

# Symmetry and Complementary Properties of Trigonometric Functions

First Quadrant:

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

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

$$\tan\left(\frac{\pi}{2} - \theta\right) = \frac{1}{\tan(\theta)} \Leftrightarrow \cot\left(\frac{\pi}{2} - \theta\right) = \tan(\theta)$$

Second Quadrant

$$\sin(\pi - \theta) = \sin(\theta) \Leftrightarrow \operatorname{cosec}(\pi - \theta) = \operatorname{cosec}(\theta)$$

$$\cos(\pi - \theta) = -\cos(\theta) \Leftrightarrow \sec(\pi - \theta) = -\sec(\theta)$$

$$\tan(\pi - \theta) = -\tan(\theta) \Leftrightarrow \cot(\pi - \theta) = -\cot(\theta)$$

$$\sin\left(\frac{\pi}{2} + \theta\right) = \cos(\theta) \Leftrightarrow \operatorname{cosec}\left(\frac{\pi}{2} + \theta\right) = \sec(\theta)$$

$$\cos\left(\frac{\pi}{2} + \theta\right) = -\sin(\theta) \Leftrightarrow \sec\left(\frac{\pi}{2} + \theta\right) = -\operatorname{cosec}(\theta)$$

$$\tan\left(\frac{\pi}{2} + \theta\right) = -\frac{1}{\tan(\theta)} = -\cot(\theta) \Leftrightarrow \cot\left(\frac{\pi}{2} + \theta\right) = -\tan(\theta)$$

Third Quadrant

$$\sin(\pi + \theta) = -\sin(\theta) \Leftrightarrow \operatorname{cosec}(\pi + \theta) = -\operatorname{cosec}(\theta)$$

$$\cos(\pi + \theta) = -\cos(\theta) \Leftrightarrow \sec(\pi + \theta) = -\sec(\theta)$$

$$\tan(\pi + \theta) = \tan(\theta) \Leftrightarrow \cot(\pi + \theta) = \cot(\theta)$$

$$\sin\left(\frac{3\pi}{2} - \theta\right) = -\cos(\theta) \Leftrightarrow \operatorname{cosec}\left(\frac{3\pi}{2} - \theta\right) = -\sec(\theta)$$

$$\cos\left(\frac{3\pi}{2} - \theta\right) = -\sin(\theta) \Leftrightarrow \sec\left(\frac{3\pi}{2} - \theta\right) = -\operatorname{cosec}(\theta)$$

$$\tan\left(\frac{3\pi}{2} - \theta\right) = \frac{1}{\tan(\theta)} = \cot(\theta) \Leftrightarrow \cot\left(\frac{3\pi}{2} - \theta\right) = \tan(\theta)$$

Fourth Quadrant

$$\sin(2\pi - \theta) = \sin(-\theta) = -\sin(\theta) \Leftrightarrow \operatorname{cosec}(2\pi - \theta) = \operatorname{cosec}(-\theta) = -\operatorname{cosec}(\theta)$$

$$\cos(2\pi - \theta) = \cos(-\theta) = \cos(\theta) \Leftrightarrow \sec(2\pi - \theta) = \sec(-\theta) = \sec(\theta)$$

$$\tan(2\pi - \theta) = \tan(-\theta) = -\tan(\theta) \Leftrightarrow \cot(2\pi - \theta) = \cot(-\theta) = -\cot(\theta)$$

$$\sin\left(\frac{3\pi}{2} + \theta\right) = -\cos(\theta) \Leftrightarrow \operatorname{cosec}\left(\frac{3\pi}{2} + \theta\right) = -\sec(\theta)$$

$$\cos\left(\frac{3\pi}{2} + \theta\right) = \sin(\theta) \Leftrightarrow \sec\left(\frac{3\pi}{2} + \theta\right) = \operatorname{cosec}(\theta)$$

$$\tan\left(\frac{3\pi}{2} + \theta\right) = -\frac{1}{\tan(\theta)} = -\cot(\theta) \Leftrightarrow \cot\left(\frac{3\pi}{2} + \theta\right) = -\tan(\theta)$$