while seemingly straightforward, offers an excellent opportunity to explore algebraic reasoning, the formula for perimeter, and the step-by-step process to arrive at the solution.

Understanding the Problem: The Basics of Rectangle Geometry

Before tackling the problem, it's essential to review the fundamental properties of rectangles, particularly how to calculate their perimeter.

The Rectangle's Dimensions

- Length: The problem states the length as $X - 4$, where X is an unknown variable. This means the length depends on the value of X .
- Width: The width is given as a fixed value of 8 units.

The Perimeter of a Rectangle

The perimeter (P) of a rectangle is the total distance around it. It can be calculated using the formula:

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

Applying this formula requires knowing both the length and width. In our case, the width is fixed, but the length depends on X .

Formulating the Equation

With the given information, we can now translate the problem into an algebraic equation.

Step 1: Write down what is known

- Length = $X - 4$
- Width = 8
- Perimeter (P) = 34

Step 2: Plug into the perimeter formula

$$34 = 2 \times [(X - 4) + 8]$$

Step 3: Simplify the expression inside the brackets

$$34 = 2 \times (X - 4 + 8)$$

$$\begin{aligned} & \backslash \\ & \backslash \\ 34 &= 2 \times (X + 4) \\ & \backslash \end{aligned}$$

Step 4: Expand the right side

$$\begin{aligned} & \backslash \\ 34 &= 2X + 8 \\ & \backslash \end{aligned}$$

This equation now relates X directly to known quantities.

Solving for X: Step-by-Step Approach

Now, let's isolate X and determine its value.

Step 1: Subtract 8 from both sides

$$\begin{aligned} & \backslash \\ 34 - 8 &= 2X \\ & \backslash \\ & \backslash \\ 26 &= 2X \\ & \backslash \end{aligned}$$

Step 2: Divide both sides by 2

$$\begin{aligned} & \backslash \\ X &= \frac{26}{2} \\ & \backslash \\ & \backslash \\ X &= 13 \\ & \backslash \end{aligned}$$

Result: The value of X is 13.

Interpreting the Solution in Context

The algebraic solution indicates that when X equals 13, the rectangle's dimensions satisfy the

perimeter condition.

Verification of the Solution

- Calculate the length: $X - 4 = 13 - 4 = 9$ units.
- Width: 8 units.
- Perimeter check:

$$P = 2 \times (\text{length} + \text{width}) = 2 \times (9 + 8) = 2 \times 17 = 34$$

The perimeter confirms our solution, validating the correctness of the calculation.

Practical Implications and Applications

While the problem at first glance appears purely academic, understanding how to manipulate algebraic formulas and solve for unknowns has far-reaching applications.

Design and Architecture

Architects often need to determine dimensions based on perimeter constraints, whether for fencing, framing, or material estimation.

Manufacturing and Engineering

Engineers may use similar calculations for designing components where specific perimeter or boundary requirements are critical.

Educational Value

Problems like these reinforce foundational skills in algebra, critical thinking, and problem-solving, which are essential for advanced mathematics and STEM careers.

Key Takeaways

- Formulating equations based on geometric formulas is a vital skill.
- Algebraic manipulation allows for solving unknown variables efficiently.
- Validating solutions through back-substitution ensures accuracy.
- Real-world applications often mirror these mathematical processes.

Conclusion

The problem of determining the value of X in a rectangle with a length of $X - 4$ and a width of 8, given that its perimeter is 34, exemplifies essential mathematical reasoning. By translating the problem into an algebraic equation, simplifying, and solving step-by-step, we find that X equals 13. This exercise not only demonstrates the power of algebra but also highlights how fundamental geometry principles are applicable in practical scenarios. Whether in classrooms, engineering design, or everyday problem-solving, mastering these concepts equips individuals with the analytical tools necessary to navigate complex challenges confidently.

In summary: When working with rectangles and their perimeters, understanding the relationship between dimensions and applying algebraic techniques enables precise solutions. In this case, the value of X is 13, ensuring the rectangle's dimensions conform to the specified perimeter—an elegant illustration of geometry and algebra working in harmony.

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