Trigonometry

LAWS & IDENTITIES CHEAT SHEET

ODD & EVEN IDENTITIES

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

DOUBLE ANGLE IDENTITIES	HALF ANGLE IDENTITIES
$\sin(2\theta) = 2\sin\theta\cos\theta$	$\sin\left(\frac{\theta}{2}\right) = \pm\sqrt{\frac{1-\cos\theta}{2}}$
$\cos(2\theta) = \cos^2\theta - \sin^2\theta$ $\cos(2\theta) = 2\cos^2\theta - 1$ $\cos(2\theta) = 1 - 2\sin^2\theta$	$\cos\left(\frac{\theta}{2}\right) = \pm\sqrt{\frac{1+\cos\theta}{2}}$
$\tan(2\theta) = \frac{2\tan\theta}{1-\tan^2\theta}$	$\tan\left(\frac{\theta}{2}\right) = \pm\sqrt{\frac{1-\cos\theta}{1+\cos\theta}}$

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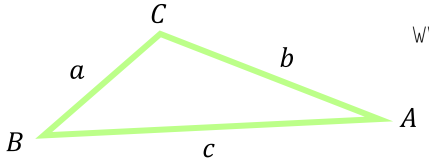


LAW OF COSINES

$a^2 = b^2 + c^2 - 2bc\cos\hat{A}$	$\hat{A} = \cos^{-1}\left(\frac{b^2+c^2-a^2}{2bc}\right)$
$b^2 = a^2 + c^2 - 2ac\cos\hat{B}$	$\hat{B} = \cos^{-1}\left(\frac{a^2+b^2-c^2}{2ab}\right)$
$c^2 = a^2 + b^2 - 2ab\cos\hat{C}$	$\hat{C} = \cos^{-1}\left(\frac{a^2+c^2-b^2}{2ac}\right)$

LAW OF SINES

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

AREA OF A TRIANGLE

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

PYTHAGOREAN IDENTITIES

$$\sin^2\theta + \cos^2\theta = 1$$
$$\tan^2\theta + 1 = \sec^2\theta$$
$$\cot^2\theta + 1 = \csc^2\theta$$

SQUARE IDENTITIES

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

PRODUCT / 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 IDENTITIES

$$\sin(\alpha+\beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$$
$$\cos(\alpha+\beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$$
$$\tan(\alpha+\beta) = \frac{\tan\alpha + \tan\beta}{1-\tan\alpha\tan\beta}$$

DIFFERENCE IDENTITIES

$$\sin(\alpha-\beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$$
$$\cos(\alpha-\beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$$
$$\tan(\alpha-\beta) = \frac{\tan\alpha - \tan\beta}{1+\tan\alpha\tan\beta}$$

CO-FUNCTION IDENTITIES

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

SPECIAL ANGLES

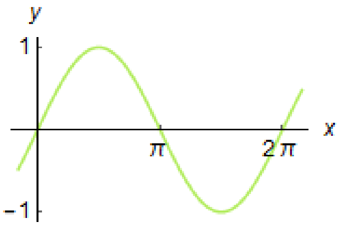
$\boldsymbol{\theta}$		$\boldsymbol{\sin\theta}$	$\boldsymbol{\cos\theta}$	$\boldsymbol{\tan\theta}$
$0°$	0	0	1	0
$30°$	$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$
$45°$	$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1
$60°$	$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
$90°$	$\frac{\pi}{2}$	1	0	$-$

Trigonometry

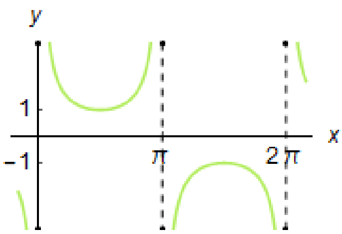
TRIGONOMETRIC FUNCTIONS CHEAT SHEET

GRAPHS OF TRIGONOMETRIC FUNCTIONS

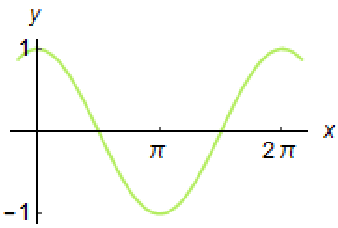
y = sin x



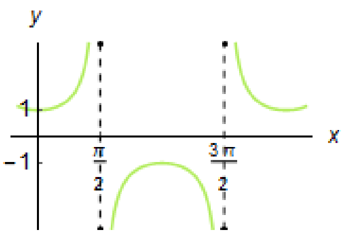
y = csc x



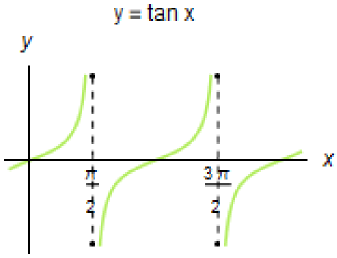
y = cos x



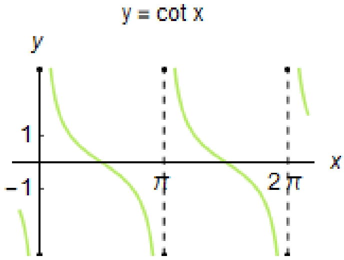
y = sec x



y = tan x

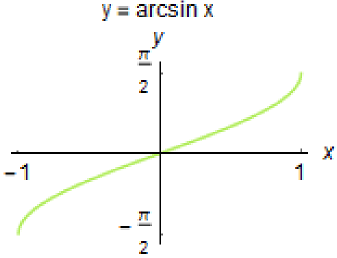


y = cot x

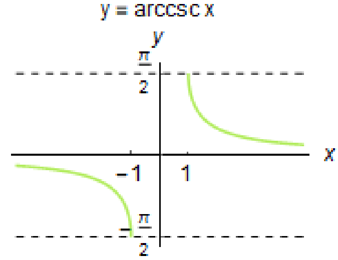


GRAPHS OF INVERSE TRIGONOMETRIC FUNCTIONS

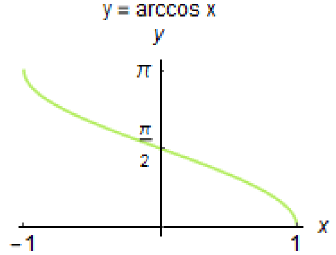
y = arcsin x



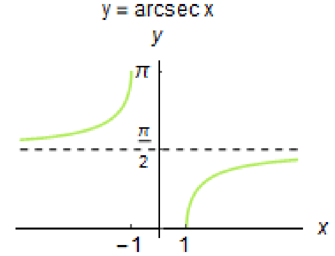
y = arccsc x



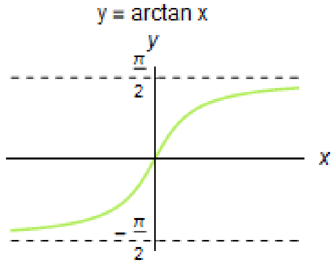
y = arccos x



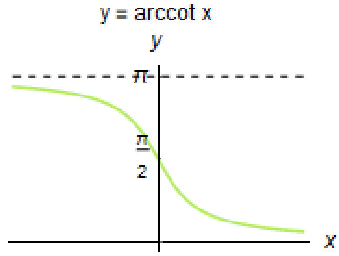
y = arcsec x



y = arctan x



y = arccot x



INVERSE TRIGONOMETRIC FUNCTIONS

$\arcsin x = \sin^{-1} x = y \Leftrightarrow \sin y = x$ and $-\frac{\pi}{2} \leq y \leq \frac{\pi}{2}$
$\arccos x = \cos^{-1} x = y \Leftrightarrow \cos y = x$ and $0 \leq y \leq \pi$
$\arctan x = \tan^{-1} x = y \Leftrightarrow \tan y = x$ and $-\frac{\pi}{2} < y < \frac{\pi}{2}$

DEGREES & RADIANS

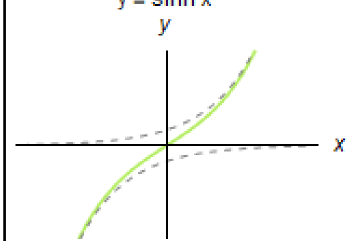
$\theta = \alpha \times \frac{180}{\pi}$	$\alpha = \theta \times \frac{\pi}{180}$

HYPERBOLIC FUNCTIONS

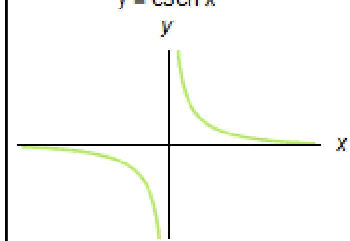
$\sinh x = \frac{e^x - e^{-x}}{2}$	$\operatorname{csch} x = \frac{1}{\sinh x}$
$\cosh x = \frac{e^x + e^{-x}}{2}$	$\operatorname{sech} x = \frac{1}{\cosh x}$
$\tanh x = \frac{\sinh x}{\cosh x}$	$\coth x = \frac{\cosh x}{\sinh x}$

GRAPHS OF HYPERBOLIC FUNCTIONS

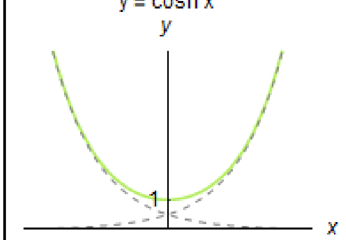
y = sinh x



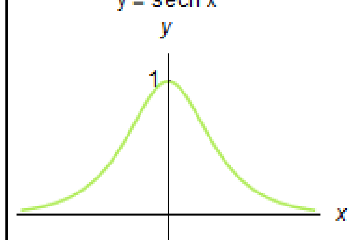
y = csch x



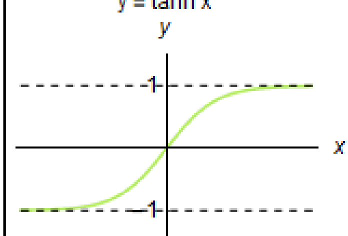
y = cosh x



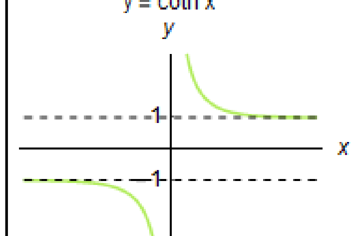
y = sech x



y = tanh x



y = coth x



INVERSE HYPERBOLIC FUNCTIONS

$y = \sinh^{-1} x = \ln\left(x + \sqrt{x^2 + 1}\right)$
$y = \cosh^{-1} x = \ln\left(x + \sqrt{x^2 - 1}\right), \quad y \geq 0$
$y = \tanh^{-1} x = \frac{1}{2} \ln\left(\frac{1 + x}{1 - x}\right)$

$\boldsymbol{a \times \sin[b(x - c)] + d}$

a: amplitude	c: horizontal shift
$b \div 360°$: period	d: vertical shift