

In A 30-60-90 Triangle, What Is The Length Of The Hypotenuse When The Shorter Leg Is 8 M?Enter Your Answer

In A 30-60-90 Triangle, What Is The Length Of The Hypotenuse When The Shorter Leg Is 8 M?Enter Your Answer

Understanding the 30-60-90 Triangle

Definition and Basic Properties

A 30-60-90 triangle is a special type of right triangle characterized by its unique angle measures: 30 degrees, 60 degrees, and 90 degrees. These angles create specific ratios between the lengths of the sides, making the triangle a fundamental component in trigonometry and geometric problem-solving.

Key properties of a 30-60-90 triangle include:

- The side opposite the 30-degree angle is the shortest side.
- The side opposite the 60-degree angle is longer than the shortest side.
- The hypotenuse, opposite the 90-degree angle, is the longest side.

Side Length Ratios

The ratios of the side lengths in a 30-60-90 triangle are well-established and are derived from equilateral triangles subdivided into two right triangles. The ratios are:

- Shorter leg (opposite 30°): 1 unit
- Longer leg (opposite 60°): $\sqrt{3}$ units
- Hypotenuse (opposite 90°): 2 units

These ratios mean that if the shortest leg has a certain length, the other sides are directly proportional.

Applying the Ratios to Find the Hypotenuse

Given Data and Objective

In this problem, you are told:

- The shorter leg (opposite 30°) is 8 meters.
- Your goal is to find the length of the hypotenuse.

Understanding the Relationship

Since the ratios are based on the shortest leg being 1 unit, and in this problem, the shortest leg is 8 meters, the scaling factor must be determined.

- The standard shortest leg (ratio) value: 1 unit
- Actual shortest leg: 8 meters

The ratio between the actual shortest leg and the standard unit is:

$$\text{scaling factor} = \text{actual shortest leg} / \text{standard shortest leg} = 8 / 1 = 8$$

Using this scaling factor, all other side lengths can be calculated.

Calculating the Hypotenuse

The hypotenuse in the standard ratios is 2 units. When scaled:

- Hypotenuse length = standard hypotenuse scaling factor
- Hypotenuse length = $2 \times 8 = 16$ meters

Therefore, the hypotenuse measures 16 meters.

Step-by-Step Summary of the Calculation

1. Identify the known side: the shorter leg = 8 meters.
2. Recall the basic ratio: shorter leg / hypotenuse = $1 / 2$.
3. Determine the scaling factor based on the known shorter leg: $8 / 1 = 8$.
4. Calculate the hypotenuse: $2 \times \text{scaling factor} = 2 \times 8 = 16$ meters.

Additional Insights and Applications

Alternative Methods of Calculation

While the ratio method is straightforward, other approaches include:

- Using Trigonometry:
 - Knowing the shorter leg is opposite 30° , the hypotenuse can also be found using the sine function:
 - $\sin(30^\circ) = \text{opposite}/\text{hypotenuse}$
 - $0.5 = 8 / \text{hypotenuse}$
 - $\text{hypotenuse} = 8 / 0.5 = 16 \text{ meters}$
- Using Pythagoras Theorem:
 - If the longer leg (opposite 60°) is known, Pythagoras can be applied directly.
 - Since in the standard triangle the longer leg is $\sqrt{3}$ times the shorter leg:
 - Longer leg $= \sqrt{3} \cdot 8 \approx 13.856 \text{ meters}$
 - Applying Pythagoras:
$$\text{hypotenuse}^2 = \text{shorter leg}^2 + \text{longer leg}^2$$
$$\text{hypotenuse}^2 = 8^2 + (\sqrt{3} \cdot 8)^2 = 64 + 3 \cdot 64 = 64 + 192 = 256$$
$$\text{hypotenuse} = \sqrt{256} = 16 \text{ meters}$$

All these methods confirm that the hypotenuse is 16 meters.

Conclusion

In a 30-60-90 triangle where the shorter leg measures 8 meters, the hypotenuse can be calculated directly using the established ratios or trigonometric functions. Both methods yield the same result, confirming the consistency and reliability of the properties inherent in this special triangle. The hypotenuse length is 16 meters.

This understanding is crucial for solving various geometric problems, especially those involving right triangles and trigonometric ratios, making the 30-60-90 triangle an essential concept in geometry and mathematics at large.

Frequently Asked Questions

In a 30-60-90 triangle, if the shorter leg is 8 meters, what is the length of the hypotenuse?

16 meters

How do you find the hypotenuse in a 30-60-90 triangle when the shorter leg measures 8 meters?

Multiply the shorter leg by 2, so the hypotenuse is 16 meters.

What is the hypotenuse of a 30-60-90 triangle with a shorter leg of 8 meters?

16 meters

If the shorter leg in a 30-60-90 triangle is 8 meters, what is the length of the longer leg?

Approximately 13.86 meters (since longer leg = shorter leg $\times \sqrt{3}$)

In a 30-60-90 triangle, what are the relationships between the legs and hypotenuse when the shorter leg is 8 meters?

The hypotenuse is 16 meters, and the longer leg is $8\sqrt{3}$ meters (~13.86 meters).

Additional Resources

In A 30-60-90 Triangle, What Is The Length Of The Hypotenuse When The Shorter Leg Is 8 M?

Understanding the properties of special right triangles is fundamental in geometry, especially when dealing with triangles that follow specific angle measures. The 30-60-90 triangle is a classic example of a right triangle with well-defined ratios between its sides. When given the length of the shorter leg, which is opposite the 30-degree angle, determining the hypotenuse becomes straightforward once the properties are understood. This article aims to explore the characteristics of 30-60-90 triangles thoroughly, demonstrate how to calculate the hypotenuse given the shorter leg, and discuss practical implications and applications of this knowledge.

Understanding the 30-60-90 Triangle

Definition and Properties

A 30-60-90 triangle is a special type of right triangle where the angles

measure exactly 30 degrees, 60 degrees, and 90 degrees. Its unique angle configuration leads to a consistent ratio between its sides, making it an invaluable tool in geometry, trigonometry, and various applied fields.

Key features include:

- The side opposite the 30-degree angle is the shortest and is often labeled as the 'shorter leg.'
- The side opposite the 60-degree angle is longer and can be expressed in relation to the shorter leg.
- The hypotenuse, which is opposite the 90-degree angle, is the longest side, with a predictable length relative to the shorter leg.

Side length ratios:

If the shorter leg (opposite 30°) is of length (x) , then:

- The longer leg (opposite 60°) measures $(x\sqrt{3})$.
- The hypotenuse (opposite 90°) measures $(2x)$.

This ratio makes calculations quick and precise, especially when working with known side lengths.

Calculating the Hypotenuse When the Shorter Leg Is 8 M

Applying the Side Ratio

Given the shorter leg $(x = 8 \text{ meters})$, the hypotenuse (h) is directly related to this side through the ratio:

$$h = 2x$$

Substituting the given value:

$$h = 2 \times 8 = 16 \text{ meters}$$

Therefore, the hypotenuse of the triangle, when the shorter leg is 8 meters, is 16 meters.

Summary of Calculation Steps

1. Recognize that the triangle is a 30-60-90 triangle and recall the side ratio: $(x : x\sqrt{3} : 2x)$.
2. Identify the given shorter leg as $(x = 8 \text{ meters})$.
3. Use the ratio to find the hypotenuse: $(h = 2x)$.
4. Compute $(h = 2 \times 8 = 16 \text{ meters})$.

This straightforward calculation exemplifies the power of understanding special triangle ratios.

Practical Applications of 30-60-90 Triangles

Engineering and Construction

Engineers and architects often rely on 30-60-90 triangles to create precise angles and measurements, especially in the design of structures like roof trusses, bridges, and ramps. Knowing the side ratios allows for quick calculations without complex trigonometry.

Educational Settings

In classrooms, 30-60-90 triangles serve as an excellent introduction to the properties of special right triangles, helping students develop geometric intuition and learn to apply ratios effectively.

Navigation and Surveying

Surveyors use these triangles to determine distances and angles indirectly, often employing the ratios to simplify calculations in fieldwork.

Advantages of Understanding 30-60-90 Triangles

- Predictability: The fixed ratios mean once one side is known, others can be easily calculated.
- Speed: Eliminates need for complex trigonometric calculations in many practical scenarios.
- Versatility: Applicable in various fields, from architecture to physics.

Limitations or Considerations

While the properties are straightforward, certain limitations exist:

- Assumption of perfect angles: Real-world measurements may deviate slightly, needing measurement corrections.
- Specificity: Only applicable when the triangle's angles are exactly 30° , 60° , and 90° , which may not always be the case.

Additional Examples and Practice Problems

Example 1:

If the shorter leg of a 30-60-90 triangle measures 10 meters, what is the length of the longer leg?

Solution:

$$\text{Longer leg} = x \sqrt{3} = 10 \sqrt{3} \approx 17.32 \text{ meters}$$

Example 2:

A ladder leans against a wall, forming a 30-60-90 triangle with the ground. If the shorter leg (distance from the foot of the ladder to the wall) is 5 meters, what is the length of the ladder?

Solution:

$$\text{Ladder length} = 2 \times 5 = 10 \text{ meters}$$

Conclusion

In a 30-60-90 triangle, the relationship between the shorter leg and the hypotenuse is a fundamental property that simplifies many geometric calculations. When the shorter leg measures 8 meters, the hypotenuse is exactly 16 meters, illustrating the elegance of these special triangles. Understanding these ratios enhances geometric problem-solving skills, aids in practical applications, and provides a solid foundation for further trigonometric studies. Whether in academic environments or real-world engineering tasks, mastering the properties of 30-60-90 triangles is a valuable skill that combines simplicity with powerful mathematical insight.

[In A 30 60 90 Triangle What Is The Length Of The Hypotenuse When The Shorter Leg Is 8 M Enter Your Answer](#)

In A 30 60 90 Triangle What Is The Length Of The Hypotenuse When The Shorter Leg Is 8 M Enter Your Answer

Related Articles

- [Companies Who Use Ad Campaigns To Raise Public Awareness Of Important Issues Such As Texting While Driving](#)
- [Greg And Bill Have Entered Into A Purchase And Sale Agreement, But Closing Cannot Happen Until Inspections](#)

- [From 1945 To 1960 And Beyond, The United States And The Soviet Union Were In A Cold War; However, Military](#)

[Back to Home](#)