

Is A Triangle With Sides Of 5 Meters, 12 Meters, And 13 Meters A Right Triangle? Explain/Show Your Work.

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When analyzing triangles, one common question is whether a given set of side lengths forms a right triangle. In this article, we will examine a triangle with side lengths of 5 meters, 12 meters, and 13 meters to determine if it is a right triangle. We will explore the concepts of the Pythagorean theorem, how to apply it, and verify if the given sides satisfy the conditions for a right triangle.

Understanding the Basics: What Is a Right Triangle?

Before delving into calculations, it's essential to understand what defines a right triangle.

Definition of a Right Triangle

- A right triangle is a triangle that contains one right angle (90 degrees).
- The side opposite the right angle is called the hypotenuse.
- The other two sides are called legs.

Identifying a Right Triangle Using the Pythagorean Theorem

- The Pythagorean theorem states that in a right triangle:

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

where c is the hypotenuse, and a and b are the other two sides.

- To verify if a triangle with given sides is right-angled, check if the sum of the squares of the shorter sides equals the square of the longest side.

Applying the Pythagorean Theorem to Sides of 5,

12, and 13 Meters

Given the sides: 5 meters, 12 meters, and 13 meters, our goal is to determine whether these satisfy the Pythagorean condition for a right triangle.

Step 1: Identify the Longest Side

- The longest side among 5, 12, and 13 meters is 13 meters.
- This side is a candidate for the hypotenuse if the triangle is right-angled.

Step 2: Calculate the Squares of Each Side

- $5^2 = 25$
- $12^2 = 144$
- $13^2 = 169$

Step 3: Check if the Pythagorean Condition Holds

- Sum of the squares of the shorter sides:

$$25 + 144 = 169$$

- Compare this sum to the square of the hypotenuse:

$$169 \text{ (hypotenuse squared)} = 169 \text{ (sum of the other two squares)}$$

Since both are equal, the Pythagorean theorem holds true for these sides.

Conclusion: Is the Triangle a Right Triangle?

Based on the calculations, the sides 5 meters, 12 meters, and 13 meters satisfy the Pythagorean theorem. Therefore, a triangle with these side lengths is a right triangle.

Additional Insights and Applications

Understanding whether a triangle is right-angled has practical applications in various fields, including construction, architecture, and geometry.

Practical Uses of Right Triangles

- Designing ramps and stairs with appropriate angles
- Calculating distances indirectly using triangulation
- Verifying the shape of structures during construction

Why Is Recognizing a 5-12-13 Triangle Important?

- The 5-12-13 triangle is a classic example of a Pythagorean triple.
- Pythagorean triples are sets of three integers that satisfy the Pythagorean theorem.
- Recognizing such triples simplifies calculations and problem-solving in geometry.

Other Common Pythagorean Triples

- 3, 4, 5
- 8, 15, 17
- 7, 24, 25
- 9, 40, 41

These sets are useful for quick verification of right triangles without complex calculations.

Summary

- The given sides are 5 meters, 12 meters, and 13 meters.
- The longest side, 13 meters, serves as the hypotenuse candidate.
- Calculations show that $5^2 + 12^2 = 25 + 144 = 169$, which equals 13^2 .
- Therefore, the triangle with sides 5 meters, 12 meters, and 13 meters is a right triangle.

Final Thoughts

Determining if a triangle is right-angled involves verifying the Pythagorean theorem. In this case, the sides 5 meters, 12 meters, and 13 meters form a classic Pythagorean triple, confirming its status as a right triangle. Recognizing such triples can streamline geometric calculations and is a valuable skill in various practical and academic contexts.

If you need to verify other triangles or explore more about Pythagorean triples, understanding this foundational approach will serve as a reliable method for geometric analysis.

Frequently Asked Questions

Is a triangle with sides 5 meters, 12 meters, and 13 meters a right triangle?

Yes, because the squares of the two shorter sides add up to the square of the longest side: $5^2 + 12^2 = 25 + 144 = 169$, which equals 13^2 . Therefore, it satisfies the Pythagorean theorem and is a right triangle.

How can you verify if a triangle with sides 5 m, 12 m, and 13 m is a right triangle?

By applying the Pythagorean theorem: check if the sum of the squares of the shorter sides equals the square of the longest side. Here, $5^2 + 12^2 = 25 + 144 = 169$, and $13^2 = 169$. Since they are equal, the triangle is right-angled.

What is the significance of the side lengths 5 m, 12 m, and 13 m in determining if the triangle is right-angled?

These side lengths form a Pythagorean triple because their squares satisfy the Pythagorean theorem, indicating the triangle is a right triangle with the hypotenuse of 13 meters.

Can a triangle with sides 5 m, 12 m, and 13 m be classified as a Pythagorean triple?

Yes, because the sides 5, 12, and 13 satisfy the Pythagorean theorem ($5^2 + 12^2 = 13^2$), making it a Pythagorean triple and confirming it's a right triangle.

What steps are involved in confirming whether a triangle with sides 5, 12, and 13 meters is right-angled?

First, identify the longest side (13 m). Then, verify if the sum of the squares of the other two sides ($5^2 + 12^2$) equals the square of the longest side (13^2). Since $25 + 144 = 169$, which equals 169 , the triangle is right-angled.

Additional Resources

Right Triangle Verification: An In-Depth Analysis of a 5m, 12m, and 13m Triangle

When exploring the fascinating world of geometry, one of the most fundamental and intriguing questions is whether a given triangle with specific side lengths is a right triangle. This question not only tests our understanding of the Pythagorean Theorem but also sharpens our analytical skills in geometric reasoning. Today, we delve into the case of a triangle with side lengths of 5 meters, 12 meters, and 13 meters, examining whether it qualifies as a right triangle.

Understanding the Basics: What Is a Right Triangle?

Before diving into calculations, it's essential to clarify what defines a right triangle.

Definition:

A right triangle (or right-angled triangle) is a triangle that contains a 90-degree angle—also known as a right angle. The side opposite this right angle is called the hypotenuse, which is always the longest side in the triangle.

Key Characteristics:

- One interior angle measures exactly 90° .
- The sides follow the Pythagorean Theorem: $a^2 + b^2 = c^2$, where c is the hypotenuse, and a and b are the other two sides.
- The theorem provides a straightforward test to verify whether a given triangle with side lengths can be classified as right-angled.

Step-by-Step Analysis: Are the Sides 5m, 12m, and 13m Forming a Right Triangle?

Let's now analyze the specific triangle with sides of 5 meters, 12 meters, and 13 meters.

Step 1: Identify the Longest Side

Since the hypotenuse is always the longest side in a right triangle, we need to determine the longest side:

- Side A: 5 meters
- Side B: 12 meters
- Side C: 13 meters

Conclusion:

The side of 13 meters is the longest and is the prime candidate for the hypotenuse.

Step 2: Apply the Pythagorean Theorem

The Pythagorean Theorem states:

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

Assuming:

- $a = 5$ meters
- $b = 12$ meters
- $c = 13$ meters

Calculate:

$$a^2 + b^2 = 5^2 + 12^2 = 25 + 144 = 169$$

Compare this to:

$$c^2 = 13^2 = 169$$

Since:

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

we observe:

$$169 = 169$$

Result:

The equality holds true, indicating that the triangle with sides 5 meters, 12 meters, and 13 meters satisfies the Pythagorean theorem.

Implications of the Calculation

Given the verification above, we can confidently conclude:

- Yes, a triangle with sides of 5 meters, 12 meters, and 13 meters is a right triangle.
- The right angle is located opposite the hypotenuse of 13 meters.

This result aligns with well-known Pythagorean triples, which are sets of three positive integers that satisfy the Pythagorean theorem. The 5-12-13 triplet is among the most common and proven Pythagorean triples.

Additional Insights: Why Is the 5-12-13 Triangle Special?

Understanding the significance of the 5-12-13 triplet extends beyond mere calculation.

1. Pythagorean Triples

- The 5-12-13 triplet is a classic example of a Pythagorean triple.
- Definition: A set of three positive integers (a, b, c) satisfying $a^2 + b^2 = c^2$.
- Examples of other triples:
 - (3, 4, 5)
 - (8, 15, 17)
 - (7, 24, 25)

2. Practical Applications

- Such triples are used in construction, engineering, and design to create right angles effortlessly.
- They serve as simple, reliable tools for checking perpendicularity without complex calculations.

3. Mathematical Significance

- The 5-12-13 triplet illustrates that Pythagorean triples can be generated systematically or found through known sets.
- It exemplifies the concept that right triangles with integer sides are not rare but are part of an infinite set of solutions.

Visualizing the Triangle

While the calculations confirm the right angle, visualizing the triangle helps to understand its proportions:

- Vertices:
 - Point A: at the origin (0,0)
 - Point B: 5 meters along the x-axis (5,0)
 - Point C: 12 meters along the y-axis from B, or based on the hypotenuse length, at (0,12)
- Coordinates (for illustration):

- $A = (0,0)$
 - $B = (5,0)$
 - $C = (0,12)$
- Distance calculations:
- $AB = 5$ meters (along x-axis)
 - $AC = 12$ meters (along y-axis)
 - $BC = \sqrt{(5-0)^2 + (0-12)^2} = \sqrt{25 + 144} = \sqrt{169} = 13$ meters

This confirms the geometric configuration aligns with the side lengths, illustrating the right triangle clearly.

Summary and Final Verdict

In conclusion:

- The side lengths of 5 meters, 12 meters, and 13 meters form a classic Pythagorean triplet.
- The Pythagorean theorem holds precisely, confirming the presence of a right angle.
- Therefore, the triangle with sides of 5 meters, 12 meters, and 13 meters is indeed a right triangle.

Key takeaways:

- Always identify the longest side as a candidate for the hypotenuse.
- Use the Pythagorean theorem as a reliable test for right-angled triangles.
- Recognize Pythagorean triples as foundational in geometry and practical applications.

Final Thoughts: Practical Relevance and Educational Value

Understanding whether a triangle is right-angled has practical significance in various fields, from construction to navigation. Recognizing familiar triples, such as the 5-12-13 set, makes it easier to construct right angles in real-world scenarios without complex tools.

Moreover, this analysis exemplifies the power of simple mathematical principles to solve real problems. It demonstrates how a straightforward

calculation can reveal profound truths about the shape and nature of geometric figures.

In essence:

The 5-meter, 12-meter, and 13-meter triangle satisfies the Pythagorean theorem, confirming it as a right triangle, making it a perfect example for both classroom learning and practical application.

Disclaimer:

While the calculations are straightforward, always ensure that side measurements are precise when applying these principles in real-world contexts, as measurement errors can affect the classification of the triangle.

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