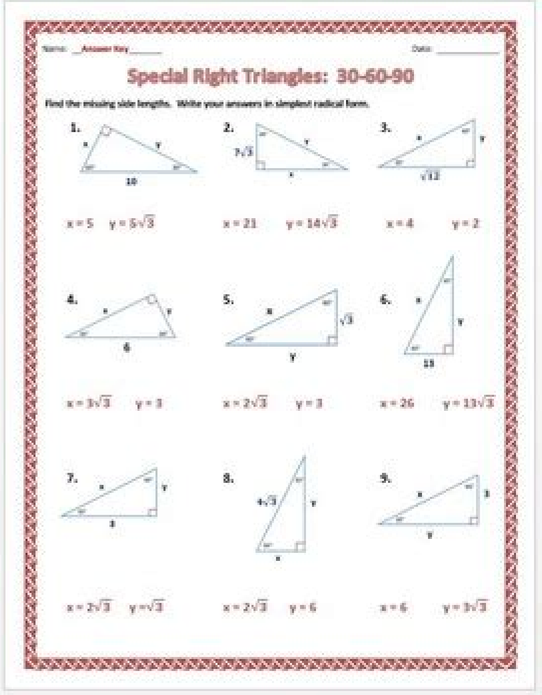
Special Right Triangles 30 60 90 Worksheet Answers



Name: Answer Key

Date:

Special Right Triangles: 30-60-90

Find the missing side lengths. Write your answers in simplest radical form.

1.
x
y
10
2.
$7\sqrt{3}$
y
x
3.
x
y
$\sqrt{12}$
4.
x
y
6
5.
x
$\sqrt{3}$
y
6.
x
y
13
7.
x
y
3
8.
$4\sqrt{3}$
y
x
9.
x
3
y

$x = 5$ $y = 5\sqrt{3}$

$x = 21$ $y = 14\sqrt{3}$

$x = 4$ $y = 2$

$x = 3\sqrt{3}$ $y = 3$

$x = 2\sqrt{3}$ $y = 3$

$x = 26$ $y = 13\sqrt{3}$

$x = 2\sqrt{3}$ $y = \sqrt{3}$

$x = 2\sqrt{3}$ $y = 6$

$x = 6$ $y = 3\sqrt{3}$

Special right triangles 30 60 90 worksheet answers are crucial for understanding the properties of these triangles, which frequently appear in various mathematical contexts, especially in geometry and trigonometry. Understanding how to work with 30-60-90 triangles can simplify complex problems and enhance problem-solving skills in both academic and real-world applications. In this article, we will explore the characteristics of 30-60-90 triangles, how to derive their side lengths, and provide example worksheet problems along with their answers.

Understanding 30-60-90 Triangles

A 30-60-90 triangle is a special type of right triangle where the angles measure 30 degrees, 60 degrees, and 90 degrees. The unique aspect of this triangle is that the ratio of its sides is consistent, regardless of the size of the triangle. This characteristic makes it easier to solve problems involving these triangles.

Side Length Ratios

The side lengths of a 30-60-90 triangle adhere to a specific ratio:

- Opposite the 30-degree angle: \(x \) (the shortest side)
- Opposite the 60-degree angle: \(x\sqrt{3} \)
- Hypotenuse (opposite the 90-degree angle): \(2x \)

This consistent ratio allows for quick calculations when dealing with these triangles.

Deriving the Side Lengths

To understand how the side lengths are derived, consider a 30-60-90 triangle inscribed in a unit circle or constructed from equilateral triangles.

1. Equilateral Triangle: Start with an equilateral triangle where each side measures \(2x \). By drawing an altitude from one vertex to the opposite side, you effectively create two 30-60-90 triangles.

2. Calculating the lengths:
- The altitude divides the equilateral triangle into two equal halves.
- The base of each 30-60-90 triangle will be \(x \), and the height represents \(x\sqrt{3} \).
- The hypotenuse remains \(2x \).

By using this configuration, you can derive the side lengths of any 30-60-90 triangle given the shortest side.

Example Problems

To solidify your understanding of 30-60-90 triangles, let’s solve a few example problems. Each problem will illustrate how to apply the side length ratios to find missing values.

Problem 1

Given: The shortest side (opposite the 30-degree angle) is 5 cm.
Find: The lengths of the other two sides.

Solution:
- Hypotenuse: \(2x = 2 \times 5 = 10 \) cm
- Opposite the 60-degree angle: \(x\sqrt{3} = 5\sqrt{3} \approx 8.66 \) cm

Answer: Hypotenuse = 10 cm, Opposite 60-degree = \(5\sqrt{3} \) cm.

Problem 2

Given: The hypotenuse is 12 cm.
Find: The lengths of the other two sides.

Solution:
- Shortest side: $x = \frac{12}{2} = 6$ cm
- Opposite the 60-degree angle: $x\sqrt{3} = 6\sqrt{3} \approx 10.39$ cm

Answer: Shortest side = 6 cm, Opposite 60-degree = $6\sqrt{3}$ cm.

Problem 3

Given: The length opposite the 60-degree angle is $7\sqrt{3}$ cm.
Find: The lengths of the other two sides.

Solution:
- Opposite the 30-degree angle: $x = \frac{7\sqrt{3}}{\sqrt{3}} = 7$ cm
- Hypotenuse: $2x = 2 \times 7 = 14$ cm

Answer: Shortest side = 7 cm, Hypotenuse = 14 cm.

Worksheet Problems

Now that we've covered some examples, let’s create a worksheet with additional problems to practice the properties of 30-60-90 triangles.

Worksheet Problems:
1. The shortest side of a 30-60-90 triangle is 4 cm. Find the lengths of the other two sides.
2. The hypotenuse of a 30-60-90 triangle is 20 cm. What are the lengths of the other two sides?
3. If the side opposite the 30-degree angle is $10\sqrt{3}$ cm, find the length of the hypotenuse and the side opposite the 60-degree angle.
4. The side opposite the 60-degree angle measures 8 cm. Calculate the lengths of the other two sides.
5. A triangle has a hypotenuse of 16 cm. Determine the lengths of the remaining sides.

Answers to Worksheet Problems

1. Answer: Hypotenuse = 8 cm, Opposite 60-degree = $4\sqrt{3}$ cm.
2. Answer: Shortest side = 10 cm, Opposite 60-degree = $10\sqrt{3}$ cm.
3. Answer: Hypotenuse = $20\sqrt{3}$ cm, Opposite 60-degree = 10 cm.

4. Answer: Shortest side = \(\frac{8}{\sqrt{3}} \) cm (approx. 4.62 cm), Hypotenuse = \(\frac{16}{\sqrt{3}} \) cm (approx. 9.24 cm).
5. Answer: Shortest side = 8 cm, Opposite 60-degree = \(8\sqrt{3} \) cm.

Conclusion

Special right triangles 30 60 90 worksheet answers play a significant role in geometry and trigonometry. By understanding the properties and ratios of these triangles, students can solve problems more efficiently. The exercises provided in this article not only reinforce the concepts but also prepare learners for more advanced mathematical challenges. Whether in academic settings or practical applications, mastering the 30-60-90 triangle concept is essential for success in various fields of study.

Frequently Asked Questions

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

In a 30-60-90 triangle, the lengths of the sides are in the ratio 1 : √3 : 2. The shortest side (opposite the 30° angle) is 'x', the longer leg (opposite the 60° angle) is 'x√3', and the hypotenuse is '2x'.

How do you find the length of the hypotenuse in a 30-60-90 triangle if the shorter leg is 4?

If the shorter leg is 4, the hypotenuse is 2 times the shorter leg, so the hypotenuse is 2 4 = 8.

What is the length of the longer leg if the hypotenuse of a 30-60-90 triangle is 10?

In a 30-60-90 triangle, the longer leg is √3 times the shorter leg. If the hypotenuse is 10, the shorter leg is 5 (10/2), making the longer leg 5√3.

How can I verify my answers for a 30-60-90 triangle worksheet?

You can verify your answers by checking the ratios of the sides: ensure that the shorter leg is half the hypotenuse and that the longer leg is √3 times the shorter leg.

What is the area of a 30-60-90 triangle with a shorter leg of length 6?

To find the area, use the formula Area = 1/2 base height. The base is the shorter leg (6) and the height is the longer leg (6√3). Thus, Area = 1/2 6 6√3 = 18√3.

How do angles in a 30-60-90 triangle relate to its side lengths?

The angles in a 30-60-90 triangle dictate the side ratios: the side opposite the 30° angle is the shortest, the side opposite the 60° angle is longer, and the hypotenuse is the longest, maintaining the ratio 1:√3:2.

What is a common mistake when solving 30-60-90 triangles?

A common mistake is miscalculating the longer leg by forgetting to multiply the shorter leg by √3, or incorrectly identifying the sides based on the angles.

Can you provide a real-world application of a 30-60-90 triangle?

30-60-90 triangles are often used in construction and architecture, especially in roof designs where angles of 30° and 60° help determine the slopes and dimensions of rafters.

How does the 30-60-90 triangle relate to the unit circle?

In the unit circle, a 30-60-90 triangle can be formed by drawing a line from the origin to the point (√3/2, 1/2), where the angles correspond to 30° and 60°, with the hypotenuse being 1.

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