Summary of Trigonometric Facts

Formulas Involving Radian Angular Measure

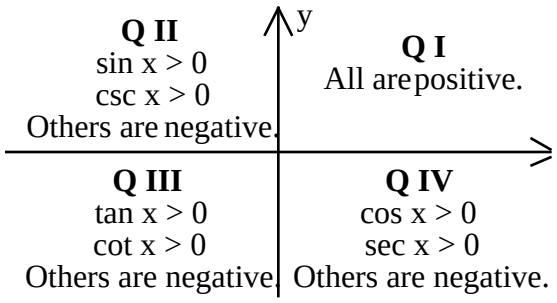
$1 \text{ deg} = \frac{\pi}{180} \text{ rad}$ $\quad 1 \text{ rad} = \frac{180}{\pi} \text{ deg}$ $\quad \theta = \frac{s}{r}$ $\quad \omega = \frac{v}{r}$ $\quad A = \frac{1}{2}\theta r^2$

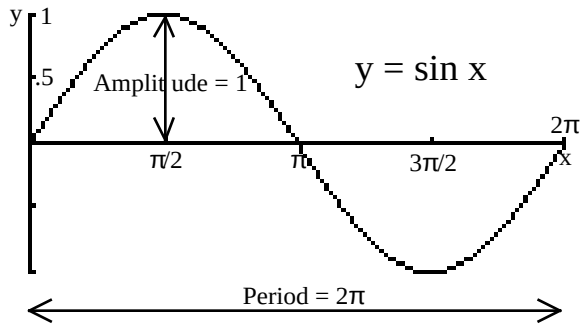
Trigonometric Function Definitions $\left(R = \sqrt{a^2 + b^2}\right)$

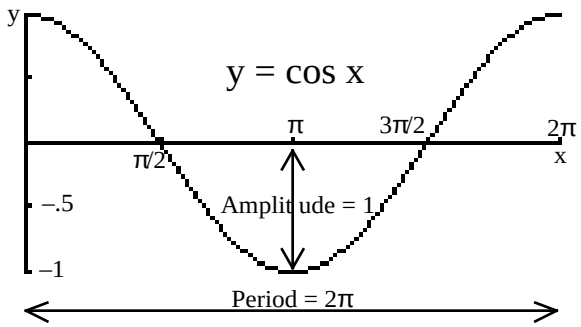
sine x = sin x = $\frac{b}{R} = \frac{\text{opp}}{\text{hyp}}$ $\quad$ cosine x = cos x = $\frac{a}{R} = \frac{\text{adj}}{\text{hyp}}$ $\quad$ tangent x = tan x = $\frac{b}{a} = \frac{\text{opp}}{\text{adj}}$

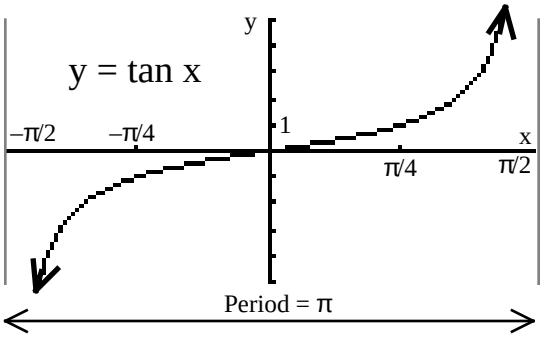
cosecant x = csc x = $\frac{R}{b} = \frac{\text{hyp}}{\text{opp}}$ $\quad$ secant x = sec x = $\frac{R}{a} = \frac{\text{hyp}}{\text{adj}}$ $\quad$ cotangent x = cot x = $\frac{a}{b} = \frac{\text{adj}}{\text{opp}}$

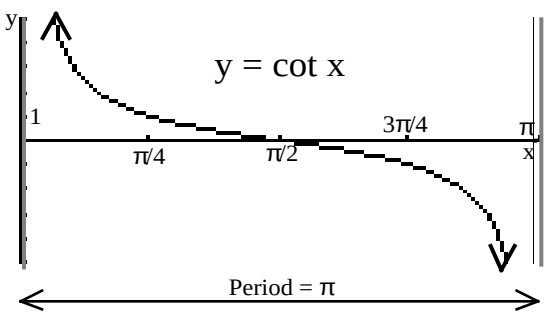
A	0°	30°	45°	60°	90°
	0	π/6	π/4	π/3	π/2
sin A	0	1 / 2	$\sqrt{2}$ / 2	$\sqrt{3}$ / 2	1
cos A	1	$\sqrt{3}$ / 2	$\sqrt{2}$ / 2	1 / 2	0
tan A	0	$\sqrt{3}$ / 3	1	$\sqrt{3}$	undef'd

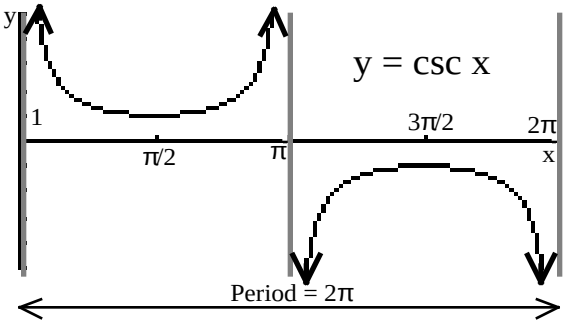


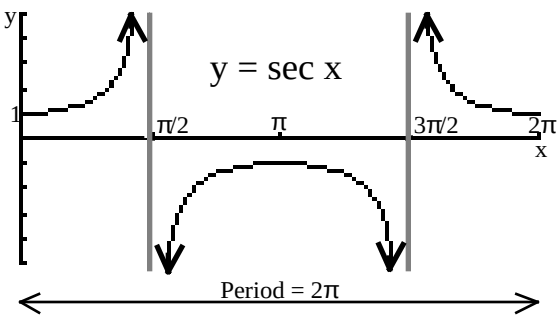












Reciprocal Identities

$$\csc x = \frac{1}{\sin x} \qquad \sec x = \frac{1}{\cos x} \qquad \cot x = \frac{1}{\tan x}$$

Tangent and Cotangent Identities

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

Pythagorean Identities

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

$$1 + \tan^2 x = \sec^2 x \qquad 1 + \cot^2 x = \csc^2 x$$

Cofunction Identities

$$\sin x = \cos(\pi/2 - x) \qquad \cos x = \sin(\pi/2 - x)$$
$$\tan x = \cot(\pi/2 - x) \qquad \csc x = \sec(\pi/2 - x)$$
$$\sec x = \csc(\pi/2 - x) \qquad \cot x = \tan(\pi/2 - x)$$

Even-Odd Identities

$$\sin(-x) = -\sin x \qquad \csc(-x) = -\csc x$$
$$\cos(-x) = \cos x \qquad \sec(-x) = \sec x$$
$$\tan(-x) = -\tan x \qquad \cot(-x) = -\cot x$$

Sum and Difference Formulas

$$\sin(x \pm y) = \sin x \cos y \pm \cos x \sin y$$

$$\cos(x \pm y) = \cos x \cos y \mp \sin x \sin y$$

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \tan y}$$

Double Angle Fomulas

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

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

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

Half Angle Formulas

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

Product to Sum or Difference Formulas

$$\sin x \cos y = \frac{1}{2}\left[\sin(x+y) + \sin(x-y)\right] \qquad \cos x \sin y = \frac{1}{2}\left[\sin(x+y) - \sin(x-y)\right]$$

$$\sin x \sin y = \frac{1}{2}\left[\cos(x-y) - \cos(x+y)\right] \qquad \cos x \cos y = \frac{1}{2}\left[\cos(x+y) + \cos(x-y)\right]$$

Inverse Trigonometric Functions

arcsin x or $\sin^{-1}x$	$\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$	arccsc x or $\csc^{-1}x$	$\left[\frac{-\pi}{2}, 0\right) \cup \left(0, \frac{\pi}{2}\right]$
arccos x or $\cos^{-1}x$	$[0, \pi]$	arcsec x or $\sec^{-1}x$	$\left[0, \frac{\pi}{2}\right) \cup \left(\frac{\pi}{2}, \pi\right]$
arctan x or $\tan^{-1}x$	$\left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$	arccot x or $\cot^{-1}x$	$\left(\frac{-\pi}{2}, 0\right) \cup \left(0, \frac{\pi}{2}\right]$

Law of Sines

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

Law of Cosines

$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$b^2 = a^2 + c^2 - 2ac\cos B$$
$$c^2 = a^2 + b^2 - 2ab\cos C$$

Area of a Triangle

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

Heron's Formula

$$\text{area} = \sqrt{s(s-a)(s-b)(s-c)},$$
$$\text{where } s = \frac{a+b+c}{2}$$

Sum of Sine and Cosine with Same Period

$$a\sin cx + b\cos cx = A\sin(cx + \phi),$$
$$\text{where } A = \sqrt{a^2 + b^2},\ \sin\phi = \frac{b}{\sqrt{a^2 + b^2}},\ \text{and } \cos\phi = \frac{a}{\sqrt{a^2 + b^2}}$$