

TRIGONOMETRY LAWS AND IDENTITIES

TANGENT IDENTITIES $\tan \theta = \frac{\sin \theta}{\cos \theta}$ $\cot \theta = \frac{\cos \theta}{\sin \theta}$	RECIPROCAL IDENTITIES $\csc \theta = \frac{1}{\sin \theta}$ $\sec \theta = \frac{1}{\cos \theta}$ $\cot \theta = \frac{1}{\tan \theta}$	PYTHAGOREAN IDENTITIES $\sin^2 \theta + \cos^2 \theta = 1$ $\tan^2 \theta + 1 = \sec^2 \theta$ $\cot^2 \theta + 1 = \csc^2 \theta$	PERIODIC IDENTITIES $\sin(\theta + 2\pi n) = \sin \theta$ $\cos(\theta + 2\pi n) = \cos \theta$ $\tan(\theta + \pi n) = \tan \theta$ $\csc(\theta + 2\pi n) = \csc \theta$ $\sec(\theta + 2\pi n) = \sec \theta$ $\cot(\theta + \pi n) = \cot \theta$
EVEN/ODD IDENTITIES $\sin(-\theta) = -\sin \theta$ $\cos(-\theta) = \cos \theta$ $\tan(-\theta) = -\tan \theta$ $\csc(-\theta) = -\csc \theta$ $\sec(-\theta) = \sec \theta$ $\cot(-\theta) = -\cot \theta$	DOUBLE ANGLE IDENTITIES $\sin(2\theta) = 2 \sin \theta \cos \theta$ $\cos(2\theta) = \cos^2 \theta - \sin^2 \theta$ $= 2 \cos^2 \theta - 1$ $= 1 - 2 \sin^2 \theta$ $\tan(2\theta) = \frac{2 \tan \theta}{1 - \tan^2 \theta}$	HALF ANGLE IDENTITIES $\sin\left(\frac{\theta}{2}\right) = \pm \sqrt{\frac{1 - \cos \theta}{2}}$ $\cos\left(\frac{\theta}{2}\right) = \pm \sqrt{\frac{1 + \cos \theta}{2}}$ $\tan\left(\frac{\theta}{2}\right) = \pm \sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}}$	LAW OF COSINES $a^2 = b^2 + c^2 - 2bc \cos \alpha$ $b^2 = a^2 + c^2 - 2ac \cos \beta$ $c^2 = a^2 + b^2 - 2ab \cos \gamma$
PRODUCT TO SUM IDENTITIES $\sin \alpha \sin \beta = \frac{1}{2} [\cos(\alpha - \beta) - \cos(\alpha + \beta)]$ $\cos \alpha \cos \beta = \frac{1}{2} [\cos(\alpha - \beta) + \cos(\alpha + \beta)]$ $\sin \alpha \cos \beta = \frac{1}{2} [\sin(\alpha + \beta) + \sin(\alpha - \beta)]$ $\cos \alpha \sin \beta = \frac{1}{2} [\sin(\alpha + \beta) - \sin(\alpha - \beta)]$	SUM TO PRODUCT IDENTITIES $\sin \alpha + \sin \beta = 2 \sin\left(\frac{\alpha + \beta}{2}\right) \cos\left(\frac{\alpha - \beta}{2}\right)$ $\sin \alpha - \sin \beta = 2 \cos\left(\frac{\alpha + \beta}{2}\right) \sin\left(\frac{\alpha - \beta}{2}\right)$ $\cos \alpha + \cos \beta = 2 \cos\left(\frac{\alpha + \beta}{2}\right) \cos\left(\frac{\alpha - \beta}{2}\right)$ $\cos \alpha - \cos \beta = -2 \sin\left(\frac{\alpha + \beta}{2}\right) \sin\left(\frac{\alpha - \beta}{2}\right)$	LAW OF SINES $\frac{\sin \alpha}{a} = \frac{\sin \beta}{b} = \frac{\sin \gamma}{c}$	LAW OF TANGENTS $\frac{a-b}{a+b} = \frac{\tan\left[\frac{1}{2}(\alpha-\beta)\right]}{\tan\left[\frac{1}{2}(\alpha+\beta)\right]}$ $\frac{b-c}{b+c} = \frac{\tan\left[\frac{1}{2}(\beta-\gamma)\right]}{\tan\left[\frac{1}{2}(\beta+\gamma)\right]}$ $\frac{a-c}{a+c} = \frac{\tan\left[\frac{1}{2}(\alpha-\gamma)\right]}{\tan\left[\frac{1}{2}(\alpha+\gamma)\right]}$
SUM/DIFFERENCES IDENTITIES $\sin(\alpha \pm \beta) = \sin \alpha \cos \beta \pm \cos \alpha \sin \beta$ $\cos(\alpha \pm \beta) = \cos \alpha \cos \beta \mp \sin \alpha \sin \beta$ $\tan(\alpha \pm \beta) = \frac{\tan \alpha \pm \tan \beta}{1 \mp \tan \alpha \tan \beta}$	MOLLWEIDE'S FORMULA $\frac{a+b}{c} = \frac{\cos\left[\frac{1}{2}(\alpha-\beta)\right]}{\sin\left(\frac{1}{2}\gamma\right)}$	COFUNCTION IDENTITIES $\sin\left(\frac{\pi}{2} - \theta\right) = \cos \theta$ $\csc\left(\frac{\pi}{2} - \theta\right) = \sec \theta$ $\tan\left(\frac{\pi}{2} - \theta\right) = \cot \theta$ $\cos\left(\frac{\pi}{2} - \theta\right) = \sin \theta$ $\sec\left(\frac{\pi}{2} - \theta\right) = \csc \theta$ $\cot\left(\frac{\pi}{2} - \theta\right) = \tan \theta$	

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