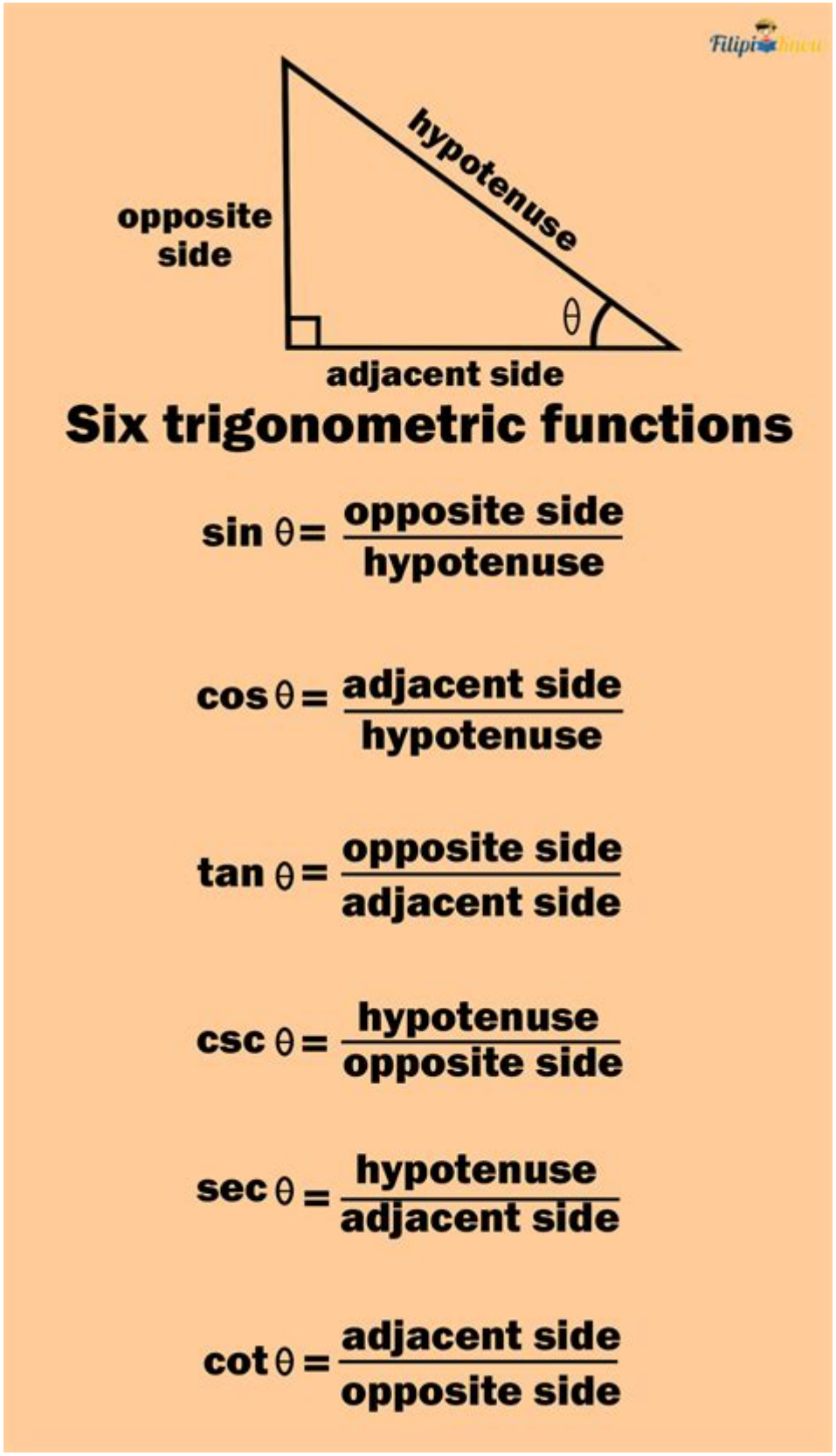
Trigonometric Functions Examples With Solution



Trigonometric functions examples with solution can be quite helpful for

students and enthusiasts of mathematics as they navigate the intricacies of angles and their relationships in triangles. Trigonometric functions, such as sine, cosine, and tangent, are foundational for studying various fields, including physics, engineering, and even computer graphics. In this article, we will explore several examples of trigonometric functions, providing step-by-step solutions to deepen your understanding.

Understanding Trigonometric Functions

Trigonometric functions relate the angles of a triangle to the lengths of its sides. The primary functions include:

- Sine (sin): The ratio of the length of the opposite side to the hypotenuse.
- Cosine (cos): The ratio of the length of the adjacent side to the hypotenuse.
- Tangent (tan): The ratio of the length of the opposite side to the adjacent side.

These functions are typically defined for right triangles and can be extended to circles and the unit circle for broader applications.

Example 1: Finding the Length of a Side in a Right Triangle

Consider a right triangle where one angle measures 30 degrees, and the length of the hypotenuse is 10 units. We want to find the length of the opposite side.

Solution:

1. Identify the function to use: Since we are dealing with the opposite side and the hypotenuse, we will use the sine function.

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

2. Plug in the values:

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

We know that $\sin(30^\circ) = 0.5$.

3. Set up the equation:

$$
0.5 = \frac{\text{Opposite}}{10}
$$

4. Solve for the opposite side:

$$
\text{Opposite} = 0.5 \times 10 = 5 \text{ units}
$$

Thus, the length of the opposite side is 5 units.

Example 2: Finding an Angle Using the Inverse Function

Suppose we have a right triangle with an adjacent side of 8 units and an opposite side of 6 units. We need to find the angle θ.

Solution:

1. Identify the function to use: Here, we will use the tangent function since it relates the opposite and adjacent sides.

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

2. Plug in the values:

$$
\tan(\theta) = \frac{6}{8}
$$

3. Simplify:

$$
\tan(\theta) = 0.75
$$

4. Find the angle using the inverse tangent function:

$$
\theta = \tan^{-1}(0.75)
$$

Using a calculator, we find:

$$
\theta \approx 36.87^\circ
$$

Thus, the angle θ is approximately 36.87 degrees.

Example 3: Solving a Trigonometric Equation

Let's solve the equation $2\sin(x) - 1 = 0$ for x in the interval $[0, 2\pi]$.

Solution:

1. Rearrange the equation:

$$
2\sin(x) = 1
$$

2. Divide both sides by 2:

$$
\sin(x) = 0.5
$$

3. Identify the angles where sine equals 0.5 within the interval $[0, 2\pi]$:

- The reference angle is 30° (or $\frac{\pi}{6}$).
- Sine is positive in the first and second quadrants.

4. Find the solutions:

- First quadrant:
$$
x = \frac{\pi}{6}
$$
- Second quadrant:
$$
x = \pi - \frac{\pi}{6} = \frac{5\pi}{6}
$$

5. Final solutions:

Thus, the values of x are:

$$
x = \frac{\pi}{6}, \frac{5\pi}{6}
$$

Example 4: Working with the Unit Circle

In this example, we will find the sine and cosine of $x = 120^\circ$.

Solution:

1. Locate the angle on the unit circle: 120° is in the second quadrant.

2. Find the reference angle:

$$
180^\circ - 120^\circ = 60^\circ
$$

3. Use known values:

- $\sin(60^\circ) = \frac{\sqrt{3}}{2}$
- $\cos(60^\circ) = \frac{1}{2}$

4. Determine the signs in the second quadrant:

- Sine is positive.
- Cosine is negative.

5. Final values:

$$
\sin(120^\circ) = \frac{\sqrt{3}}{2}, \quad \cos(120^\circ) = -\frac{1}{2}
$$

Example 5: Graphing Trigonometric Functions

Understanding the graphical representation of trigonometric functions is crucial. Let’s graph the function $y = \sin(x)$ over the interval $[0, 2\pi]$.

Solution:

1. Identify key points:

- At $x = 0$: $y = \sin(0) = 0$
- At $x = \frac{\pi}{2}$: $y = \sin\left(\frac{\pi}{2}\right) = 1$
- At $x = \pi$: $y = \sin(\pi) = 0$
- At $x = \frac{3\pi}{2}$: $y = \sin\left(\frac{3\pi}{2}\right) = -1$
- At $x = 2\pi$: $y = \sin(2\pi) = 0$

2. Plot these points on a coordinate plane:

- $(0, 0)$
- $\left(\frac{\pi}{2}, 1\right)$
- $(\pi, 0)$
- $\left(\frac{3\pi}{2}, -1\right)$
- $(2\pi, 0)$

3. Draw the curve: Connect the points smoothly to show the wave-like nature of the sine function.

The graph will clearly exhibit a periodic wave, oscillating between -1 and 1.

Conclusion

In this article, we explored several examples of trigonometric functions, demonstrating how to apply these concepts to solve problems involving right triangles, angles, equations, and graphical representations. By practicing these examples, you will enhance your understanding of trigonometric functions and their applications. Mastery of these functions can significantly aid in various mathematical and scientific endeavors.

Frequently Asked Questions

What is the sine of 30 degrees and how can it be calculated?

The sine of 30 degrees is 0.5. It can be calculated using the unit circle, where the y-coordinate of the point corresponding to 30 degrees (or π/6 radians) is 0.5.

How do you find the cosine of 45 degrees?

The cosine of 45 degrees is √2/2 (approximately 0.707). This can be derived from the properties of an isosceles right triangle, where the adjacent and

opposite sides are equal.

What is the tangent of 60 degrees, and what is an example of how to compute it?

The tangent of 60 degrees is √3 (approximately 1.732). It can be computed as the ratio of the sine to the cosine of 60 degrees: tan(60°) = sin(60°)/cos(60°) = (√3/2) / (1/2) = √3.

Can you explain how to calculate the cosecant of 30 degrees?

The cosecant of 30 degrees is 2. Since cosecant is the reciprocal of sine, we find csc(30°) = 1/sin(30°) = 1/0.5 = 2.

What is the secant of 0 degrees and how is it derived?

The secant of 0 degrees is 1. It is derived as the reciprocal of the cosine: sec(0°) = 1/cos(0°) = 1/1 = 1.

How do you find the cotangent of 45 degrees?

The cotangent of 45 degrees is 1. This is because cotangent is the reciprocal of tangent: cot(45°) = 1/tan(45°) = 1/1 = 1.

What is an example of using trigonometric functions in real-world applications?

An example is calculating the height of a building using the tangent function. If a person stands 50 meters away from the building and measures the angle of elevation to the top as 30 degrees, the height can be calculated using the formula: height = distance tan(angle) = 50 tan(30°) ≈ 50 0.577 = 28.85 meters.

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