

Verify - Pythagorean Identities

Verify the following.

1) $\frac{\cos x}{1 - \sin x} = \sec x + \tan x$

2) $\frac{\tan^2 x + 1}{\tan^2 x} = \csc^2 x$

3) $\frac{\csc^2 x - \tan^2 (90^\circ - x)}{\csc^2 (90^\circ - x) - \tan^2 x} = \frac{\csc^2 x - \cot^2 x}{\csc^2 x - \cot^2 x}$

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Verify - Pythagorean Identities

Verify the following.

4) $\cot^2 x \sin^2 x + \cos^2 x \tan^2 x = 1$

5) $\sec^2 x - 1 = \sin^2 x$

6) $\frac{\cos x}{\csc^2 x - 1} = \tan x$

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Verify - Pythagorean Identities

Verify the following.

$$1) \quad \frac{\cos x}{1 - \sin x} = \sec x + \tan x$$

$$\frac{\cos x}{1 - \sin x} = \left(\frac{\cos x}{1 - \sin x} \right) \left(\frac{1 + \sin x}{1 + \sin x} \right)$$

Multiply & divide by $1 + \sin x$

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

Using $a^2 - b^2 = (a + b)(a - b)$

$$= \frac{\cos x(1 + \sin x)}{(1 + \sin x)(1 - \sin x)}$$

Using Pythagorean identity

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

$$= \frac{\cos x}{\cos^2 x}$$

$$= \sec x$$

Reciprocal & quotient

$$2) \quad \frac{\tan^2 x + 1}{\tan^2 x} = \csc^2 x$$

$$\frac{\tan^2 x + 1}{\tan^2 x} = \frac{\tan^2 x + 1}{\tan^2 x}$$

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Pythagorean & quotient

$$= \frac{\tan^2 x + 1}{\tan^2 x}$$

$$= \frac{\tan^2 x + 1}{\frac{\sin^2 x}{\cos^2 x}}$$

$$= \frac{\tan^2 x + 1}{\frac{\sin^2 x}{\cos^2 x}}$$

$$= \csc^2 x$$

Pythagorean identity & common factors

Pythagorean identity

$$3) \quad \frac{\csc^2 x - \tan^2(90^\circ - x)}{\csc^2(90^\circ - x) - \tan^2 x} = 1$$

$$\frac{\csc^2 x - \tan^2(90^\circ - x)}{\csc^2(90^\circ - x) - \tan^2 x} = \frac{\csc^2 x - \cot^2 x}{\sec^2 x - \tan^2 x}$$

Using cofunction identities

$$= \frac{1}{1}$$

Using Pythagorean identities

$$= 1$$

Verify - Pythagorean Identities

Verify the following.

4) $\cot^2 x \sin^2 x + \cos^2 x \tan^2 x = 1$

$$\cot^2 x \sin^2 x + \cos^2 x \tan^2 x = \frac{\cos^2 x}{\sin^2 x} \sin^2 x + \cos^2 x \frac{\sin^2 x}{\cos^2 x} \quad \text{Using quotient identities}$$

$$= \frac{\cos^2 x}{\sin^2 x} \sin^2 x + \cos^2 x \frac{\sin^2 x}{\cos^2 x} \quad \text{Cancel the common factors}$$

PREVIEW**Pythagorean identity**

5) $\sec^2 x - 1 = \tan^2 x$

$$\sec^2 x - 1 = \tan^2 x$$

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

$$= \frac{\sin^2 x - \cos^2 x}{\cos^2 x}$$

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

$$\frac{\cos x}{\csc^2 x - 1} = \frac{\cos x}{\frac{1}{\sin^2 x} - 1}$$

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

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

$$= \tan x \sin x$$

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Pythagorean identity**quotient identity****reciprocal identity**

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www.mathworksheets4kids.com**Pythagorean identity****Using quotient identity****Simplify****Using quotient identity**