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:

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

$$\cot\theta = \frac{1}{\tan\theta} = \frac{\cos\theta}{\sin\theta}$$

$$\csc = \frac{1}{\sin\theta}$$

$$\sec = \frac{1}{\cos\theta}$$

Pythagorean Identities:

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

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

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

$$\tan^2\theta + 1 = \sec^2\theta$$

$$1 + \cot^2\theta = \csc^2\theta$$

There is usually more than one way to simplify a trigonometric expression. On the following pages is just one example of how to simplify each expression. No matter which method you use it will lead to the same answer.

Simplify each trig expression:

$$\frac{\tan^2 x + 1}{1 + \cot^2 x} = \frac{\sec^2}{\csc^2} = \frac{\frac{1}{\cos^2}}{\frac{1}{\sin^2}} = \frac{1}{\cos^2} \cdot \frac{\sin^2}{1}$$

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

$$= \tan^2 x$$

Simplify each trig expression:

$$(\text{Tan}x + \text{Cot}x)(\text{Sin}x \cdot \text{Cos}x)$$

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

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

$$= 1$$

$$\frac{\text{Cot}\theta}{\text{Csc}\theta - \text{Sin}\theta} = \frac{\frac{\cos}{\sin}}{\left(\frac{1}{\sin} - \sin\right)} \cdot \frac{\sin}{\sin}$$

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

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

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

$$\frac{\text{Sin}^2\theta}{\text{Cos}\theta} + \text{Cos}\theta$$

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

$$= \frac{\sin^2}{\cos} + \frac{\cos^2}{\cos} = \frac{\sin^2 + \cos^2}{\cos} = \frac{1}{\cos} = \sec\theta$$

$$\frac{\text{Sin}^2 x}{\text{Cos}x\ \text{Tan}x}$$

$$= \frac{\sin^2}{\cos \cdot \frac{\sin}{\cos}}$$

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

You can now finish Hwk #24: Sec 14-1

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Problems: 18, 20, 21, 23, 28, 30, 32-34

No work = No credit

$\text{Sec}x\text{Cot}x - \text{Cot}x\text{Cos}x$

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

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

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