Pythagorean Identities

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

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

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

Even and Odd Functions

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

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

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

Reciprocal Identities

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

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

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

Quotient Identities

$\tan\theta = \dfrac{\sin\theta}{\cos\theta}$ $\qquad$ $\cot\theta = \dfrac{\cos\theta}{\sin\theta}$

Periodic Formulas

If n is an integer

$\sin(\theta + 2\pi n) = \sin\theta$ $\qquad$ $\csc(\theta + 2\pi n) = \csc\theta$

$\cos(\theta + 2\pi n) = \cos\theta$ $\qquad$ $\sec(\theta + 2\pi n) = \sec\theta$

$\tan(\theta + \pi n) = \tan\theta$ $\qquad$ $\cot(\theta + \pi n) = \cot\theta$

Cofunction Identities

$\sin\theta = \cos(90° - \theta)$ $\qquad$ $\cos\theta = \sin(90° - \theta)$

$\tan\theta = \cot(90° - \theta)$ $\qquad$ $\cot\theta = \tan(90° - \theta)$

$\sec\theta = \csc(90° - \theta)$ $\qquad$ $\csc\theta = \sec(90° - \theta)$

Inverse Properties

$\sin\left(\sin^{-1}x\right) = x \quad$ *for every x in the interval* $[-1,1]$

$\sin^{-1}(\sin\theta) = \theta \quad$ *for every θ in the interval* $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

$\cos\left(\cos^{-1}x\right) = x \quad$ *for every x in the interval* $[-1,1]$

$\cos^{-1}(\cos\theta) = \theta \quad$ *for every θ in the interval* $[0,\pi]$

$\tan\left(\tan^{-1}x\right) = x \quad$ *for every real number x*

$\tan^{-1}(\tan\theta) = \theta \quad$ *for every θ in the interval* $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

Sum and Difference Formulas

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

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

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

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

$\tan(\alpha + \beta) = \dfrac{\tan\alpha + \tan\beta}{1 - \tan\alpha\tan\beta}$

$\tan(\alpha - \beta) = \dfrac{\tan\alpha - \tan\beta}{1 + \tan\alpha\tan\beta}$

Double-Angle Formulas

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

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

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

Power-Reducing Formulas

$\sin^2\theta = \dfrac{1 - \cos 2\theta}{2}$

$\cos^2\theta = \dfrac{1 + \cos 2\theta}{2}$

$\tan^2\theta = \dfrac{1 - \cos 2\theta}{1 + \cos 2\theta}$

Half-Angle Formulas

Sign determined by quadrant that half-angle lies

$\sin\dfrac{\alpha}{2} = \pm\sqrt{\dfrac{1 - \cos\alpha}{2}}$

$\cos\dfrac{\alpha}{2} = \pm\sqrt{\dfrac{1 + \cos\alpha}{2}}$

$$\tan\frac{\alpha}{2} = \pm\sqrt{\frac{1 - \cos\alpha}{1 + \cos\alpha}} = \frac{1 - \cos\alpha}{\sin\alpha} = \frac{\sin\alpha}{1 + \cos\alpha}$$

Product-to-Sum Formulas

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

$\cos\alpha\cos\beta = \frac{1}{2}\left[\cos(\alpha - \beta) + \cos(\alpha + \beta)\right]$

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

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

Sum-to-Product Formulas

$\sin\alpha + \sin\beta = 2\sin\dfrac{\alpha + \beta}{2}\cos\dfrac{\alpha - \beta}{2}$

$\sin\alpha - \sin\beta = 2\sin\dfrac{\alpha - \beta}{2}\cos\dfrac{\alpha + \beta}{2}$

$\cos\alpha + \cos\beta = 2\cos\dfrac{\alpha + \beta}{2}\cos\dfrac{\alpha - \beta}{2}$

$\cos\alpha - \cos\beta = -2\sin\dfrac{\alpha + \beta}{2}\cos\dfrac{\alpha - \beta}{2}$

Law of Sines

$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Area of an Oblique Triange

$Area = \frac{1}{2}bc\sin A = \frac{1}{2}ab\sin C = \frac{1}{2}ac\sin B$

Law of Cosines

$a^2 = b^2 + c^2 - 2bc\cos A$

$b^2 = a^2 + c^2 - 2ac\cos B$

$c^2 = a^2 + b^2 - 2ab\cos C$

Heron's Formula

$Area = \sqrt{s(s-a)(s-b)(s-c)}$

where $s = \frac{1}{2}(a + b + c)$

Mollweide's Formula

$\dfrac{a + b}{c} = \dfrac{\cos\frac{1}{2}(A - B)}{\sin\frac{1}{2}C}$

Law of Tangents

$\dfrac{a - b}{a + b} = \dfrac{\tan\frac{1}{2}(A - B)}{\tan\frac{1}{2}(A + B)}$

$\dfrac{b - c}{b + c} = \dfrac{\tan\frac{1}{2}(B - C)}{\tan\frac{1}{2}(B + C)}$

$\dfrac{a - c}{a + c} = \dfrac{\tan\frac{1}{2}(A - C)}{\tan\frac{1}{2}(A + C)}$

Length of a Circular Arc

$s = r\theta$