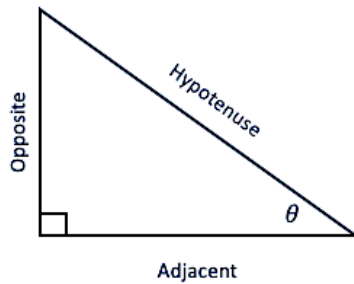




Trigonometry Formula List

Trigonometric Ratios

Right triangle definitions, where $0 < \theta < \frac{\pi}{2}$.



$$\sin \theta = \frac{opp}{hyp}$$

$$\tan \theta = \frac{opp}{adj}$$

$$\sec \theta = \frac{hyp}{adj}$$

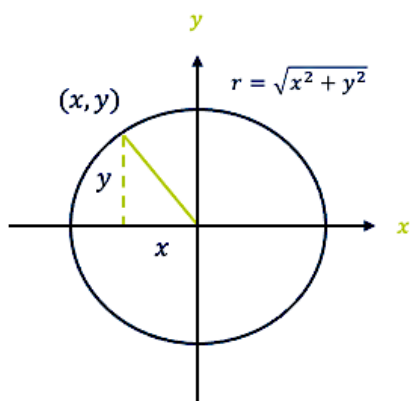
$$\cos \theta = \frac{adj}{hyp}$$

$$\csc \theta = \frac{hyp}{opp}$$

$$\cot \theta = \frac{adj}{opp}$$

Unit Circle Definitions

Circular function definitions, where θ is any angle.



$$\sin \theta = \frac{y}{r}$$

$$\tan \theta = \frac{y}{x}$$

$$\sec \theta = \frac{r}{x}$$

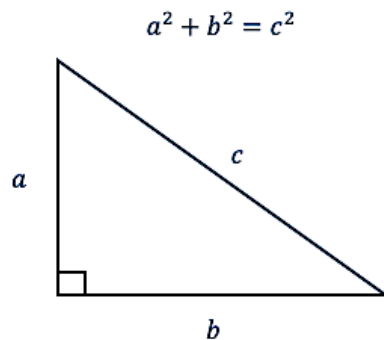
$$\cos \theta = \frac{x}{r}$$

$$\csc \theta = \frac{r}{y}$$

$$\cot \theta = \frac{x}{y}$$



Pythagorean Identities



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

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

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

Tangent & Cotangent Identities

$$\tan x = \frac{\sin x}{\cos x}$$

$$\cot x = \frac{\cos x}{\sin x}$$

Reciprocal Identities

$$\sin x = \frac{1}{\csc x}$$

$$\sec x = \frac{1}{\cos x}$$

$$\tan x = \frac{1}{\cot x}$$

$$\csc x = \frac{1}{\sin x}$$

$$\cos x = \frac{1}{\sec x}$$

$$\cot x = \frac{1}{\tan x}$$

Sum & Difference Formulas (Addition Formulas)

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

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

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

Double-Angle Formulas

$$\sin 2x = 2 \sin x \cos x$$

$$\cos 2x = \cos^2 x - \sin^2 x = 2\cos^2 x - 1 = 1 - 2\sin^2 x$$

$$\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}$$



Reduction Formulas

$$\sin(-x) = -\sin x$$

$$\cos(-x) = \cos x$$

$$\tan(-x) = -\tan x$$

$$\csc(-x) = -\csc x$$

$$\sec(-x) = \sec x$$

$$\cot(-x) = -\cot x$$

Cofunction Formulas

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

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

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

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

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

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

Power-Reducing Formulas

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

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

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

Sum-to-Product Formulas

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

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

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

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

Product-to-Sum Formulas

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

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

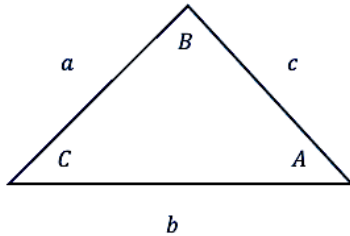
$$\sin u \cos v = \frac{1}{2} [\sin(u+v) + \sin(u-v)]$$

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



Sine & Cosine Rule

For any general (non-right angled) triangle we have



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

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

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

Radians

<i>Degrees</i>	30°	45°	60°	90°	120°	150°	180°
<i>Radians</i>	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{5\pi}{6}$	π

<i>Degrees</i>	180°	210°	240°	270°	300°	330°	360°
<i>Radians</i>	π	$\frac{7\pi}{6}$	$\frac{4\pi}{3}$	$\frac{3\pi}{2}$	$\frac{5\pi}{3}$	$\frac{11\pi}{6}$	2π