

The Lengths Of Two Sides Of A Rectangle Are In The Ratio $2:3$. The Area Of The Rectangle Is 864 . What

The Lengths Of Two Sides Of A Rectangle Are In The Ratio $2:3$. The Area Of The Rectangle Is 864 . What are the steps to find the dimensions of the rectangle? This problem involves understanding ratios, algebraic expressions, and area calculations—fundamental concepts in geometry and mathematics. Whether you're a student preparing for exams or a math enthusiast exploring real-world applications of geometric principles, grasping how to approach such problems is essential. In this comprehensive guide, we will delve into the methodology for solving this type of problem, explore related concepts, and provide tips for mastering similar questions.

Understanding the Problem: Ratios and Area of a Rectangle

Before diving into calculations, it's crucial to understand the key components of the problem:

- Given Ratio of Sides: The lengths of two sides of a rectangle are in the ratio $2:3$.
- Area of the Rectangle: The total area is 864 square units.
- Objective: Find the exact lengths of the sides.

Key Concepts Involved in Solving the Problem

To effectively approach this problem, let's identify and understand the fundamental concepts involved:

1. Ratios and Proportions

- Ratios compare two quantities relative to each other.
- If sides are in ratio $2:3$, then if one side is represented as ' $2x$ ', the other is ' $3x$ '.

2. Algebraic Representation of Sides

- Expressing sides using a common variable simplifies calculations.
- For example, if the sides are in ratio 2:3, then:
- Side 1 = $2x$
- Side 2 = $3x$

3. Area of a Rectangle

- The area (A) of a rectangle is calculated as:

$$A = \text{length} \times \text{breadth}$$

- Using algebra, if the sides are $2x$ and $3x$, then:

$$A = (2x) \times (3x) = 6x^2$$

4. Solving for the Variable

- Once the algebraic expression for the area is established, solve for x using the given area value.

Step-by-Step Solution to the Problem

Let's walk through the detailed process of finding the dimensions of the rectangle.

Step 1: Assign Variables to the Sides

Given that the sides are in ratio 2:3, let:

- Side 1 = $(2x)$
- Side 2 = $(3x)$

Step 2: Write the Area Equation

The area of the rectangle is given as 864. Therefore:

$$\text{Area} = (2x) \times (3x) = 6x^2$$

\]

Set this equal to 864:

$$\begin{aligned} & \backslash[\\ & 6x^2 = 864 \\ & \backslash] \end{aligned}$$

Step 3: Solve for x

Divide both sides by 6:

$$\begin{aligned} & \backslash[\\ & x^2 = \frac{864}{6} = 144 \\ & \backslash] \end{aligned}$$

Take the square root of both sides:

$$\begin{aligned} & \backslash[\\ & x = \sqrt{144} = 12 \\ & \backslash] \end{aligned}$$

Since length cannot be negative:

$$\begin{aligned} & \backslash[\\ & x = 12 \\ & \backslash] \end{aligned}$$

Step 4: Find the Actual Lengths of Sides

Substitute $x = 12$ into the expressions for the sides:

- Side 1:

$$\begin{aligned} & \backslash[\\ & 2x = 2 \times 12 = 24 \\ & \backslash] \end{aligned}$$

- Side 2:

$$\begin{aligned} & \backslash[\\ & 3x = 3 \times 12 = 36 \\ & \backslash] \end{aligned}$$

Result: The sides of the rectangle are 24 units and 36 units.

Verifying the Solution

It's important to confirm that the solution satisfies all initial conditions:

- Check the ratio:

$$\frac{24}{36} = \frac{2}{3}$$

Correct, the ratio matches.

- Calculate the area:

$$24 \times 36 = 864$$

Correct, the area matches the given value.

This verification confirms the solution is accurate.

Applications of Ratios and Area Calculations in Real Life

Understanding how to manipulate ratios and calculate areas is vital in various practical fields:

1. Architecture & Construction

- Designing rooms, buildings, and plots involves ratio-based dimensions.
- Calculating the area helps determine material requirements.

2. Engineering & Manufacturing

- Components often need to be scaled proportionally.
- Area calculations aid in material efficiency and cost estimation.

3. Agriculture & Land Management

- Dividing land plots based on ratios for crop planting.
- Estimating land area for resource allocation.

4. Art & Design

- Creating proportional layouts and designs based on specific ratios.
- Ensuring aesthetic balance through geometric measurements.

Related Problems & Practice Questions

To deepen your understanding, consider practicing with similar problems:

1.
The lengths of two sides of a rectangle are in ratio 3:4. If the area is 960, find the side lengths.
2.
A rectangle has a length of 50 units and a width in the ratio 2:5. Find the width if the area is 600 square units.
3.
The sides of a rectangle are in ratio 5:7, and the area is 700. Determine the lengths of each side.

Tips for Solving Ratio and Area Problems Effectively

To excel in solving similar geometric problems, keep these tips in mind:

- **Always define variables clearly:** Assign variables to unknown quantities for easier manipulation.
- **Express all quantities in terms of the variable:** Simplifies solving equations.
- **Verify your answers:** Check the ratio and area to ensure consistency.
- **Practice with diverse problems:** Builds confidence and understanding of different scenarios.

Conclusion

Understanding how to solve problems involving ratios and areas of rectangles is a fundamental skill in geometry. By expressing side lengths in terms of a common variable, setting up algebraic equations, and solving systematically, you can determine unknown dimensions effectively. Remember to verify your solutions to ensure accuracy. Mastery of these techniques not only enhances your mathematical proficiency but also prepares you for practical applications in various fields like architecture, engineering, and design. Keep practicing with different ratios and area problems to strengthen your problem-solving skills and deepen your understanding of geometric principles.

Keywords for SEO Optimization:

- Ratio of rectangle sides
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- Rectangle area calculation
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- Solving ratio problems
- Geometry practice problems
- Area of rectangle formula
- How to solve ratio and area problems
- Real-world applications of ratios
- Geometry tips and tricks

Frequently Asked Questions

What are the lengths of the sides of the rectangle if their ratio is 2:3 and the area is 864?

Let the sides be $2x$ and $3x$. Then, $(2x)(3x) = 864 \rightarrow 6x^2 = 864 \rightarrow x^2 = 144 \rightarrow x = 12$. So, sides are 24 and 36.

How do you find the actual lengths of the sides of a rectangle when given the ratio and area?

Assign variables based on the ratio (e.g., $2x$ and $3x$), then set up the area equation (product of sides). Solve for x , then find the actual lengths.

What is the significance of the ratio in determining the sides of the rectangle?

The ratio provides the proportional relationship between the sides, allowing us to express both sides in terms of a common variable and solve for their actual lengths.

If the sides of a rectangle are in a ratio 2:3 and the area is 864, what are the dimensions of the rectangle?

The sides are 24 and 36 units long, since we find $x = 12$, and sides are $2x = 24$ and $3x = 36$.

Can this problem be solved without assuming the ratio is in simplest form?

Yes, but assuming the simplest form (2:3) makes calculations straightforward. The ratio directly guides the expression of sides and simplifies solving for their lengths.

What other properties or information might be useful to know about this rectangle?

Knowing the perimeter, whether the rectangle is a square (if sides are equal), or additional constraints could provide more insights, but with just the ratio and area, the side lengths can be determined as shown.

Additional Resources

The Lengths Of Two Sides Of A Rectangle Are In The Ratio 2:3. The Area Of The Rectangle Is 864. What questions often appear in geometry problems, especially in exams and competitive tests, as they test the understanding of ratios, areas, and algebraic concepts. This particular problem provides an excellent opportunity to explore these concepts in depth, blending algebraic reasoning with geometric intuition. In this article, we will thoroughly analyze the problem, explore different methods to solve it, and discuss related concepts that enhance our understanding of rectangles and ratios.

Understanding the Problem

The problem states that the lengths of two sides of a rectangle are in the

ratio 2:3, and the area of the rectangle is 864 square units. The question is to determine the actual lengths of the sides, or possibly other related parameters, based on this information.

Key points to note:

- The ratio of sides: 2:3
- The area: 864 square units
- The goal: To find the lengths of the sides, or other relevant measures.

This is a classic example of a ratio-problem combined with an area calculation, requiring the translation of ratio information into algebraic expressions and solving for unknowns.

Breaking Down the Problem

Step 1: Assign Variables Based on the Ratio

Since the sides are in the ratio 2:3, we can let:

- The shorter side = $(2x)$
- The longer side = $(3x)$

where (x) is a positive real number.

Step 2: Use the Area Formula

The area (A) of a rectangle is given by:

$$A = \text{length} \times \text{width}$$

Substituting the expressions:

$$864 = (2x) \times (3x) = 6x^2$$

This simplifies the problem to solving for (x) .

Step 3: Solving for (x)

Rearranging:

$$[$$

$$6x^2 = 864$$

$$\backslash]$$

$$\backslash[$$

$$x^2 = \frac{864}{6} = 144$$

$$\backslash]$$

$$\backslash[$$

$$x = \pm \sqrt{144} = \pm 12$$

$$\backslash]$$

Since lengths are positive, $(x = 12)$.

Calculating the Actual Lengths of the Sides

Using $(x=12)$:

- Shorter side = $(2x = 2 \times 12 = 24)$
- Longer side = $(3x = 3 \times 12 = 36)$

Thus, the sides of the rectangle are 24 units and 36 units.

Verifying the Solution

To ensure our calculation is correct, verify the area:

$$\backslash[$$

$$24 \times 36 = 864$$

$$\backslash]$$

which matches the given area.

This confirms the solution is consistent and accurate.

Extended Discussion: Exploring Variations and Related Concepts

While the problem appears straightforward, it opens doors to several interesting topics in geometry and algebra.

1. Understanding Ratios and Proportions

Ratios are fundamental in geometry, allowing us to compare lengths, areas,

and volumes efficiently. They are particularly useful when the actual measurements are unknown but the relative proportions are known.

- Features:
 - Ratios maintain their scale regardless of the actual size.
 - They simplify complex problems by reducing variables.
- Pros:
 - Simplify calculations involving multiple dimensions.
 - Help in scaling figures or solving proportional problems.
- Cons:
 - Require careful interpretation to avoid errors.

2. Algebraic Formulation of Geometric Problems

Transforming geometric relationships into algebraic equations is a powerful method.

- Features:
 - Facilitates solving for unknown quantities.
 - Connects geometric intuition with algebraic manipulation.

- Example:

Using variables based on ratios, as in this problem, is a standard approach.

3. Area Calculations and Their Applications

Understanding how to calculate areas and relate them to side lengths is crucial.

- Features:
 - Basic formula: $(A = \text{length} \times \text{width})$.
 - Can be extended to other shapes and higher dimensions.
- Pros:
 - Essential for practical applications in engineering, architecture, and design.
- Cons:
 - Sometimes requires complex calculations for irregular shapes.

4. Solving for Dimensions in Geometric Shapes

This problem exemplifies how to find dimensions of a rectangle when given

ratios and area.

- Features:
 - Using substitution simplifies the process.
 - The key is to express all unknowns in terms of a single variable.
- Pros:
 - Clear method applicable to various problems.
 - Enhances problem-solving skills.
- Cons:
 - Can become complicated with more variables or constraints.

Alternative Approaches to the Problem

While the algebraic method described is straightforward, alternative approaches can also be considered.

Graphical Method

- Plot the possible dimensions for various values of x .
- Identify the pair that satisfies the area condition.
- Less precise but useful for visual understanding.

Using Proportional Reasoning

- Recognize that the ratio of sides directly influences the area.
- Use proportionality to estimate or verify the dimensions.

Real-world Applications and Significance

Problems like this are not merely academic exercises; they have practical implications.

- Architecture & Design: Understanding ratios and areas helps in space planning.
- Engineering: Calculating material quantities based on dimensions.
- Art & Graphics: Maintaining proportions in design elements.

Features and Pros:

- Develop critical thinking and problem-solving skills.

- Enhance understanding of fundamental mathematical concepts.

Challenges or Cons:

- Real-world scenarios often involve irregular shapes, requiring advanced methods.
- Over-reliance on ratios can sometimes oversimplify complex problems.

Summary and Final Remarks

This problem elegantly combines ratio concepts, algebraic manipulation, and geometric understanding. By assigning variables based on ratios, setting up an algebraic equation, and solving for the unknowns, we find that the sides of the rectangle are 24 and 36 units. The process underscores the importance of translating geometric information into algebraic form, verifying solutions, and understanding the interconnectedness of ratios and areas.

In essence, mastering such problems equips students and practitioners with a robust toolkit for tackling a wide variety of mathematical challenges, from simple geometric figures to complex real-world applications. The key takeaway is the power of ratios and algebra in solving geometric problems efficiently and accurately.

In conclusion, exploring the problem of a rectangle with sides in a given ratio and known area reveals foundational principles in geometry and algebra. It demonstrates how a simple ratio leads to a solvable algebraic equation, and how such problems serve as building blocks for more complex mathematical reasoning. Whether for academic purposes or practical applications, understanding these concepts is crucial for developing a comprehensive mathematical skill set.

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