Reciprocal IDs

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

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

$$\tan\theta = \frac{1}{\cot\theta} \qquad \cot\theta = \frac{1}{\tan\theta}$$

Quotient IDs

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

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

co-function

$$\sin\left(\frac{\pi}{2}-\theta\right)=\cos\theta$$

$$\cos\left(\frac{\pi}{2}-\theta\right)=\sin\theta$$

$$\tan\left(\frac{\pi}{2}-\theta\right)=\cot\theta$$

$$\csc\left(\frac{\pi}{2}-\theta\right)=\sec\theta$$

$$\sec\left(\frac{\pi}{2}-\theta\right)=\csc\theta$$

$$\cot\left(\frac{\pi}{2}-\theta\right)=\tan\theta$$

Odd/even identities

$\sin(-\theta) = -\sin\theta$

$\csc(-\theta) = -\csc\theta$

$\cot(-\theta) = -\cot\theta$

$\tan(-\theta) = -\tan\theta$

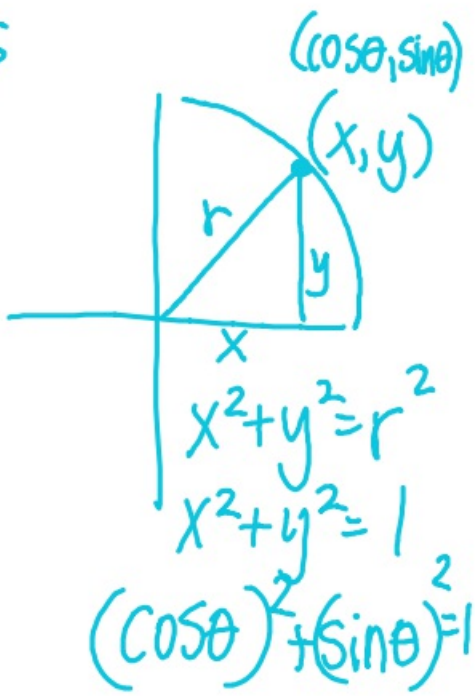
} odd

$\cos(-\theta) = \cos\theta$

$\sec(-\theta) = \sec\theta$

} even

Pythagorean Identities



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

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

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

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

$$\boxed{1 + \tan^2\theta = \sec^2\theta}$$

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

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

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

$$\boxed{\cot^2\theta + 1 = \csc^2\theta}$$

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

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

Ex Prove the identity.

A. $\tan x(\cot x + \tan x) = \sec^2 x$

$\tan x \cot x + \tan^2 x = \sec^2 x$

$\tan x \cdot \frac{1}{\tan x} + \tan^2 x = \sec^2 x$

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

$\sec^2 x = \sec^2 x$ ✓

$$\frac{\cos x \sec x}{\cos x \sin x} - \frac{\sin x \sin x}{\cos x \sin x} = \cot x$$

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

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

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

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

$$\cot x = \cot x$$ ☺