Trigonometric Identities Questions And Answers

a)	$\sin 5x = 1$	m)	$\frac{\sqrt{3}}{4}\cos(4x-1) = -1$
b)	$\cos 2x = 0$	n)	$\cos\left(\frac{x}{2} - \frac{\pi}{6}\right) = -\frac{\sqrt{3}}{2}$
c)	$\tan 3x = \sqrt{3}$	o)	$\sqrt{3}\tan\frac{x}{2} = -1$
d)	$\cot\frac{x}{2} = 0$	p)	$\sin\left(\frac{x}{4}+1\right) = \frac{2}{\sqrt{2}}$
e)	$\sin\left(\frac{x}{3}+\frac{\pi}{4}\right) = \frac{\sqrt{2}}{2}$	q)	$2\sin\left(\frac{x}{2}+\frac{\pi}{4}\right) = -1$
f)	$\cos\frac{x}{4} = -1$	r)	$\sqrt{2}\cos^2 3x - \cos 3x = 0$
g)	$\cos(3x+1) = -\sqrt{3}$	s)	$(2\sin x - \cos x)(1+\cos x) = \sin^2 x$
h)	$\tan\frac{x}{4} = -1$	t)	$\sin^4 x = 1 - \cos^4 x$
i)	$\tan(3x-1) = -\sqrt{3}$	u)	$1 + \cos x + \cos 2x = 0$
j)	$2\cos\left(x+\frac{\pi}{6}\right) = -1$	v)	$\sin^3 x - \cos^3 x = 1 + \sin x \cos x$
k)	$\sin\left(\frac{x}{3}-\frac{\pi}{2}\right) = \frac{\sqrt{2}}{2}$	w)	$\frac{1+\tan x}{1-\tan x} = (\sin x + \cos x)^2$
l)	$\cot(2x-1) = 1$	x)	$1 - \sin 2x = \cos x - \sin x$

Trigonometric identities questions and answers are essential for mastering the concepts of trigonometry, a fundamental branch of mathematics that deals with the relationships between the angles and sides of triangles. Understanding trigonometric identities not only aids in solving various mathematical problems but also enhances the comprehension of advanced topics in calculus and physics. In this article, we will explore some common questions related to trigonometric identities, provide detailed answers, and explain the reasoning behind them.

Understanding Trigonometric Identities

Trigonometric identities are equations that involve trigonometric functions and hold true for all values of the involved variables. These identities can be classified into several categories:

1. Fundamental Identities

The fundamental trigonometric identities are the building blocks for deriving

other identities. They include:

- Reciprocal Identities:
- $\sin(x) = \frac{1}{\csc(x)}$
- $\cos(x) = \frac{1}{\sec(x)}$
- $\tan(x) = \frac{1}{\cot(x)}$

- Pythagorean Identities:
- $\sin^2(x) + \cos^2(x) = 1$
- $1 + \tan^2(x) = \sec^2(x)$
- $1 + \cot^2(x) = \csc^2(x)$

- Co-Function Identities:
- $\sin\left(\frac{\pi}{2} - x\right) = \cos(x)$
- $\cos\left(\frac{\pi}{2} - x\right) = \sin(x)$

2. Sum and Difference Identities

These identities help in finding the sine, cosine, and tangent of the sum or difference of two angles:

- Sine Sum and Difference:
- $\sin(a + b) = \sin(a)\cos(b) + \cos(a)\sin(b)$
- $\sin(a - b) = \sin(a)\cos(b) - \cos(a)\sin(b)$

- Cosine Sum and Difference:
- $\cos(a + b) = \cos(a)\cos(b) - \sin(a)\sin(b)$
- $\cos(a - b) = \cos(a)\cos(b) + \sin(a)\sin(b)$

- Tangent Sum and Difference:
- $\tan(a + b) = \frac{\tan(a) + \tan(b)}{1 - \tan(a)\tan(b)}$
- $\tan(a - b) = \frac{\tan(a) - \tan(b)}{1 + \tan(a)\tan(b)}$

Common Questions and Answers

Understanding trigonometric identities can often lead to confusion. Here are some common questions and their answers:

1. How do I prove that $\sin^2(x) + \cos^2(x) = 1$?

To prove this identity, we can use the definitions of sine and cosine based on a right triangle or the unit circle.

- Using the Unit Circle: In a unit circle, the coordinates of any point on

the circle are given by (x, y) where $x = \cos(\theta)$ and $y = \sin(\theta)$. The equation of the unit circle is:

$$
x^2 + y^2 = 1
$$

Substituting x and y gives:

$$
\cos^2(\theta) + \sin^2(\theta) = 1
$$

Thus, the identity is proven.

2. Can you simplify $\frac{1 - \cos(2x)}{\sin(2x)}$?

To simplify this expression, we can use the double angle identities:

- Using Double Angle Identities:

Recall that:
- $\cos(2x) = 2\cos^2(x) - 1$ or $\cos(2x) = 1 - 2\sin^2(x)$
- $\sin(2x) = 2\sin(x)\cos(x)$

Using the second version of the cosine double angle identity:

$$
1 - \cos(2x) = 1 - (1 - 2\sin^2(x)) = 2\sin^2(x)
$$

Now replacing in the expression:

$$
\frac{1 - \cos(2x)}{\sin(2x)} = \frac{2\sin^2(x)}{2\sin(x)\cos(x)} = \frac{\sin(x)}{\cos(x)} = \tan(x)
$$

Thus, the simplified form is $\tan(x)$.

3. How do I use the tangent sum identity to find $\tan(75^\circ)$?

To find $\tan(75^\circ)$, we can express it as:

$$
75^\circ = 45^\circ + 30^\circ
$$

Using the tangent sum identity:

$$
\tan(a + b) = \frac{\tan(a) + \tan(b)}{1 - \tan(a)\tan(b)}
$$

Substituting $a = 45^\circ$ and $b = 30^\circ$:

$$
\tan(45^\circ) = 1 \quad \text{and} \quad \tan(30^\circ) = \frac{1}{\sqrt{3}}
$$

Now applying the identity:

$$
\tan(75^\circ) = \frac{\tan(45^\circ) + \tan(30^\circ)}{1 - \tan(45^\circ)\tan(30^\circ)} = \frac{1 + \frac{1}{\sqrt{3}}}{1 - 1 \cdot \frac{1}{\sqrt{3}}}
$$

Simplifying the numerator:

$$
1 + \frac{1}{\sqrt{3}} = \frac{\sqrt{3} + 1}{\sqrt{3}}
$$

And the denominator:

$$
1 - \frac{1}{\sqrt{3}} = \frac{\sqrt{3} - 1}{\sqrt{3}}
$$

Thus:

$$
\tan(75^\circ) = \frac{\frac{\sqrt{3} + 1}{\sqrt{3}}}{\frac{\sqrt{3} - 1}{\sqrt{3}}} = \frac{\sqrt{3} + 1}{\sqrt{3} - 1}
$$

To rationalize the denominator:

$$
\tan(75^\circ) = \frac{(\sqrt{3} + 1)(\sqrt{3} + 1)}{(\sqrt{3} - 1)(\sqrt{3} + 1)} = \frac{4 + 2\sqrt{3}}{2} = 2 + \sqrt{3}
$$

Thus, $\tan(75^\circ) = 2 + \sqrt{3}$.

Conclusion

In summary, trigonometric identities questions and answers provide a valuable resource for anyone looking to deepen their understanding of trigonometry. By mastering the fundamental identities, sum and difference identities, and learning to prove and simplify various expressions, students and enthusiasts alike can gain a clearer understanding of the intricacies of trigonometric functions. Whether preparing for exams or simply exploring mathematical concepts, proficiency in these identities will serve as a powerful tool in one’s mathematical arsenal.

Frequently Asked Questions

What is the Pythagorean identity involving sine and cosine?

The Pythagorean identity states that $\sin^2(\theta) + \cos^2(\theta) = 1$ for any angle θ.

How can you express tan(θ) in terms of sin(θ) and cos(θ)?

tan(θ) can be expressed as $\tan(\theta) = \sin(\theta) / \cos(\theta)$.

What is the double angle formula for sine?

The double angle formula for sine is $\sin(2\theta) = 2\sin(\theta)\cos(\theta)$.

What is the formula for the cosine of a sum of angles?

The cosine of a sum of angles is given by $\cos(A + B) = \cos(A)\cos(B) - \sin(A)\sin(B)$.

How can you convert sec(θ) to sine and cosine?

sec(θ) can be expressed as $\sec(\theta) = 1 / \cos(\theta)$.

What is the relationship between csc(θ) and sin(θ)?

csc(θ) is the reciprocal of sin(θ), so $\csc(\theta) = 1 / \sin(\theta)$.

What is the tangent addition formula?

The tangent addition formula is $\tan(A + B) = (\tan(A) + \tan(B)) / (1 - \tan(A)\tan(B))$.

How do you simplify sin(θ)cos(θ) using a double angle identity?

Using the double angle identity, sin(θ)cos(θ) can be simplified to 1/2 sin(2θ).

What is the cotangent in terms of sine and cosine?

The cotangent function is defined as cot(θ) = cos(θ) / sin(θ).

How can you express the identity sin²(θ) using the cosine function?

Using the Pythagorean identity, sin²(θ) can be expressed as 1 - cos²(θ).

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