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Algebra II

### Pythagorean Identities

1. Simplify:  $\sec^2 \theta (1 - \cos^2 \theta)$

$$\sec^2 \theta (\sin^2 \theta)$$

$$\frac{1}{\cos^2 \theta} \cdot \frac{\sin^2 \theta}{1} = \frac{\sin^2 \theta}{\cos^2 \theta} = \tan^2 \theta$$

2. Simplify:  $\sec \theta (1 - \sin^2 \theta)$

$$\sec \theta (\cos^2 \theta)$$

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

3. Simplify:  $\tan^2 \theta + \sin^2 \theta + \cos^2 \theta$

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

$$\sec^2 \theta$$

4. Show that  $\frac{\sec^2 x - 1}{\sec^2 x}$  is equivalent to  $\sin^2 x$ .

$$\frac{\tan^2 x}{\sec^2 x}$$

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

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

$$\sin^2 x$$

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

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

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

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

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

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

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

$$\sec \theta = \frac{1}{\cos \theta} \quad \csc \theta = \frac{1}{\sin \theta}$$

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

5. The expression  $\frac{\sin^2 \theta + \cos^2 \theta}{1 - \sin^2 \theta}$  is equivalent to

- 1)  $\cos^2 \theta$
- 2)  $\sin^2 \theta$
- 3)  $\sec^2 \theta$
- 4)  $\csc^2 \theta$

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

6. The expression  $\frac{\sin A}{\sin A} \sin A + \frac{\cos^2 A}{\sin A}$  is equivalent to

- (1) 1
- (2)  $\sin A$
- (3)  $\sec A$
- (4)  $\csc A$

LCD:  $\sin A$

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

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

7. The expression  $(\cos^2 \theta - 1)$  is equivalent to

- (1)  $\sin^2 \theta$
- (2)  $\cos^2 \theta$
- (3)  $-\sin^2 \theta$
- (4)  $-\cos^2 \theta$

$$\begin{aligned} \sin^2 \theta + \cos^2 \theta &= 1 \\ -\sin^2 \theta & \quad -\sin^2 \theta \\ \cos^2 \theta &= 1 - \sin^2 \theta \\ -1 & \quad -1 \end{aligned}$$

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

8. Which trigonometric expression does *not* simplify to 1?

- 1)  $\sin^2 x (1 + \cot^2 x)$
- 2)  $\sec^2 x (1 - \sin^2 x)$
- 3)  $\cos^2 x (\tan^2 x - 1)$  *not an identity.  $\tan^2 x + 1$  is*
- 4)  $\cot^2 x (\sec^2 x - 1)$

1)  $\sin^2 x (\csc^2 x)$

$$\cancel{\sin^2 x} \cdot \frac{1}{\cancel{\sin^2 x}} = 1$$

2)  $\sec^2 x (\cos^2 x)$

$$\frac{1}{\cancel{\cos^2 x}} \cdot \cancel{\cos^2 x} = 1$$

3) -

4)  $\cot^2 x (\tan^2 x)$

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