Trigonometric Identities

Pythagorean Identities

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

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

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

Co-function Identities

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

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

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

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

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

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

Even Odd Identities

$$\sin(-u) = -\sin(u)$$

$$\cos(-u) = \cos(u)$$

$$\tan(-u) = -\tan(u)$$

$$\csc(-u) = -\csc(u)$$

$$\sec(-u) = \sec(u)$$

$$\cot(-u) = -\cot(u)$$

Sum Difference Identities

$$\sin(u\pm v) = \sin(u)\cos(v) \pm \cos(u)\sin(v)$$

$$\cos(u\pm v) = \cos(u)\cos(v) \mp \sin(u)\sin(v)$$

$$\tan(u\pm v) = \frac{\tan(u)\pm\tan(v)}{1\mp\tan(u)\tan(v)}$$

Double Angle Identities

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

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

$$\cos(2u) = 2\cos^2(u)-1$$

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

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

Half Angle Identities

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

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

$$\tan^2(u) = \frac{1-\cos(2u)}{1+\cos(2u)}$$

Sum to Product Identities

$$\sin(u) + \sin(v) = 2\sin\left(\frac{u+v}{2}\right)\cos\left(\frac{u-v}{2}\right)$$

$$\sin(u) - \sin(v) = 2\cos\left(\frac{u+v}{2}\right)\sin\left(\frac{u-v}{2}\right)$$

$$\cos(u) + \cos(v) = 2\cos\left(\frac{u+v}{2}\right)\cos\left(\frac{u-v}{2}\right)$$

$$\cos(u) - \cos(v) = -2\sin\left(\frac{u+v}{2}\right)\sin\left(\frac{u-v}{2}\right)$$

Product to Sum Identities

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

$$\cos(u)\cos(v) = \frac{1}{2}[\cos(u-v)+\cos(u+v)]$$

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

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