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Study Guide

Verifying Trigonometric Identities

When verifying trigonometric identities, you cannot add or subtract quantities from each side of the identity. An unverified identity is not an equation, so the properties of equality do not apply.

Example 1 **Verify that $\frac{\sec^2 x - 1}{\sec^2 x} = \sin^2 x$ is an identity.**

Since the left side is more complicated, transform it into the expression on the right.

$$\frac{\sec^2 x - 1}{\sec^2 x} \stackrel{?}{=} \sin^2 x$$

$$\frac{(\tan^2 x + 1) - 1}{\sec^2 x} \stackrel{?}{=} \sin^2 x \qquad \sec^2 x = \tan^2 x + 1$$

$$\frac{\tan^2 x}{\sec^2 x} \stackrel{?}{=} \sin^2 x \qquad \textit{Simplify.}$$

$$\frac{\frac{\sin^2 x}{\cos^2 x}}{\frac{1}{\cos^2 x}} \stackrel{?}{=} \sin^2 x \qquad \tan^2 x = \frac{\sin^2 x}{\cos^2 x},\ \sec^2 x = \frac{1}{\cos^2 x}$$

$$\frac{\sin^2 x}{\cos^2 x} \cdot \cos^2 x \stackrel{?}{=} \sin^2 x$$

$$\sin^2 x = \sin^2 x \qquad \textit{Multiply.}$$

The techniques that you use to verify trigonometric identities can also be used to simplify trigonometric equations.

Example 2 **Find a numerical value of one trigonometric function of x if $\cos x \csc x = 3$.**

You can simplify the trigonometric epression on the left side by writing it in terms of sine and cosine.

$$\cos x \csc x = 3$$

$$\cos x \cdot \frac{1}{\sin x} = 3 \qquad \csc x = \frac{1}{\sin x}$$

$$\frac{\cos x}{\sin x} = 3 \qquad \textit{Multiply.}$$

$$\cot x = 3 \qquad \cot x = \frac{\cos x}{\sin x}$$

Therefore, if $\cos x \csc x = 3$, then $\cot x = 3$.