

Pythagorean Identities

$$\begin{aligned}\sin^2(\theta) + \cos^2(\theta) &= 1 \\ \tan^2(\theta) + 1 &= \sec^2(\theta) \\ 1 + \cot^2(\theta) &= \csc^2(\theta)\end{aligned}$$

Power Reducing Formulas

$$\begin{aligned}\sin^2(\theta) &= \frac{1 - \cos(2\theta)}{2} \\ \cos^2(\theta) &= \frac{1 + \cos(2\theta)}{2} \\ \tan^2(\theta) &= \frac{1 - \cos(2\theta)}{1 + \cos(2\theta)}\end{aligned}$$

Double-Angle Formulas

$$\begin{aligned}\sin(2\theta) &= 2 \sin(\theta) \cos(\theta) \\ \cos(2\theta) &= \cos^2(\theta) - \sin^2(\theta) \\ \cos(2\theta) &= 2 \cos^2(\theta) - 1 \\ \cos(2\theta) &= 1 - 2 \sin^2(\theta) \\ \tan(2\theta) &= \frac{2 \tan(\theta)}{1 - \tan^2(\theta)}\end{aligned}$$

Half-Angle Formulas

$$\begin{aligned}\sin\left(\frac{\theta}{2}\right) &= \pm \sqrt{\frac{1 - \cos(\theta)}{2}} \\ \cos\left(\frac{\theta}{2}\right) &= \pm \sqrt{\frac{1 + \cos(\theta)}{2}} \\ \tan\left(\frac{\theta}{2}\right) &= \frac{1 - \cos(\theta)}{\sin(\theta)} \\ \tan\left(\frac{\theta}{2}\right) &= \frac{\sin(\theta)}{1 + \cos(\theta)}\end{aligned}$$

Sum and Difference Formulas

$$\begin{aligned}\sin(A + B) &= \sin(A) \cos(B) + \cos(A) \sin(B) \\ \sin(A - B) &= \sin(A) \cos(B) - \cos(A) \sin(B) \\ \cos(A + B) &= \cos(A) \cos(B) - \sin(A) \sin(B) \\ \cos(A - B) &= \cos(A) \cos(B) + \sin(A) \sin(B)\end{aligned}$$

$$\tan(A + B) = \frac{\tan(A) + \tan(B)}{1 - \tan(A) \tan(B)}$$

$$\tan(A - B) = \frac{\tan(A) - \tan(B)}{1 + \tan(A) \tan(B)}$$

Product-to-Sum Formulas

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

$$\cos(A) \cos(B) = \frac{1}{2} [\cos(A - B) + \cos(A + B)]$$

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

Sum-to-Product Formulas

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

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

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

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