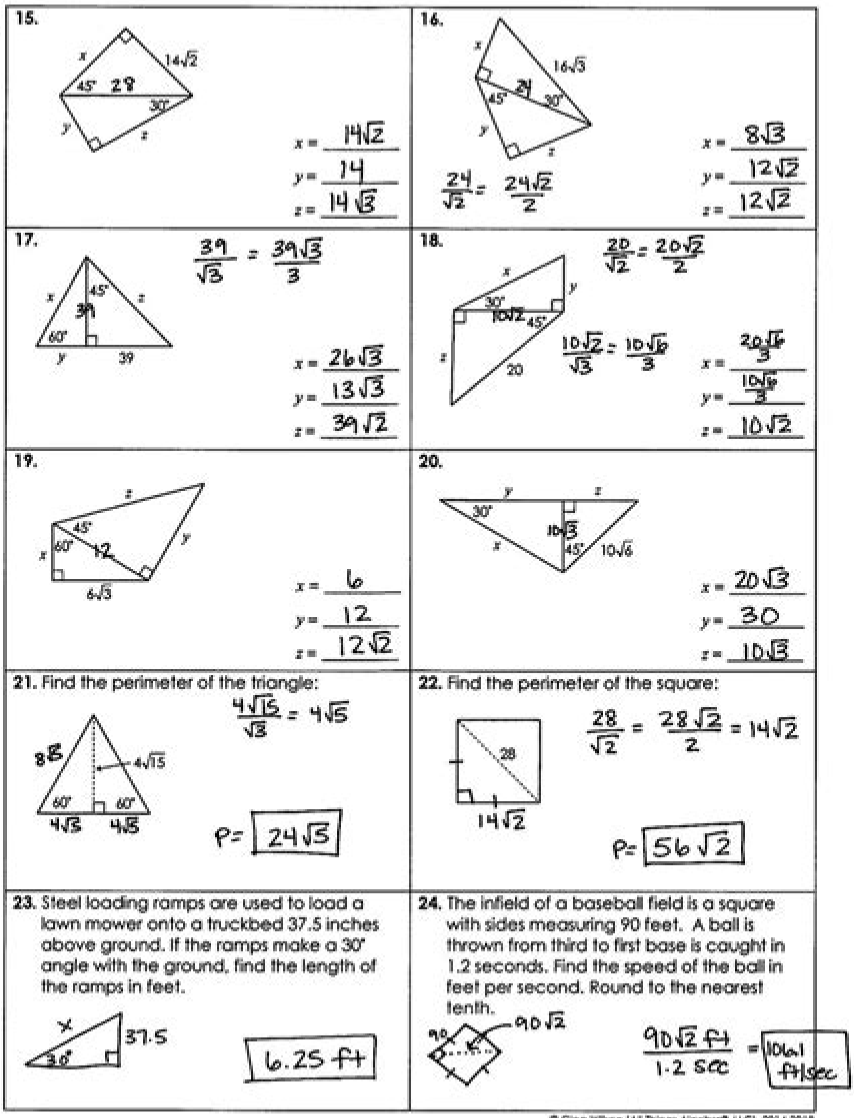
Right Triangles And Trigonometry Answer Key



15. $x = 14\sqrt{2}$, $y = 14$, $z = 14\sqrt{3}$

16. $\frac{24}{\sqrt{2}} = \frac{24\sqrt{2}}{2}$; $x = 8\sqrt{3}$, $y = 12\sqrt{2}$, $z = 12\sqrt{2}$

17. $\frac{39}{\sqrt{3}} = \frac{39\sqrt{3}}{3}$; $x = 26\sqrt{3}$, $y = 13\sqrt{3}$, $z = 39\sqrt{2}$

18. $\frac{20}{\sqrt{2}} = \frac{20\sqrt{2}}{2}$; $\frac{10\sqrt{2}}{\sqrt{3}} = \frac{10\sqrt{6}}{3}$; $x = \frac{20\sqrt{6}}{3}$, $y = \frac{10\sqrt{6}}{3}$, $z = 10\sqrt{2}$

19. $x = 6$, $y = 12$, $z = 12\sqrt{2}$

20. $x = 20\sqrt{3}$, $y = 30$, $z = 10\sqrt{3}$

21. Find the perimeter of the triangle: $\frac{4\sqrt{15}}{\sqrt{3}} = 4\sqrt{5}$; $P = 24\sqrt{5}$

22. Find the perimeter of the square: $\frac{28}{\sqrt{2}} = \frac{28\sqrt{2}}{2} = 14\sqrt{2}$; $P = 56\sqrt{2}$

23. Steel loading ramps are used to load a lawn mower onto a truckbed 37.5 inches above ground. If the ramps make a 30° angle with the ground, find the length of the ramps in feet. 6.25 ft

24. The infield of a baseball field is a square with sides measuring 90 feet. A ball is thrown from third to first base is caught in 1.2 seconds. Find the speed of the ball in feet per second. Round to the nearest tenth. $\frac{90\sqrt{2}\text{ ft}}{1.2\text{ sec}} = 106.1$ ft/sec

Right triangles and trigonometry answer key are essential tools in the study of mathematics, particularly in geometry and trigonometry. These concepts play a crucial role in various fields, including engineering, physics, architecture, and even computer science. Understanding right triangles and their properties allows students and professionals to solve complex problems involving angles, distances, and various measurements. In this article, we will explore the key concepts related to right triangles, delve into trigonometric functions, and provide a comprehensive answer key for common problems involving these triangles.

Understanding Right Triangles

Right triangles are defined as triangles that contain one angle measuring exactly 90 degrees. The side opposite the right angle is known as the hypotenuse, while the other two sides are referred to as the legs. The relationships between the sides and angles of right triangles are foundational in trigonometry.

Key Properties of Right Triangles

1. Pythagorean Theorem: The most important property of right triangles is captured by the Pythagorean theorem, which states that in a right triangle with legs a and b, and hypotenuse c:

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

2. Trigonometric Ratios: The sides of right triangles give rise to three primary trigonometrical ratios:
- Sine ($\sin$): The ratio of the opposite side to the hypotenuse.
- Cosine ($\cos$): The ratio of the adjacent side to the hypotenuse.
- Tangent ($\tan$): The ratio of the opposite side to the adjacent side.

3. Special Right Triangles: There are two types of special right triangles that are frequently encountered:
- 45-45-90 Triangle: Both legs are equal, and the hypotenuse is $\sqrt{2}$ times the length of a leg.
- 30-60-90 Triangle: The lengths of the sides are in the ratio $1 : \sqrt{3} : 2$.

Trigonometric Functions and Their Applications

Trigonometric functions are critical for solving problems involving right triangles. They allow us to find unknown angles and side lengths using the known values. Here are the primary trigonometric functions associated with right triangles:

1. Sine Function

The sine of an angle θ in a right triangle is defined as:

$$
\sin(\theta) = \frac{\text{Opposite Side}}{\text{Hypotenuse}}
$$

2. Cosine Function

The cosine of an angle θ is defined as:

$$
\cos(\theta) = \frac{\text{Adjacent Side}}{\text{Hypotenuse}}

\]

3. Tangent Function

The tangent of an angle θ is defined as:

$$
\tan(\theta) = \frac{\text{Opposite Side}}{\text{Adjacent Side}}
$$

Using the Trigonometric Functions

To apply these trigonometric functions effectively, it is essential to understand the relationships and how to manipulate them to solve for unknown values. Here, we will provide a step-by-step approach to solving common problems involving right triangles.

Example Problem 1: Finding a Side Length

Given a right triangle where one angle measures 30° and the hypotenuse is 10 units, find the length of the opposite side.

Solution:
1. Use the sine function:

$$
\sin(30^\circ) = \frac{\text{Opposite}}{10}
$$

2. Since $\sin(30^\circ) = \frac{1}{2}$, we have:

$$
\frac{1}{2} = \frac{\text{Opposite}}{10}
$$

3. Solve for the opposite side:

$$
\text{Opposite} = 10 \times \frac{1}{2} = 5 \text{ units}
$$

Example Problem 2: Finding an Angle

Given a right triangle where the lengths of the legs are 3 units and 4 units, find the angle opposite the side measuring 3 units.

Solution:
1. Use the tangent function:

$$
\tan(\theta) = \frac{\text{Opposite}}{\text{Adjacent}} = \frac{3}{4}
$$

2. To find the angle, take the arctangent:

\[

$$
\theta = \tan^{-1}\left(\frac{3}{4}\right) \approx 36.87^\circ
$$

Practice Problems and Answer Key

To solidify your understanding of right triangles and trigonometry, here are some practice problems along with their answers.

Practice Problems

1. A right triangle has one angle measuring 45°, and the length of one leg is 7 units. Find the length of the hypotenuse.
2. In a right triangle, the hypotenuse is 13 units long, and one leg measures 5 units. Find the length of the other leg.
3. Calculate the angle opposite to a side measuring 6 units in a triangle where the hypotenuse is 10 units.

Answer Key

1. Using the 45-45-90 triangle property, the hypotenuse is $7\sqrt{2} \approx 9.9$ units.
2. Using the Pythagorean theorem: $c^2 = a^2 + b^2 \Rightarrow 13^2 = 5^2 + b^2 \Rightarrow 169 = 25 + b^2 \Rightarrow b^2 = 144 \Rightarrow b = 12$ units.
3. Using the sine function:

$$
\sin(\theta) = \frac{6}{10} \Rightarrow \theta = \sin^{-1}(0.6) \approx 36.87^\circ
$$

Conclusion

Understanding **right triangles and trigonometry answer key** equips students and professionals with the necessary skills to tackle a wide range of mathematical problems. Through the Pythagorean theorem and the application of trigonometric functions, one can easily navigate the intricacies of angles and side lengths in right triangles. Regular practice and application of these concepts will enhance problem-solving skills and deepen understanding in mathematics and its related fields.

Frequently Asked Questions

What is the Pythagorean theorem and how is it used in right triangles?

The Pythagorean theorem states that in a right triangle, the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the other two sides. It is expressed as $a^2 + b^2 =$

c^2, where c is the hypotenuse.

What are the primary trigonometric ratios used in right triangles?

The primary trigonometric ratios are sine (sin), cosine (cos), and tangent (tan). They are defined as follows: $\sin(\theta)$ = opposite/hypotenuse, $\cos(\theta)$ = adjacent/hypotenuse, and $\tan(\theta)$ = opposite/adjacent.

How do you calculate the angle of a right triangle using trigonometric ratios?

To calculate an angle in a right triangle, you can use the inverse trigonometric functions: $\theta = \sin^{-1}$(opposite/hypotenuse), $\theta = \cos^{-1}$(adjacent/hypotenuse), or $\theta = \tan^{-1}$(opposite/adjacent).

What is the significance of the 30-60-90 triangle in trigonometry?

In a 30-60-90 triangle, the sides have a specific ratio: the lengths are in the ratio $1:\sqrt{3}:2$. This means the side opposite the 30° angle is 1, the side opposite the 60° angle is $\sqrt{3}$, and the hypotenuse is 2.

Can you explain the 45-45-90 triangle and its properties?

A 45-45-90 triangle is an isosceles right triangle where the angles are 45°, 45°, and 90°. The sides opposite the 45° angles are equal, and the lengths are in the ratio $1:1:\sqrt{2}$, meaning if each leg is x, the hypotenuse is $x\sqrt{2}$.

What role do trigonometric identities play in solving problems involving right triangles?

Trigonometric identities, such as the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$, help simplify and solve problems involving right triangles by relating the trigonometric functions of angles to one another.

How can trigonometry be applied in real-world situations involving right triangles?

Trigonometry can be applied in various real-world situations, such as calculating heights and distances in construction, navigation, and astronomy, using the relationships between angles and sides of right triangles.

Right Triangles And Trigonometry Answer Key

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