

# Use The Pythagorean Theorem To Find The Missing Length And Then Round The Result To The Nearest Tenth.

## Use The Pythagorean Theorem To Find The Missing Length And Then Round The Result To The Nearest Tenth.

Understanding how to find missing lengths in right triangles is a fundamental skill in geometry, and the Pythagorean Theorem provides an essential tool for this purpose. Whether you're working on homework problems, preparing for a test, or solving real-world construction or design issues, mastering this theorem allows you to accurately determine unknown side lengths. This article offers a comprehensive guide on applying the Pythagorean Theorem to find missing lengths and how to round the results to the nearest tenth for precise answers.

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## Introduction to the Pythagorean Theorem

Before diving into problem-solving techniques, it's important to understand what the Pythagorean Theorem states and when it applies.

## What Is the Pythagorean Theorem?

The Pythagorean Theorem is a fundamental principle in geometry, describing the relationship between the lengths of the sides of a right triangle.

- Definition: In a right triangle, the square of the hypotenuse (the side opposite the right angle) equals the sum of the squares of the other two sides.
- Formula:  $c^2 = a^2 + b^2$

where:

- $c$  is the hypotenuse length
- $a$  and  $b$  are the lengths of the triangle's legs

## Applicability

This theorem is applicable only to right triangles. It's useful for:

- Finding a missing side length when two sides are known

- Verifying if a triangle is right-angled
- Solving real-world problems involving distances, heights, or lengths

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## Step-by-Step Guide to Using the Pythagorean Theorem

Applying the Pythagorean Theorem involves several clear steps that, when followed carefully, lead to accurate results.

### 1. Identify the Known and Unknown Sides

- Determine which sides of the triangle are known.
- Label the sides as  $a$ ,  $b$ , and  $c$ , with  $c$  being the hypotenuse.
- Recognize the side you need to find (either  $a$ ,  $b$ , or  $c$ ).

### 2. Write Down the Pythagorean Equation

- Use the standard formula  $c^2 = a^2 + b^2$ .
- Rearrange the formula if necessary to solve for the unknown side.

### 3. Plug in Known Values

- Substitute the known side lengths into the equation.

For example, if  $a$  and  $c$  are known and  $b$  is missing, rewrite as:

$$b^2 = c^2 - a^2$$

### 4. Solve for the Missing Length

- Perform the calculations step-by-step:
- Calculate the squares of the known lengths.
- Subtract or add as necessary.
- Take the square root of the result to find the length of the unknown side.

## 5. Round the Result to the Nearest Tenth

- Use a calculator's square root function.
- Round the final answer to one decimal place for precision.

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## Practical Examples

To solidify understanding, let's work through some practical examples illustrating how to find missing lengths and round to the nearest tenth.

### Example 1: Find the Hypotenuse

Problem: A right triangle has legs measuring 3.5 meters and 4.2 meters. Find the length of the hypotenuse  $(c)$ , rounded to the nearest tenth.

Solution:

1. Known sides:  $(a = 3.5)$ ,  $(b = 4.2)$

2. Apply the Pythagorean Theorem:

$$c^2 = (3.5)^2 + (4.2)^2$$

3. Calculate squares:

$$c^2 = 12.25 + 17.64 = 29.89$$

4. Take the square root:

$$c = \sqrt{29.89} \approx 5.467$$

5. Round to the nearest tenth:

$$c \approx 5.5 \text{ meters}$$

Answer: The hypotenuse is approximately 5.5 meters.

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## Example 2: Find a Missing Leg

Problem: The hypotenuse of a right triangle is 10 units, and one leg measures 6 units. Find the length of the other leg, rounded to the nearest tenth.

Solution:

1. Known:  $(c = 10)$ ,  $(a = 6)$ ,  $(b)$  unknown.

2. Use the rearranged formula:

$$b^2 = c^2 - a^2$$

3. Substitute known values:

$$b^2 = 10^2 - 6^2 = 100 - 36 = 64$$

4. Calculate  $(b)$ :

$$b = \sqrt{64} = 8$$

5. Round to the nearest tenth:

$$b = 8.0$$

Answer: The missing leg measures 8.0 units.

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## Tips for Accurate Calculations and Rounding

Ensuring precision when solving problems with the Pythagorean Theorem is essential. Here are some helpful tips:

## Use a Reliable Calculator

- Always double-check the calculator entries.
- Use parentheses appropriately to avoid order of operations errors.

## Pay Attention to Units

- Keep units consistent throughout calculations.
- Convert units if necessary before plugging into formulas.

## Rounding Correctly

- Round only after completing all calculations.
- When rounding to the nearest tenth, examine the hundredths digit:
  - If the hundredths digit is 5 or more, round up.
  - If less than 5, round down.

## Double-Check Your Work

- Verify calculations by substituting the rounded result back into the theorem to check for reasonableness.
- Confirm that the computed length makes sense for the problem context.

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## Real-World Applications of the Pythagorean Theorem

The Pythagorean Theorem is not just a classroom tool; it has numerous practical applications:

- **Construction and Architecture:** Calculating lengths of rafters, stairs, or diagonals.
- **Navigation:** Determining shortest paths or direct distances between points.
- **Design and Engineering:** Ensuring components fit precisely when designing objects.
- **Physics:** Computing distances in projectile motion or forces.

These real-world uses emphasize the importance of accurately finding side lengths and rounding results appropriately.

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## Practice Problems for Mastery

Test your understanding with these practice questions:

1. Find the hypotenuse of a right triangle with legs measuring 7.8 meters and 9.3 meters. Round to the nearest tenth.
2. A right triangle has a hypotenuse of 15 units, one leg measuring 9 units. Find the other leg, rounded to the nearest tenth.
3. If the legs of a right triangle are 5.4 meters and an unknown length, and the hypotenuse is 8 meters, what is the length of the unknown leg?

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## Conclusion

Mastering the use of the Pythagorean Theorem to find missing lengths and accurately rounding to the nearest tenth is a valuable skill in both academic and real-world contexts. By carefully identifying known and unknown sides, systematically applying the formula, performing precise calculations, and rounding correctly, you can solve right triangle problems confidently. Practice regularly with various problems to develop proficiency, and you'll find this theorem an indispensable tool for geometric and spatial reasoning.

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Remember: Always double-check your work, keep track of units, and use proper rounding techniques to ensure your answers are both accurate and reliable.

## Frequently Asked Questions

### How do I apply the Pythagorean Theorem to find a missing side length in a right triangle?

To find the missing side, identify the hypotenuse and legs, then use the formula  $a^2 + b^2 =$

$c^2$ . Rearrange to solve for the missing side: if it's a leg, use  $c^2 - a^2 = b^2$ ; if it's the hypotenuse, use  $a^2 + b^2 = c^2$ , then take the square root of the result.

## **What is the process for rounding the result to the nearest tenth after calculating the missing length?**

After computing the square root to find the missing length, look at the hundredth's place. If it's 5 or greater, round up the tenths place by 1; if less than 5, keep the tenths place as is. Then, write the answer rounded to one decimal place.

## **Can I use the Pythagorean Theorem if the triangle is not a right triangle?**

No, the Pythagorean Theorem only applies to right triangles. For non-right triangles, you should use other methods like the Law of Cosines or Law of Sines.

## **What are common mistakes to avoid when using the Pythagorean Theorem to find a missing length?**

Common mistakes include mixing up the hypotenuse and legs, forgetting to square the numbers, not taking the square root after calculating, and incorrect rounding. Double-check your values and ensure the triangle is right-angled.

## **If the sides of a right triangle are 3 units and 4 units, what is the length of the hypotenuse rounded to the nearest tenth?**

Calculate  $c = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5.0$ . Rounded to the nearest tenth, the hypotenuse is 5.0 units.

## **How do I interpret the result after applying the Pythagorean Theorem in real-world problems?**

The result gives the length of the missing side, which you can interpret in context—such as distance, height, or length—by considering the units used in the problem and rounding appropriately for practical use.

## **Additional Resources**

Use The Pythagorean Theorem To Find The Missing Length And Then Round The Result To The Nearest Tenth

In the world of mathematics, understanding the relationships between different shapes and their dimensions is essential. One of the most fundamental tools for solving problems involving right triangles is the Pythagorean Theorem. Whether you're a student tackling

geometry homework or a professional applying these principles in real-world scenarios such as construction or design, knowing how to find missing lengths efficiently and accurately is invaluable. This article explores the process of using the Pythagorean Theorem to determine unknown side lengths and how to round your results to the nearest tenth for clarity and precision.

## Understanding the Pythagorean Theorem

### What Is the Pythagorean Theorem?

The Pythagorean Theorem is a mathematical principle that relates the lengths of the sides of a right triangle. A right triangle is one that has a 90-degree angle. The theorem states that:

$$a^2 + b^2 = c^2$$

where:

- a and b are the lengths of the legs (the two sides that form the right angle),
- c is the length of the hypotenuse (the side opposite the right angle).

This relationship allows us to calculate any one side if the other two are known.

### Historical Context and Significance

Named after the ancient Greek mathematician Pythagoras, the theorem has been a cornerstone of geometry for over two millennia. Its applications extend far beyond pure mathematics, influencing fields like physics, engineering, architecture, and computer science. The simplicity and power of the theorem make it a foundational skill for anyone working with right triangles.

## Applying the Pythagorean Theorem to Find Missing Lengths

### Step-by-Step Procedure

To find a missing side, follow these steps:

1. Identify the known sides: Determine which sides of the triangle are known and which is unknown.

2. Choose the correct formula:

- If the hypotenuse (c) is unknown:

$$c = \sqrt{a^2 + b^2}$$

- If a leg (a or b) is unknown:

$$a = \sqrt{c^2 - b^2} \text{ or } b = \sqrt{c^2 - a^2}$$

3. Substitute the known values: Plug the known side lengths into the formula.

4. Calculate the square root: Use a calculator to find the square root of the sum or difference.

5. Verify your result: Ensure the calculated length makes sense within the context of your problem.

## Example Problem 1: Finding the Hypotenuse

Suppose you have a right triangle with legs measuring 3 meters and 4 meters. To find the hypotenuse:

- Known sides:  $a = 3$ ,  $b = 4$

- Calculation:

$$c = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$$

The hypotenuse measures 5 meters.

## Example Problem 2: Finding a Missing Leg

Imagine a right triangle where the hypotenuse is 10 meters, and one leg is 6 meters. Find the other leg:

- Known sides:  $c = 10$ ,  $b = 6$

- Calculation:

$$a = \sqrt{c^2 - b^2} = \sqrt{10^2 - 6^2} = \sqrt{100 - 36} = \sqrt{64} = 8$$

The missing leg is 8 meters.

## Rounding Results to the Nearest Tenth

### Why Round to the Nearest Tenth?

Rounding the final answer to the nearest tenth provides a balance between precision and simplicity. It's especially useful in real-world applications where exact measurements are impractical or unnecessary, and a clear, easy-to-understand figure is preferred.

# How to Round Correctly

1. Identify the digit in the tenths place: This is the first digit after the decimal point.
2. Look at the hundredths place (second digit after the decimal):
  - If this digit is 5 or higher, increase the tenths digit by 1.
  - If it is 4 or lower, keep the tenths digit the same.
3. Adjust the number accordingly: Remove all digits beyond the tenths place after rounding.

Example:

Suppose the calculated hypotenuse is 5.236 meters.

- The tenths digit: 2
- The hundredths digit: 3 (less than 5)
- Rounded to the nearest tenth: 5.2 meters

Now, consider a result of 8.567 meters:

- The tenths digit: 5
- The hundredths digit: 6 (greater than or equal to 5)
- Rounded: 8.6 meters

## Practical Application: From Calculation to Reality

### Using the Theorem in Real-World Scenarios

The Pythagorean Theorem isn't just for textbook problems. It has practical applications in:

- Construction: Calculating the length of rafters or diagonals of structures.
- Navigation: Determining the shortest path between two points.
- Design: Ensuring components fit correctly in engineering projects.
- Land surveying: Calculating distances across uneven terrain.

### Example: Designing a Ramp

Suppose an architect needs to determine the length of a ramp that rises 4 feet vertically and extends horizontally 3 feet. To find the actual length of the ramp:

- Known sides: vertical = 4 ft, horizontal = 3 ft
- Calculation:  
$$\text{Ramp length} = \sqrt{4^2 + 3^2} = \sqrt{16 + 9} = \sqrt{25} = 5 \text{ ft}$$

Since the calculation results in a whole number, rounding isn't necessary here. However, if the calculation had resulted in a decimal, rounding to the nearest tenth would be

appropriate for precise planning.

## Common Mistakes and Tips for Accuracy

### Common Errors

- Mixing up sides: Remember that the hypotenuse is always opposite the right angle.
- Incorrect formula application: Use  $a^2 + b^2 = c^2$  when solving for the hypotenuse, and  $c^2 - a^2$  or  $c^2 - b^2$  when solving for a leg.
- Forgetting to take the square root: The Pythagorean Theorem involves squaring and square roots; missing these steps leads to incorrect answers.
- Misplacing decimal points: Pay attention when rounding to ensure accuracy.

### Tips for Accurate Calculations

- Use a calculator with a square root function for precision.
- Double-check your substitutions before computing.
- Keep track of units throughout the process.
- Practice with different problems to build confidence.

## Conclusion

Mastering the use of the Pythagorean Theorem to find missing side lengths is an essential skill in both academic and practical contexts. By carefully applying the formula, performing accurate calculations, and rounding results to the nearest tenth, you can efficiently solve right triangle problems with confidence. Whether designing a building, planning a landscape, or solving homework problems, understanding this fundamental theorem empowers you to approach geometric challenges systematically and accurately. Remember, precision in measurement and calculation is key to turning mathematical theory into practical solutions.

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