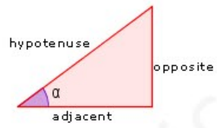
Trigonometry Ratios



$$\sin\alpha = \frac{opp.}{hip.}$$ — $opp.$: opposite, $hip.$: hypotenuse

$$\cos\alpha = \frac{adj.}{hip.}$$ — $adj.$: adjacent, $hip.$: hypotenuse

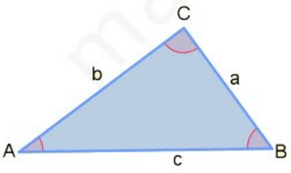
$$\tan\alpha = \frac{opp.}{adj.}$$ — $opp.$: opposite, $adj.$: adjacent

Fundamental Identities

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

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

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



Law of Sines (aka sine rule)

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

Law of Cosines (aka cosine rule)

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

Heron's formula

$$A = \sqrt{s(s-a)(s-b)(s-c)}$$
$$s = \frac{a+b+c}{2}$$

Exact Values

$\sin\left(\frac{\pi}{6}\right) = \frac{1}{2}$	$\cos\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{2}$	$\tan\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{3}$
$\sin\left(\frac{\pi}{4}\right) = \frac{\sqrt{2}}{2}$	$\cos\left(\frac{\pi}{4}\right) = \frac{\sqrt{2}}{2}$	$\tan\left(\frac{\pi}{4}\right) = 1$
$\sin\left(\frac{\pi}{3}\right) = \frac{\sqrt{3}}{2}$	$\cos\left(\frac{\pi}{3}\right) = \frac{1}{2}$	$\tan\left(\frac{\pi}{3}\right) = \sqrt{3}$

Angle Relationships

$\sin(-\alpha) = -\sin\alpha$	$\cos(-\alpha) = \cos\alpha$	$\tan(-\alpha) = -\tan\alpha$
$\sin(\pi-\alpha) = \sin\alpha$	$\cos(\pi-\alpha) = -\cos\alpha$	$\tan(\pi-\alpha) = -\tan\alpha$
$\sin(\pi+\alpha) = -\sin\alpha$	$\cos(\pi+\alpha) = -\cos\alpha$	$\tan(\pi+\alpha) = \tan\alpha$
$\sin\left(\frac{\pi}{2}-\alpha\right) = \cos\alpha$	$\cos\left(\frac{\pi}{2}-\alpha\right) = \sin\alpha$	$\tan\left(\frac{\pi}{2}-\alpha\right) = \frac{1}{\tan\alpha}$
$\sin\left(\frac{\pi}{2}+\alpha\right) = \cos\alpha$	$\cos\left(\frac{\pi}{2}+\alpha\right) = -\sin\alpha$	$\tan\left(\frac{\pi}{2}+\alpha\right) = -\frac{1}{\tan\alpha}$
$\sin\left(\frac{3\pi}{2}-\alpha\right) = -\cos\alpha$	$\cos\left(\frac{3\pi}{2}-\alpha\right) = -\sin\alpha$	$\tan\left(\frac{3\pi}{2}-\alpha\right) = \frac{1}{\tan\alpha}$
$\sin\left(\frac{3\pi}{2}+\alpha\right) = -\cos\alpha$	$\cos\left(\frac{3\pi}{2}+\alpha\right) = \sin\alpha$	$\tan\left(\frac{3\pi}{2}+\alpha\right) = -\frac{1}{\tan\alpha}$

Trigonometric Equations

$$\sin x = \sin\alpha \Leftrightarrow x = \alpha + 2k\pi \vee x = \pi - \alpha + 2k\pi, k \in \mathbb{Z}$$

$$\cos x = \cos\alpha \Leftrightarrow x = \alpha + 2k\pi \vee x = -\alpha + 2k\pi, k \in \mathbb{Z}$$

$$\tan x = \tan\alpha \Leftrightarrow x = \alpha + k\pi, k \in \mathbb{Z}$$

Sum Formulas

$$\sin(a+b) = \sin a \times \cos b + \sin b \times \cos a$$

$$\cos(a+b) = \cos a \times \cos b - \sin a \times \sin b$$

$$\tan(a+b) = \frac{\tan a + \tan b}{1 - \tan a \times \tan b}$$

Difference Formulas

$$\sin(a-b) = \sin a \times \cos b - \sin b \times \cos a$$

$$\cos(a-b) = \cos a \times \cos b + \sin a \times \sin b$$

$$\tan(a-b) = \frac{\tan a - \tan b}{1 + \tan a \times \tan b}$$

Double Angle Formulas

$$\sin(2a) = 2 \times \sin a \times \cos a$$

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

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