# A Rectangle Has A Perimeter Of 48 In. The Length And Width Are Scaled By A Factor Of 2.5. What Is The

### A Rectangle Has A Perimeter Of 48 In. The Length And Width Are Scaled By A Factor Of 2.5. What Is The

Understanding the properties of rectangles and how scaling affects their dimensions is fundamental in geometry. In this article, we will explore a specific problem involving a rectangle with a given perimeter, how its dimensions change when scaled, and how to calculate the new measurements. Whether you're a student preparing for exams or someone interested in geometric concepts, this comprehensive guide will clarify the process step-by-step.

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## Understanding the Basic Properties of a Rectangle

Before diving into the problem, it's essential to understand the fundamental properties of rectangles.

### What Defines a Rectangle?

- A rectangle is a four-sided polygon (quadrilateral) with opposite sides equal and four right angles.
- The key dimensions of a rectangle are its length (L) and width (W).

### Perimeter of a Rectangle

- The perimeter (P) is the total distance around the rectangle.
- It is calculated as:

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

- For example, if a rectangle has a length of 10 inches and a width of 4 inches:

$$P = 2 \times (10 + 4) = 2 \times 14 = 28 \text{ inches}$$

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## Given Data and the Problem Statement

The problem states:

- The original perimeter of the rectangle is 48 inches.
- The length and width are scaled by a factor of 2.5.
- The question: What is the new perimeter after scaling?

The key steps involve:
1. Determining the original dimensions (length and width) based on the perimeter.
2. Scaling these dimensions by the given factor.
3. Calculating the new perimeter with scaled dimensions.

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## Step 1: Find Original Dimensions of the Rectangle

Given:

- Original perimeter, $P = 48$ inches

We know:

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

To find the sum of the original length and width:

- $L + W = P / 2 = 48 / 2 = 24$ inches

Note: Without additional information, the original length and width are not uniquely determined, but their sum is known to be 24 inches.

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## Step 2: Understand the Effect of Scaling on Dimensions

When a rectangle's length and width are scaled by a factor of $k = 2.5$, the new dimensions become:

- $L' = L \times 2.5$
- $W' = W \times 2.5$

The implications:

- The scaled length and width are 2.5 times their original sizes.
- The new perimeter can be calculated using the scaled dimensions.

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## Step 3: Calculate the New Dimensions and Perimeter

Since the original sum of dimensions is $L + W = 24$ inches, the scaled dimensions will have a sum:

- $L' + W' = (L + W) \times 2.5 = 24 \times 2.5 = 60$ inches

Now, the new perimeter is:

- $P' = 2 \times (L' + W') = 2 \times 60 = 120$ inches

Therefore:

> After scaling both the length and width by a factor of 2.5, the new perimeter of the rectangle is 120 inches.

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## Summary of the Calculation Process

To wrap up, here is a step-by-step outline:

1. Determine the sum of original dimensions:

- Original perimeter = 48 inches
- Sum of original dimensions = 24 inches

2. Apply the scaling factor to the sum:

- Scaling factor = 2.5
- Scaled sum = 24 × 2.5 = 60 inches

3. Calculate the new perimeter:

- New perimeter = 2 × scaled sum = 2 × 60 = 120 inches

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# Additional Considerations and Variations

While the problem doesn't specify the original length and width individually, it's important to note:

- The original dimensions could vary as long as their sum is 24 inches.
- For example:
- If the original length is 10 inches, then the width is 14 inches.
- If the length is 12 inches, then the width is 12 inches.
- After scaling, these specific dimensions would be:

- For length: $L' = L \times 2.5$
- For width: $W' = W \times 2.5$
- The perimeter would always be 120 inches regardless of the original dimensions, as long as their sum is 24 inches.

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# Real-World Applications of Scaling in Geometry

Understanding how scaling affects dimensions and perimeters is valuable in various fields:

- Architecture and Design: Scaling blueprints to real-world sizes.
- Engineering: Adjusting component sizes proportionally.
- Art and Modeling: Creating scaled models while maintaining proportions.
- Mathematics Education: Developing spatial reasoning and proportional thinking.

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# Practice Problems to Reinforce Concepts

1. If a rectangle has a perimeter of 60 inches, and its length is 20 inches, what is its width? If both dimensions

are scaled by a factor of 3, what is the new perimeter?

2. A rectangle's width is 8 inches, and its perimeter is 40 inches. If the width is increased by 4 inches, and the length remains the same, what is the new perimeter?

3. A rectangle with an original perimeter of 72 inches is scaled down by a factor of 0.5. What is the perimeter of the scaled rectangle?

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# Conclusion

Understanding the relationship between perimeter, dimensions, and scaling factors is essential in geometry. In the problem discussed, scaling both the length and width by a factor of 2.5 results in the perimeter increasing proportionally. Specifically, starting with a rectangle with a perimeter of 48 inches, scaling its dimensions by 2.5 yields a new perimeter of 120 inches. This exercise emphasizes the importance of proportional reasoning and provides practical insights into how geometric figures behave under scaling transformations.

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Meta Description:
Learn how to calculate the new perimeter of a rectangle when its length and width are scaled by a factor of 2.5. Step-by-step explanation of the problem involving a rectangle with a 48-inch perimeter.

# Frequently Asked Questions

## What is the original length and width of the rectangle given its perimeter of 48 inches?

The original length and width cannot be uniquely determined from only the perimeter; additional information is needed. However, if we assume the rectangle has length $L$ and width $W$, then $2L + 2W = 48$ inches.

## If the length and width of a rectangle are scaled by a factor of 2.5, how does the perimeter change?

The perimeter is scaled by the same factor of 2.5. Therefore, the new perimeter will be 48 inches $\times$ 2.5 = 120 inches.

## What is the new length and width of the rectangle after scaling by a factor of 2.5?

If the original length and width are $L$ and $W$, the new length is $2.5L$ and the new width is $2.5W$.

## Given the original perimeter of 48 inches, what are the new dimensions after scaling?

The new length is 2.5 times the original length, and the new width is 2.5 times the original width. Without the original dimensions, the exact new dimensions cannot be calculated, but the perimeter will be 120 inches.

## How does scaling the dimensions by 2.5 affect the area of the rectangle?

The area is scaled by the square of the scaling factor. So, the new area will be $2.5^2 = 6.25$ times the original area.

## Can we determine the exact new length and width without knowing the original dimensions?

No, without the original dimensions, we cannot determine the exact new length and width. We only know the perimeter after scaling.

## What is the main takeaway about scaling dimensions and perimeters in rectangles?

Scaling the length and width by a factor scales the perimeter by the same factor and the area by the square of that factor.

# Additional Resources

**A rectangle has a perimeter of 48 inches. The length and width are scaled by a factor of 2.5. What is the** — this intriguing problem combines fundamental geometric concepts with algebraic reasoning, offering a rich opportunity to explore the relationships between dimensions, scaling, and perimeter. In this comprehensive analysis, we will delve into the principles underpinning the problem, step-by-step calculations, and broader implications, all presented in a clear, structured manner suitable for readers seeking both understanding and insight.

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# Understanding the Problem: Key Concepts and Terminology

Before embarking on the solution, it's essential to clarify the core elements involved:

### What Is a Rectangle?

A rectangle is a quadrilateral with four right angles. Its defining dimensions are:

- Length (L): The longer side.
- Width (W): The shorter side.

Both dimensions are typically expressed in units of length, such as inches.

### Perimeter of a Rectangle

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

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

Given that the perimeter is 48 inches, the initial dimensions satisfy:

$$2 \times (L + W) = 48 \implies L + W = 24$$

### Scaling of Dimensions

Scaling refers to increasing or decreasing the size of an object proportionally. When the length and width are scaled by a factor of 2.5, their new dimensions become:

- New length: $L' = 2.5 \times L$
- New width: $W' = 2.5 \times W$

This operation preserves the shape but alters the size.

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# Step-by-Step Solution Approach

The problem essentially asks: After scaling the original rectangle's length and width by 2.5, what is the new perimeter? To answer this, we will:

1. Determine the original dimensions $L$ and $W$.
2. Calculate the scaled dimensions $L'$ and $W'$.
3. Find the perimeter of the scaled rectangle.

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## 1. Finding the Original Dimensions

Given:

$$L + W = 24$$

However, this single equation contains two variables. To find specific values for $L$ and $W$, an additional assumption or constraint is needed. Since the problem does not specify the ratio of length to width, the most general approach considers all possible pairs that satisfy the sum condition.

Possible dimension pairs:

- For example, if $L = 10$, then $W = 14$.
- If $L = 12$, then $W = 12$.
- If $L = 8$, then $W = 16$.

In general, the set of solutions is:

$$L = x, \quad W = 24 - x, \quad \text{where } 0 < x < 24$$

This parametric form allows us to analyze the effect of scaling for any initial dimensions satisfying the perimeter condition.

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## 2. Calculating the Scaled Dimensions

Once the original dimensions are known, scaling by a factor of 2.5 results in:

$$L' = 2.5 \times L$$
$$W' = 2.5 \times W$$

Because $W = 24 - L$, the scaled dimensions become:

$$ L' = 2.5 \times L $$
$$ W' = 2.5 \times (24 - L) $$

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## 3. Computing the New Perimeter

The perimeter of the scaled rectangle is:

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

Substituting the scaled dimensions:

$$ P' = 2 \times (2.5L + 2.5(24 - L)) $$

Factor out 2.5:

$$ P' = 2 \times 2.5 \times (L + 24 - L) $$

Simplify inside the parentheses:

$$ P' = 2 \times 2.5 \times 24 $$

Calculate:

$$ P' = (2 \times 2.5) \times 24 = 5 \times 24 = 120 $$

Result: Regardless of the initial dimensions, as long as the original perimeter is 48 inches, the scaled rectangle's perimeter will always be 120 inches.

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# Implications and Broader Context

This calculation highlights an important principle in geometry: scaling a shape by a factor of $k$ increases its perimeter by the same factor $k$, provided the shape remains similar (i.e., proportions are preserved). Here, the perimeter scales linearly with the scale factor:

$$ P' = k \times P $$

Confirming the Scaling Law

- Original perimeter: $P = 48$ inches.
- Scale factor: $k = 2.5$.
- Calculated scaled perimeter: $P' = 2.5 \times 48 = 120$ inches.

This confirms the general rule that perimeters of similar figures scale linearly with the scale factor.

Real-World Applications

Understanding scaling is fundamental in fields such as:

- Architecture: Scaling blueprints to actual construction sizes.

- Manufacturing: Adjusting designs proportionally.
- Art and Design: Creating proportional enlargements or reductions.
- Mathematics Education: Teaching concepts of similarity and proportionality.

Potential Limitations and Considerations

While the linear scaling of perimeters holds true for similar shapes, the area scales differently:

$$\text{Area scale factor} = k^2$$

Thus, if the perimeter increases by a factor of 2.5, the area increases by $2.5^2 = 6.25$.

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## Summary and Key Takeaways

In conclusion:

- The original rectangle, with a perimeter of 48 inches, has dimensions satisfying $L + W = 24$.
- When both length and width are scaled by a factor of 2.5, the shape remains similar.
- The perimeter scales linearly, resulting in a new perimeter of 120 inches.
- The problem exemplifies the fundamental geometric principle that perimeters of similar figures scale directly with the scale factor.

Key points:

- The initial dimensions are not unique; any pair satisfying $L + W = 24$ is valid.
- The scaled perimeter is independent of the specific initial dimensions, depending only on the scale factor.
- Understanding scaling principles is vital for practical applications and mathematical reasoning.

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## Final Reflection

This exploration demonstrates the elegance and consistency of geometric scaling. Whether in design, engineering, or education, recognizing how dimensions and perimeters change proportionally enables precise calculations and effective problem-solving. The problem exemplifies how fundamental formulas—like the perimeter of a rectangle—serve as the foundation for more complex reasoning about shape transformations. As such, it underscores the importance of mastering basic geometric concepts as a stepping stone to more advanced mathematical literacy.

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In essence, the answer to the problem is that the scaled rectangle's perimeter is 120 inches, illustrating the linear relationship between scale factors and perimeter measurements in similar figures.

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