Simplify each trigonometric expression on the following pages.

There is usually more than one way to simplify these expressions but they all lead to the same answer.

For some of the problems I've shown two methods to reach the answer.

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:

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

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

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

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

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

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

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

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

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

$$= \sin^2 x$$

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

$$= \frac{\sec}{\sec} - \frac{\cos}{\sec}$$

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

$$= 1 - \cos^2$$

$$= \sin^2 x$$

$\text{Cosx}(1 + \text{Tan}^2 x)$

$= \cos\left(\sec^2\right)$

$= \cos\left(\frac{1}{\cos^2}\right)$

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

$$\frac{\text{Secx}}{\text{Cosx}} - \frac{\text{Tanx}}{\text{Cotx}}$$

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

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

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

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

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

$$\frac{\text{Sec}\theta}{\text{Cot}\theta + \text{Tan}\theta}$$

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

$\frac{\frac{1}{\cos}}{\frac{\cos^2+\sin^2}{\sin\cdot\cos}}$

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

$$\frac{\text{Sec}\theta}{\text{Cot}\theta + \text{Tan}\theta}$$

$\frac{\frac{1}{\cos}}{\frac{\cos}{\sin} + \frac{\sin}{\cos}}$ (multiply by $\frac{\sin\cdot\cos}{\sin\cdot\cos}$)

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

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

$$\frac{\sin^4(x) - \cos^4(x)}{\sin^2(x) - \cos^2(x)} = \frac{(\sin^2 - \cos^2)(\sin^2 + \cos^2)}{\sin^2 - \cos^2}$$

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

$= 1$

You can now finish Hwk #25:

Practice Sheet: Sec 14-1

Simplifying Trigonometric Expressions