

*Section 5.1 & 5.2*

## Using Trigonometric Identities

*part 2*

**Objective:**

Given an **equation** students will be able to prove the equation is true by using the trig identities.

**Study problems**

**Trigonometry II Part 2 wks**

## ***Algebraic proofs of trigonometric identities***

- In this lesson, we will look at various strategies for proving identities.
- Try to memorize all the different types, as it will make things much simpler for you when they are mixed together.

## Type II: Identities with Adding and Subtracting

- ***We will now look at identities where adding & subtracting is involved. You will first convert everything to sine & cosine, then use a common denominator to simplify the fractions.***

Multiply the first fraction by the denominator of the second fraction.

Multiply the second fraction by the denominator of the first fraction.

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

Now multiply the fractions together and simplify

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

## Example 2:

$$\frac{1}{\cos x} + 1$$

Multiply the second fraction by the den

We don't need to do anything with the  
will now have the same denominator.

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

$$= \frac{1}{\cos x} + \frac{\cos x}{\cos x}$$

$$= \frac{1 + \cos x}{\cos x}$$



# Example

Use the fundamental trig identities to transform one side of the equation into the other.

$$\cot x + \sec x = \frac{\cos^2 x + \sin x}{\sin x \cos x}$$

A handwritten derivation of the identity  $\cot x + \sec x = \frac{\cos^2 x + \sin x}{\sin x \cos x}$ . The expression  $\cot x + \sec x$  is written in blue ink. The  $\cot x$  term is written as  $\frac{\cos x}{\sin x}$ , and the  $\sec x$  term is written as  $\frac{1}{\cos x}$ . Red parentheses are drawn around the  $\cos x$  in the numerator of the first fraction and the  $\sin x$  in the denominator of the second fraction. Green arrows point from these parentheses to the final simplified expression. The final expression is  $\frac{\cos^2 x + \sin x}{\cos x \sin x}$ , written in green ink.

A handwritten derivation of the identity  $\cot x + \sec x = \frac{\cos^2 x + \sin x}{\sin x \cos x}$ . The expression  $\frac{\cos^2 x}{\sin x \cos x} + \frac{\sin x}{\sin x \cos x}$  is written in pink ink. The  $\cos x$  in the denominator of the first fraction and the  $\sin x$  in the denominator of the second fraction are crossed out with pink lines.

$$\frac{\cos x}{\sin x} + \frac{1}{\cos x}$$

$$\cot x + \sec x$$

# Example

Use the fundamental trig identities to verify the equation.

$$\tan \theta + \cot \theta = \csc \theta \sec \theta$$

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

$$\left( \frac{\sin \theta}{\sin \theta} \right) \frac{\sin \theta}{\cos \theta} + \frac{\cos \theta}{\sin \theta} \left( \frac{\cos \theta}{\cos \theta} \right)$$
$$\frac{\overset{1}{\sin^2 \theta} + \overset{2}{\cos^2 \theta}}{\sin \theta \cos \theta}$$
$$\frac{1}{\sin \theta \cos \theta}$$
$$\frac{1}{\sin \theta} \cdot \frac{1}{\cos \theta}$$

$$\csc \theta \sec \theta = \csc \theta \sec \theta \quad \checkmark$$

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

$$\cot x + \sin x$$

$$= \frac{\cos x}{\sin x} + \sin x$$

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

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

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

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

