Formula Sheet for Pre-Calculus

Pythagorean Identities

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

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

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

Co-function identities:

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

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

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

Even/odd Identities:

$\sin(-\theta) = -\sin\theta$ $\quad$ $\cos(-\theta) = \cos\theta$

$\csc(-\theta) = -\csc\theta$ $\quad$ $\tan(-\theta) = -\tan\theta$

$\sec(-\theta) = \sec\theta$ $\quad$ $\cot(-\theta) = -\cot\theta$

Sum and difference formulas:

$\sin(\theta \pm \varphi) = \sin\theta\cos\varphi \pm \cos\theta\sin\varphi$

$\cos(\theta \pm \varphi) = \cos\theta\cos\varphi \mp \sin\theta\sin\varphi$

$\tan(\theta \pm \varphi) = \frac{\tan\theta \pm \tan\varphi}{1 \mp \tan\theta\tan\varphi}$

Half-angle formulas:

$\sin\frac{\theta}{2} = \pm\sqrt{\frac{1-\cos\theta}{2}}$

$\cos\frac{\theta}{2} = \pm\sqrt{\frac{1+\cos\theta}{2}}$

$\tan\frac{\theta}{2} = \frac{1-\cos\theta}{\sin\theta} = \frac{\sin\theta}{1+\cos\theta}$

Double-angle formulas:

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

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

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

Power reducing formulas:

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

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

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

Sum-to-product formulas:

$\sin\theta + \sin\varphi = 2\sin\left(\frac{\theta+\varphi}{2}\right)\cos\left(\frac{\theta-\varphi}{2}\right)$

$\sin\theta - \sin\varphi = 2\cos\left(\frac{\theta+\varphi}{2}\right)\sin\left(\frac{\theta-\varphi}{2}\right)$

$\cos\theta + \cos\varphi = 2\cos\left(\frac{\theta+\varphi}{2}\right)\cos\left(\frac{\theta-\varphi}{2}\right)$

$\cos\theta - \cos\varphi = -2\sin\left(\frac{\theta+\varphi}{2}\right)\sin\left(\frac{\theta-\varphi}{2}\right)$

Product-to-sum formulas:

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

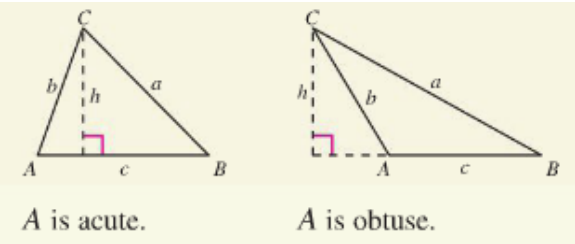
$\cos\theta\cos\varphi = \frac{1}{2}[\cos(\theta - \varphi) + \cos(\theta + \varphi)]$

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

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

Law of Sines:

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



Law of Cosines:

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

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

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