Cofunction Identities

$\cos(\pi/2 - x) = \sin x$ $\qquad$ $\sin(\pi/2 - x) = \cos x$

$\cot(\pi/2 - x) = \tan x$ $\qquad$ $\tan(\pi/2 - x) = \cot x$

$\csc(\pi/2 - x) = \sec x$ $\qquad$ $\sec(\pi/2 - x) = \csc x$

Even / Odd Identities

Even: $f(-x) = f(x)$ $\qquad$ Odd: $f(-x) = -f(x)$

$\cos(-\theta) = \cos(\theta)$ $\qquad$ $\sin(-\theta) = -\sin(\theta)$ $\qquad$ $\tan(-\theta) = -\tan(\theta)$

$\sec(-\theta) = \sec(\theta)$ $\qquad$ $\csc(-\theta) = -\csc(\theta)$ $\qquad$ $\cot(-\theta) = -\cot(\theta)$

Sum and Difference Identities for Cosine

$$\cos(\alpha + \beta) = \cos(\alpha)\cos(\beta) - \sin(\alpha)\sin(\beta)$$

$$\cos(\alpha - \beta) = \cos(\alpha)\cos(\beta) + \sin(\alpha)\sin(\beta)$$

Cofunction Identities: For all applicable angles θ

$\cos\left(\frac{\pi}{2} - \theta\right) = \sin(\theta)$ $\qquad$ $\sec\left(\frac{\pi}{2} - \theta\right) = \csc(\theta)$ $\qquad$ $\tan\left(\frac{\pi}{2} - \theta\right) = \cot(\theta)$

$\sin\left(\frac{\pi}{2} - \theta\right) = \cos(\theta)$ $\qquad$ $\csc\left(\frac{\pi}{2} - \theta\right) = \sec(\theta)$ $\qquad$ $\cot\left(\frac{\pi}{2} - \theta\right) = \tan(\theta)$

Sum and Difference Identities for Sine

$$\sin(\alpha + \beta) = \sin(\alpha)\cos(\beta) + \cos(\alpha)\sin(\beta)$$

$$\sin(\alpha - \beta) = \sin(\alpha)\cos(\beta) - \cos(\alpha)\sin(\beta)$$

Sum and Difference Identities for Tan

$\tan(a+B) = \dfrac{\tan(a) - \tan(B)}{1 + \tan(a)\tan(B)}$ $\qquad$ $\tan(a-B) = \dfrac{\tan(a) + \tan(B)}{1 - \tan(a)\tan(B)}$

Reciprocal / Quotient

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

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

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

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

Pythagorean

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

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

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

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

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

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

Pythagorean Conjugates

$1 - \cos(\theta)$ and $1 + \cos(\theta)$: $(1 - \cos(\theta))(1 + \cos(\theta)) = 1 - \cos^2(\theta) = \sin^2(\theta)$

$1 - \sin(\theta)$ and $1 + \sin(\theta)$: $(1 - \sin(\theta))(1 + \sin(\theta)) = 1 - \sin^2(\theta) = \cos^2(\theta)$

$\sec(\theta) - 1$ and $\sec(\theta) + 1$: $(\sec(\theta) - 1)(\sec(\theta) + 1) = \sec^2(\theta) - 1 = \tan^2(\theta)$

$\sec(\theta) - \tan(\theta)$ and $\sec(\theta) + \tan(\theta)$:
$(\sec(\theta) - \tan(\theta))(\sec(\theta) + \tan(\theta)) = \sec^2(\theta) - \tan^2(\theta) = 1$

$\csc(\theta) - 1$ and $\csc(\theta) + 1$: $(\csc(\theta) - 1)(\csc(\theta) + 1) = \csc^2(\theta) - 1 = \cot^2(\theta)$

$\csc(\theta) - \cot(\theta)$ and $\csc(\theta) + \cot(\theta)$:
$(\csc(\theta) - \cot(\theta))(\csc(\theta) + \cot(\theta) = \csc^2(\theta) - \cot^2(\theta) = 1$

Even-Odd Identities

Cosine is Even : $\cos(-x) = \cos x$

Sine is Odd : $\sin(-x) = -\sin x$

tangent is odd : $\tan(-x) = -\tan x$

Double Angle Identities

$$\cos(2\theta) = \cos^2(\theta) - \sin^2(\theta)$$

$$2\cos^2(\theta) - 1$$

$$1 - 2\sin^2(\theta)$$

$$\sin(2\theta) = 2\sin(\theta)\cos(\theta)$$

$$\tan(2\theta) = \frac{2\tan(\theta)}{1-\tan^2(\theta)}$$

Power Reduction Formulas

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

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

Half Angle Formulas

$$\cos\left(\frac{\theta}{2}\right) = \pm\sqrt{\frac{1+\cos(\theta)}{2}}$$

$$\sin\left(\frac{\theta}{2}\right) = \pm\sqrt{\frac{1-\cos(\theta)}{2}}$$

$$\tan\left(\frac{\theta}{2}\right) = \pm\sqrt{\frac{1-\cos(\theta)}{1+\cos(\theta)}}$$

Sum to Product Formulas

$$\cos(a) + \cos(B) = 2\cos\left(\frac{a+B}{2}\right)\cos\left(\frac{a-B}{2}\right)$$

$$\cos(a) - \cos(B) = -2\sin\left(\frac{a+B}{2}\right)\sin\left(\frac{a-B}{2}\right)$$

$$\sin(a) \pm \sin(B) = 2\sin\left(\frac{a \pm B}{2}\right)\cos\left(\frac{a \mp B}{2}\right)$$

Product to Sum Formulas

$$\cos(a)\cos(B) = \frac{1}{2}\left[\cos(a-b) + \cos(a+b)\right]$$

$$\sin(a)\sin(B) = \frac{1}{2}\left[\cos(a-b) - \cos(a+b)\right]$$

$$\sin(a)\cos(B) = \frac{1}{2}\left[\sin(a-B) + \sin(a+B)\right]$$