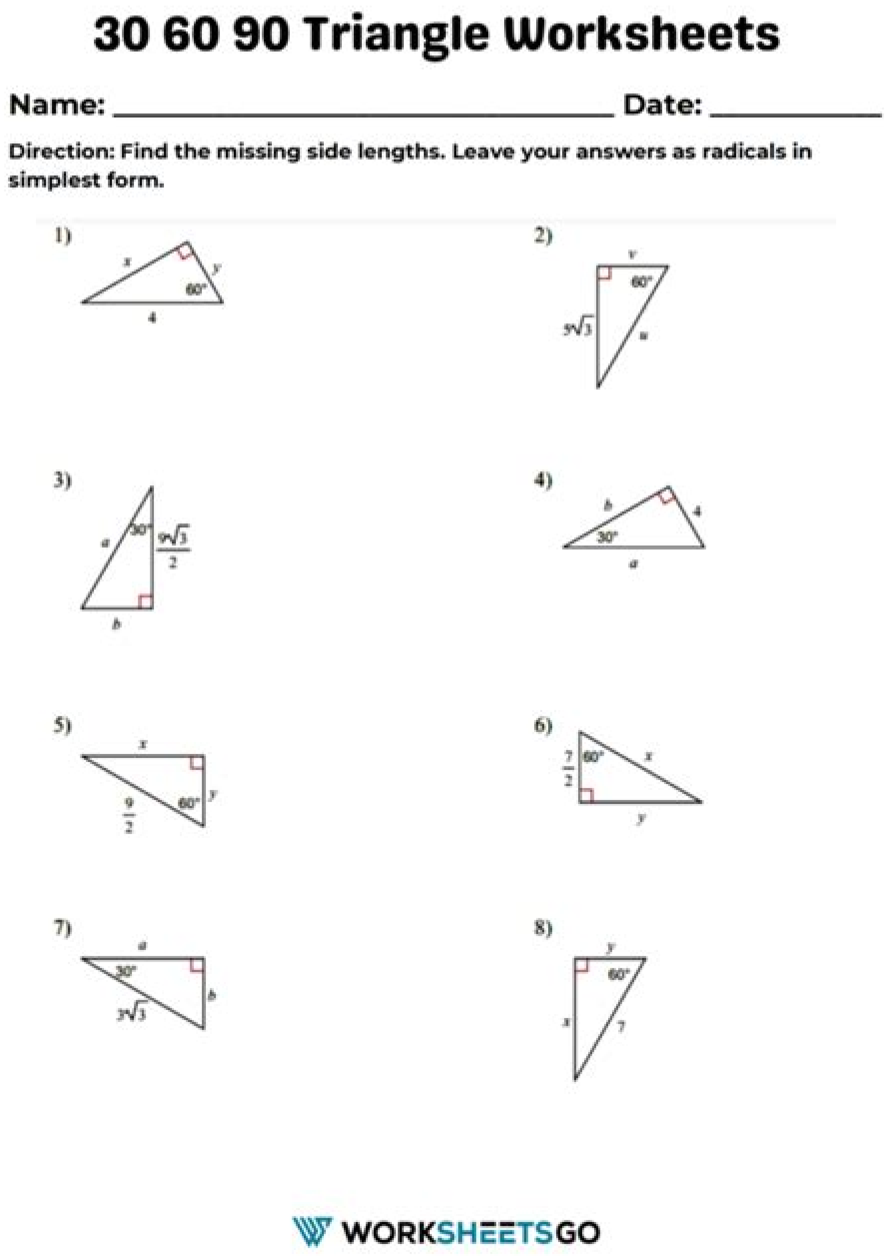
30 60 90 Triangles Answer Key



Understanding 30-60-90 Triangles: An Answer Key to the Basics

In geometry, the **30 60 90 triangles answer key** serves as a crucial reference point for students and educators alike. These special right triangles have unique properties that make them fundamental in various mathematical applications, including trigonometry, geometry, and even real-world problem-solving. This article aims to explain the properties of 30-60-90 triangles, how to solve problems involving them, and provide an answer key to commonly encountered questions.

What is a 30-60-90 Triangle?

A 30-60-90 triangle is a type of right triangle where the angles measure 30 degrees, 60 degrees, and 90 degrees. The sides of this triangle are in a specific ratio, which is essential for solving problems related to these triangles.

Properties of 30-60-90 Triangles

The most important properties of 30-60-90 triangles are as follows:

1. Angle Measures:
- One angle measures 30 degrees.
- Another angle measures 60 degrees.
- The right angle measures 90 degrees.

2. Side Length Ratios:
- The side opposite the 30-degree angle is the shortest and is commonly denoted as x.
- The side opposite the 60-degree angle is longer and can be represented as $x\sqrt{3}$.
- The hypotenuse, opposite the 90-degree angle, is the longest side and is represented as $2x$.

This can be summarized in a ratio format:
- Side opposite 30°: x
- Side opposite 60°: $x\sqrt{3}$
- Hypotenuse: $2x$

Solving Problems Involving 30-60-90 Triangles

To effectively solve problems involving 30-60-90 triangles, it is vital to apply the properties mentioned above. Below are the steps to solve typical problems associated with this type of triangle:

Step-by-Step Problem Solving

1. Identify the Known Values: Determine which side length is known and which angle corresponds to that side.
2. Use Ratios to Find Unknowns:
- If the length of the side opposite the 30-degree angle is known, multiply by 2 to find the hypotenuse and by $\sqrt{3}$ to find the side opposite the 60-degree angle.
- If the hypotenuse is known, divide by 2 to find the side opposite the 30-degree angle and multiply by $\sqrt{3}$ to find the side opposite the 60-degree angle.
- If the side opposite the 60-degree angle is known, divide by $\sqrt{3}$ to find the side opposite the 30-degree angle and multiply by 2 to find the hypotenuse.

3. Double-Check Using Pythagorean Theorem: For verification, employ the Pythagorean theorem $a^2 + b^2 = c^2$ to ensure that the calculated side lengths satisfy this equation.

Common Problems and Their Solutions

To further illustrate the concept, we will explore some common problems related to 30-60-90 triangles along with their solutions.

Example Problem 1: Finding the Side Lengths

Problem: A 30-60-90 triangle has a side opposite the 30-degree angle measuring 5 cm. What are the lengths of the other two sides?

Solution:
- Side opposite 30°: $x = 5 \text{ cm}$
- Side opposite 60°: $x\sqrt{3} = 5\sqrt{3} \approx 8.66 \text{ cm}$
- Hypotenuse: $2x = 2 \times 5 = 10 \text{ cm}$

Answer: The lengths of the sides are approximately 5 cm, 8.66 cm, and 10 cm.

Example Problem 2: Finding the Side Opposite the 60-Degree Angle

Problem: If the hypotenuse of a 30-60-90 triangle measures 12 cm, what is the length of the side opposite the 60-degree angle?

Solution:
- Hypotenuse: $c = 12 \text{ cm}$
- Side opposite 30°: $x = \frac{c}{2} = \frac{12}{2} = 6 \text{ cm}$
- Side opposite 60°: $x\sqrt{3} = 6\sqrt{3} \approx 10.39 \text{ cm}$

Answer: The length of the side opposite the 60-degree angle is approximately 10.39 cm.

Example Problem 3: Using Pythagorean Theorem

Problem: A right triangle has a hypotenuse of length 14 cm. Verify if it is a 30-60-90 triangle by checking one of the side lengths.

Solution:
- Hypotenuse: $c = 14 \text{ cm}$
- Side opposite 30°: $x = \frac{c}{2} = \frac{14}{2} = 7 \text{ cm}$
- Side opposite 60°: $x\sqrt{3} = 7\sqrt{3} \approx 12.12 \text{ cm}$

Now, check using the Pythagorean theorem:
- $7^2 + (7\sqrt{3})^2 = 49 + 147 = 196$
- $14^2 = 196$

Since both sides match, it confirms that the triangle is indeed a 30-60-90 triangle.

Conclusion

The **30 60 90 triangles answer key** not only helps students understand the unique properties of these triangles but also equips them with the necessary tools to solve a variety of problems effectively. By mastering these properties and applying them in different contexts, one can confidently tackle geometry and trigonometry challenges. Whether in academic settings or real-world applications, the understanding of 30-60-90 triangles remains a fundamental aspect of mathematical education.

Frequently Asked Questions

What are the side lengths of a 30-60-90 triangle?

In a 30-60-90 triangle, the side lengths are in the ratio $1 : \sqrt{3} : 2$. The shortest side (opposite the 30-degree angle) is 'x', the longer leg (opposite the 60-degree angle) is '$x\sqrt{3}$', and the hypotenuse (opposite the 90-degree angle) is '2x'.

How do you find the length of the hypotenuse in a 30-60-90 triangle?

To find the hypotenuse in a 30-60-90 triangle, multiply the length of the shortest side (opposite the 30-degree angle) by 2. If the shortest side is 'x', then the hypotenuse is '2x'.

What is the formula to calculate the area of a 30-60-90 triangle?

The area of a 30-60-90 triangle can be calculated using the formula: Area = (1/2) base height. Using the sides, the area can be expressed as Area = $(1/2)\ (x)\ (x\sqrt{3}) = (\sqrt{3}/2)\ x^2$.

Can you use the 30-60-90 triangle to solve real-world problems?

Yes, 30-60-90 triangles are used in various real-world applications such as architecture, engineering, and physics, particularly when dealing with angles and distances that conform to these specific ratios.

How can you determine the angles in a 30-60-90 triangle if you know one side length?

If you know one side length, you can determine the other sides and angles using the ratios. For example, if the shortest side is known, the other sides can be found by multiplying by $\sqrt{3}$ for the longer leg and by 2 for the hypotenuse, confirming that the angles are 30°, 60°, and 90°.

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