# These Figures Are Similar. Thearea Of One Is Given. Find Thearea Of The Other.3 In

**These Figures Are Similar. Thearea Of One Is Given. Find Thearea Of The Other.3 In** is a common problem in geometry that involves understanding the properties of similar figures and applying ratios to find unknown areas. When working with similar figures, the key concept is that all corresponding angles are equal, and the lengths of corresponding sides are proportional. Knowing the area of one figure and the scale factor between two similar figures allows us to determine the area of the other figure. This article will guide you through the principles of similar figures, how to relate their side lengths and areas, and step-by-step methods to solve such problems efficiently.

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## Understanding Similar Figures

### What Are Similar Figures?

Similar figures are geometric shapes that have the same shape but not necessarily the same size. In similar figures:
- Corresponding angles are congruent (equal).
- Corresponding sides are proportional.

For example, two triangles are similar if their angles are equal, and the ratios of their corresponding sides are constant.

### The Importance of Scale Factors

The scale factor (k) between two similar figures is the ratio of any pair of corresponding sides. If the sides of the first figure are length \(a\), and the sides of the second figure are length \(b\), then:
- \(b = k \times a\)

This scale factor helps us relate the sizes of the figures directly.

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## Relating Side Lengths and Areas in Similar Figures

### Finding the Scale Factor From Known Lengths

If you know the lengths of corresponding sides, calculating the scale factor is straightforward:
- \[
k = \frac{\text{length of side in second figure}}{\text{corresponding side in first figure}}
\]

### Using the Scale Factor to Find Areas

The ratio of the areas of two similar figures is the square of the scale factor:
- \[

$$
\frac{\text{Area of second figure}}{\text{Area of first figure}} = k^2
$$

This means:

- $$
\text{Area of second figure} = \text{Area of first figure} \times k^2
$$

This relationship is crucial because it allows you to find the area of the unknown figure once the scale factor is known.

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# Step-by-Step Approach to Find the Area of the Other Figure

## Step 1: Identify Known Quantities

- Area of the known figure
- Corresponding side lengths or other measurements
- Which figure's area is given and which is unknown

## Step 2: Find the Scale Factor

- Use the known side lengths to calculate the scale factor $k$
- If only the areas are given, and the scale factor is unknown, use the ratio of areas to find $k$

## Step 3: Calculate the Unknown Area

- Use the area ratio formula:

$$
\text{Area of unknown figure} = \text{Area of known figure} \times k^2
$$

- Substitute the known values to compute

## Step 4: Verify Your Result

- Check whether the calculated area makes sense within the context
- Confirm that the scale factor used is consistent with the side lengths or other given data

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# Example Problem: Find the Area of the Other Figure

Suppose you are given two similar rectangles. The area of the first rectangle is 36 square inches, and the length of its longer side is 4 inches. The corresponding longer side in the second rectangle measures 6 inches. Your goal is to find the area of the second rectangle.

## Solution Steps:

1. **Identify knowns:**
   - Area of first rectangle = 36 $\text{in}^2$
   - Longer side of first rectangle = 4 in
   - Longer side of second rectangle = 6 in

2. **Find the scale factor $k$:**
   - $$k = \frac{\text{longer side in second rectangle}}{\text{longer side in first rectangle}} = \frac{6}{4} = 1.5$$

3. **Calculate the area of the second rectangle:**
   - $$\text{Area}_2 = \text{Area}_1 \times k^2 = 36 \times (1.5)^2 = 36 \times 2.25 = 81 \text{ in}^2$$

4. **Result:** The area of the second rectangle is 81 square inches.

This example illustrates how proportional side lengths directly influence area calculations for similar figures.

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# Additional Tips for Solving Similar Figures Problems

## Use Consistent Units

Always ensure that all measurements are in the same units before calculating the scale factor or areas.

## Understand the Relationships

- The ratio of areas is the square of the ratio of sides.
- If the figures are polygons, verify similarity by checking angles and sides.

### Practice with Different Shapes

While rectangles and triangles are common, similar figures can include circles, parallelograms, and more complex polygons. Practice with diverse shapes to strengthen your understanding.

### Check Your Work

- Confirm that the scale factor makes sense (e.g., if side lengths double, area should quadruple).
- Recalculate using different pairs of sides to verify consistency.

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## Common Challenges and How to Overcome Them

### Incorrectly Applying Ratios

Make sure you're using side lengths and areas correctly. Remember, ratios of areas involve the square of the scale factor.

### Confusing Corresponding Parts

Double-check which sides correspond to avoid errors in calculating the scale factor.

### Handling Non-Uniform Figures

Ensure the figures are truly similar before applying these methods. Non-similar figures cannot be related through these ratios.

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## Conclusion

Understanding how to find the area of a second similar figure when given the area of one and some dimensions is a fundamental skill in geometry. The key concepts involve recognizing similar figures, calculating the scale factor from side lengths, and applying the square of this scale factor to relate their areas. Whether dealing with triangles, rectangles, or other polygons, these principles enable you to solve a wide range of problems efficiently.

Remember:
- Confirm similarity before proceeding.
- Use proportionality for side lengths.
- Square the scale factor to find the ratio of areas.
- Always verify your results for consistency.

By mastering these techniques, you'll be well-equipped to tackle geometry problems involving similar figures confidently and accurately.

# Frequently Asked Questions

### If two similar figures have areas in a ratio of 1:4 and the area of the first figure is 3 $in^2$, what is the area of the second figure?

Since the figures are similar, their areas are proportional to the square of their corresponding sides. Therefore, the ratio of areas is $1^2 : 2^2 = 1 : 4$. The area of the second figure is 4 times the first, so $3\ in^2 \times 4 = 12\ in^2$.

### The area of a smaller similar square is 3 $in^2$, and its side length is given. How do you find the area of a larger similar square with a side length twice as long?

Because the figures are similar, the area scales with the square of the side length. Doubling the side length increases the area by a factor of $2^2 = 4$. Therefore, the larger square's area is $3\ in^2 \times 4 = 12\ in^2$.

### Two similar rectangles have areas of 3 $in^2$ and an unknown, respectively. If the ratio of their corresponding sides is 1:3, what is the area of the larger rectangle?

Since the rectangles are similar with a side ratio of 1:3, the area ratio is $1^2:3^2 = 1:9$. The larger rectangle's area is $3\ in^2 \times 9 = 27\ in^2$.

### Given that the area of one similar triangle is 3 $in^2$ and the ratio of their corresponding sides is 1:5, what is the area of the other triangle?

The ratio of areas for similar triangles is the square of the ratio of their sides. So, 1:25. The area of the larger triangle is $3\ in^2 \times 25 = 75\ in^2$.

### A small similar circle has an area of 3 $in^2$, and its radius is known. How do you find the area of a larger similar circle with a radius twice as long?

The area of a circle is proportional to the square of its radius. Doubling the radius increases the area by a factor of $2^2 = 4$. Therefore, the larger circle's area is $3\ in^2 \times 4 = 12\ in^2$.

# Additional Resources

These Figures Are Similar. The Area Of One Is Given. Find The Area Of The Other. 3 In

Understanding the concept of similar figures and their properties is fundamental in geometry, especially when solving problems involving areas, perimeters, and scale factors. The problem statement, "These figures are similar. The area of one is given. Find the area of the other," is a classic example that demonstrates how the ratio of corresponding sides influences the ratio of their areas. This type of problem appears frequently in math exercises, standardized tests, and real-world applications such as architecture, engineering, and design. In this detailed review, we will explore the principles behind similar figures, the mathematical relationships between their dimensions, and step-by-step strategies for solving these problems effectively.

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# Understanding Similar Figures

## What Are Similar Figures?

Similar figures are geometric shapes that have the same shape but not necessarily the same size. This means that:

- Corresponding angles are equal.
- Corresponding sides are proportional.

For example, two triangles are similar if their angles are equal in the same order, and their sides are in proportion.

## Properties of Similar Figures

- Equal Angles: Corresponding angles are congruent.
- Proportional Sides: The ratios of lengths of corresponding sides are equal.
- Scale Factor: The ratio of any pair of corresponding sides is called the scale factor.

## Why Are Similar Figures Important?

- They allow us to compare shapes regardless of their size.
- They enable us to find unknown measurements once a scale factor or one measurement is known.
- They are essential in real-world applications like map reading, model building, and design scaling.

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# Mathematical Relationships in Similar Figures

## Ratio of Corresponding Sides

Suppose two similar figures have corresponding sides $a, b, c$ and $a', b', c'$. Then:

$$
\frac{a'}{a} = \frac{b'}{b} = \frac{c'}{c} = k
$$

where $k$ is the scale factor from the smaller to the larger figure.

## Relationship Between Areas

The areas of similar figures relate to the square of the scale factor:

$$
\frac{\text{Area of larger figure}}{\text{Area of smaller figure}} = k^2
$$

This critical relationship allows us to find the area of one figure when the other's area and the scale factor are known.

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# Problem Solving Strategy

When faced with a problem like "These figures are similar. The area of one is given. Find the area of the other," follow this systematic approach:

1. Identify the known values: the given area and any given side lengths.
2. Determine the scale factor $k$: find the ratio of corresponding sides.
3. Use the area ratio: relate the known area to the unknown area via $k^2$.
4. Solve for the unknown area.

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# Applying the Concepts: Step-by-Step Example

Suppose you are given two similar rectangles, with the first rectangle's area being 12 square inches. One of its sides measures 3 inches, and the corresponding side in the second rectangle measures 6 inches. Find the area of the second rectangle.

Step 1: Find the scale factor $k$.

Corresponding sides: 3 inches (first rectangle) and 6 inches (second rectangle).

$$
k = \frac{6}{3} = 2
$$

Step 2: Relate the areas.

Since the figures are similar, the ratio of their areas is $k^2$:

$$
\frac{\text{Area}_2}{12} = 2^2 = 4
$$

Step 3: Find the unknown area.

$$
\text{Area}_2 = 12 \times 4 = 48 \text{ square inches}
$$

Therefore, the second rectangle has an area of 48 square inches.

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# Special Cases and Variations

## When Only Area Is Known

If only the area of one figure and some information about the scale factor are given, the same principles apply. The key is to identify the scale factor from available side lengths or other measurements.

### Using Perimeters for Additional Clues

In some problems, perimeter ratios can help find the scale factor if side lengths are unknown, especially in polygons.

### Dealing with Non-Linear Figures

The principles of similar figures extend beyond rectangles and triangles to circles, polygons, and complex shapes, provided they are similar.

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## Common Pitfalls and Tips

- Misidentifying Corresponding Sides: Always ensure you are comparing the correct pairs of sides.
- Forgetting to Square the Scale Factor: Remember, areas relate to the square of the linear scale factor.
- Mixing Units: Keep units consistent to avoid calculation errors.
- Overlooking Similarity Conditions: Verify that figures are truly similar before applying ratio relationships.

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## Features and Benefits of Solving These Problems

- Enhances understanding of proportional reasoning.
- Reinforces the importance of ratios and squares in geometry.
- Develops problem-solving skills crucial for higher-level mathematics.
- Provides practical skills for real-world applications involving scaling.

Pros:
- Clear relationship between side ratios and area ratios.
- Straightforward calculations once the scale factor is identified.
- Applicability to various geometric figures.

Cons:
- Requires accurate identification of corresponding sides.
- Can be confusing if figures are not perfectly similar or if measurements are approximate.
- Misapplication of ratios leads to errors.

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## Conclusion

The problem of finding the area of one similar figure when the area of another is known hinges on understanding the relationship between their side lengths and areas. Recognizing that the ratio of areas equals the square of the ratio of corresponding sides is fundamental. By systematically identifying the scale factor and applying the proportionate relationship, students and practitioners can efficiently solve these problems with confidence. Whether dealing with rectangles, triangles, circles, or complex polygons, these principles form the backbone of similarity-based calculations in geometry. Mastery of these concepts not only improves mathematical proficiency but also prepares learners for more advanced topics in geometry, trigonometry, and real-world applications involving scaling and proportional reasoning.

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