**Strategies for Simplifying Expressions**

1) Change the expression into sines and cosines.
2) Look to use known formulas for purposes of substitution.
3) If there are fractions, gain a common denominator.
4) Use algebraic manipulations, like factoring, distributing, ...
5) If a strategy or substitution proves not to help, try something different.

## Trigonometric Tools:

### Basic Identities:

$$\text{Tan}\theta = \frac{\text{Sin}\theta}{\text{Cos}\theta}$$

$$\text{Cot}\theta = \frac{1}{\text{Tan}\theta} = \frac{\text{Cos}\theta}{\text{Sin}\theta}$$

$$\text{Csc} = \frac{1}{\text{Sin}\theta}$$

$$\text{Sec} = \frac{1}{\text{Cos}\theta}$$

### Pythagorean Identities:

$$\text{Sin}^2\theta + \text{Cos}^2\theta = 1$$

$$\text{Sin}^2\theta = 1 - \text{Cos}^2\theta$$

$$\text{Cos}^2\theta = 1 - \text{Sin}^2\theta$$

$$\text{Tan}^2\theta + 1 = \text{Sec}^2\theta$$

$$1 + \text{Cot}^2\theta = \text{Csc}^2\theta$$

Simplify this expression:

$$\frac{\text{Sin}^2 x}{1 + \text{Cos}x} + \text{Cos}x$$

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

$$= 1 - \cos + \cos$$

$$= 1$$

## Verifying trig identities:

Showing that the two sides of the equation really are equal.

Two basic techniques:

- Work on one side only and make it look like the other side.

or

- Work on both sides until they look the same.

When trying to verify/prove an identity you CAN'T do the following:

- Move terms from one side of the equation to the other side
- Multiply/divide/square/square root both sides of the equation
- Add/Subtract from both sides of the equation

You are NOT solving

You are trying to show the two sides of the equation are equal which means you don't know they are equal....YET.

Verify this identity:

$$\tan\theta \cdot \sec\theta \cdot \cot\theta = \frac{\tan\theta}{\sin\theta}$$

$\frac{1}{\cos} \cdot \frac{\cos}{\sin}$

$\tan \cdot \frac{1}{\sin}$

$\frac{\tan}{\sin} = \frac{\tan\theta}{\sin\theta}$

Verify this identity:

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

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

$\sin \cdot \frac{\cos}{\sin} + \cos \cdot \frac{\sin}{\cos}$

$\cos + \sin = \sin + \cos$

Verify this identity:

$$\cos\theta \cdot \cot\theta = \csc\theta - \sin\theta$$

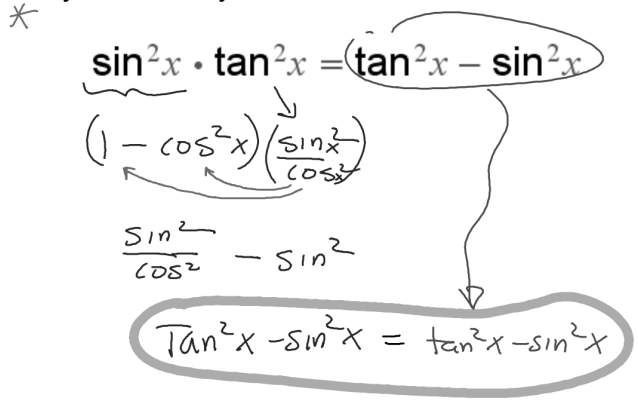
$\cos \cdot \frac{\cos}{\sin} = \frac{1}{\sin} - \frac{\sin}{1} \cdot \frac{\sin}{\sin}$

$\frac{\cos^2}{\sin}$ $\qquad$ $\frac{1}{\sin} - \frac{\sin^2}{\sin}$

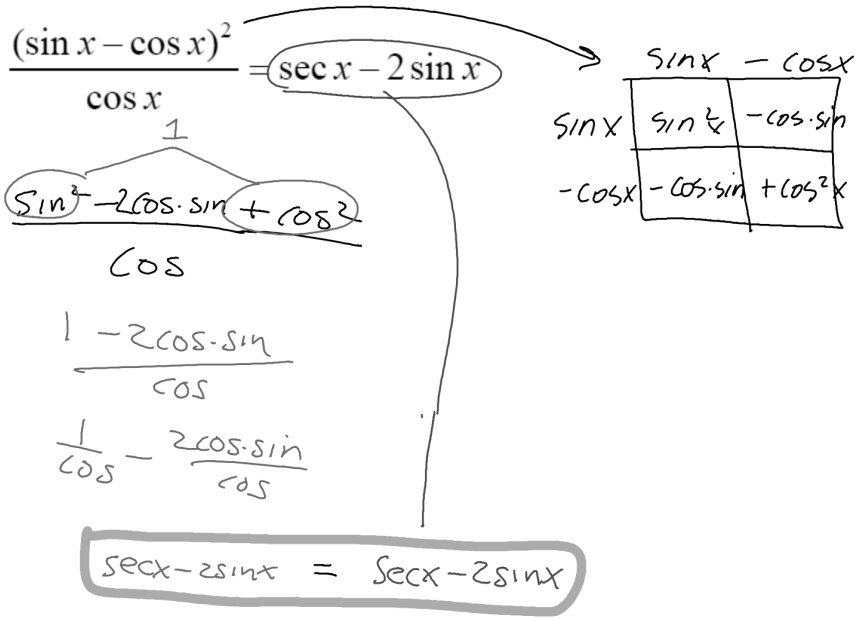
$\frac{1-\sin^2}{\sin}$

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

Verify this identity:




Verify this trig identity.




You should now be able to complete

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