TRIGONOMETRY

IDENTITIES AND FORMULAS

Listen.
Learn.
Grow.

Mathematics is not a contemplative but a creative subject-Hardy

Sean Douglas

Algebra Rules

Algebra Laws

	Additive	*Multiplicative*
Associative:	$a+(b+c)=(a+b)+c$	$a(bc)=(ab)c$
Commutative:	$a+b=b+a$	$ab=ba$
Inverse:	$a+(-a)=0$	$a\cdot\frac{1}{a}=\frac{a}{a}=1$
Identity:	$a+0=a$	$a\cdot 1=a$
Distributive:	$a(b+c)=ab+ac$	

Fractions

Common Dem: $\frac{a}{b}+\frac{c}{d}=\frac{ad+bc}{bd}$ Fraction Mult: $\frac{a}{b}\frac{c}{d}=\frac{ac}{bd}$ Neg Exponent: $a^{-1}=\frac{1}{a}$

Basic rule: $\frac{ac}{b}=\frac{a}{b}c=\frac{c}{b}a$ Double fractions: $\frac{a/b}{c/d}=\frac{ad}{bc}$ Signs: $\frac{-a}{b}=-\frac{a}{b}=\frac{a}{-b}$

Exponent rules

Remember the logarithm and exponential are inverses of each other, thus the *only* way to get x by its self in e^x or $\ln(x)$ is to apply the inverse.

$a^xb^x=(ab)^x$ $a^xa^y=a^{x+y}$ $a^{-x}=\frac{1}{a^x}$ $a^0=1$

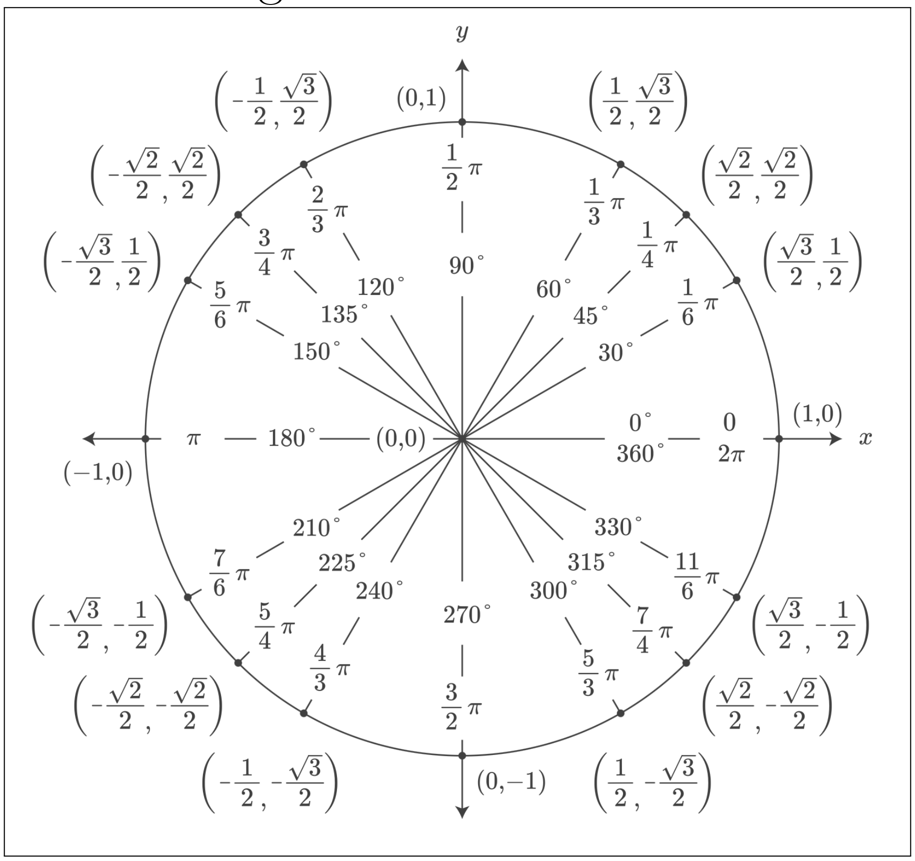
$(a^x)^y=a^{xy}$ $\left(\frac{a}{b}\right)^x=\frac{a^x}{b^x}$ $\frac{a^x}{a^y}=a^{x-y}$ $a^x=e^{x\ln(a)}$

Logarithms

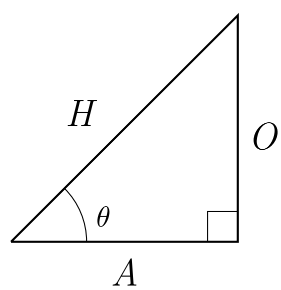
Remember the logarithm and exponential are inverses of each other, thus the *only* way to get x by its self in e^x or $\ln(x)$ is to do the opposite one.

$\ln(ab)=\ln(a)+\ln(b)$ $\ln\left(\frac{a}{b}\right)=\ln(a)-\ln(b)$ $\ln(a^x)=xln(a)$

Trigonometric Identities



SOH-CAH-TOA



$$\sin(\theta) = \frac{O}{H} \qquad \csc(\theta) = \frac{1}{\sin(\theta)} = \frac{H}{O}$$

$$\cos(\theta) = \frac{A}{H} \qquad \sec(\theta) = \frac{1}{\cos(\theta)} = \frac{H}{A}$$

$$\tan(\theta) = \frac{O}{A} \qquad \cot(\theta) = \frac{1}{\tan(\theta)} = \frac{A}{O}$$

Co-function Identities

Divide by $\sin(\theta)$ and $\cos(\theta)$ to get the other Co-function Identities.

$$\sin(\theta) = \cos(\frac{\pi}{2} - \theta) \qquad \cos(\theta) = \sin(\frac{\pi}{2} - \theta)$$

Supplement Angle Identities

Take reciprocals on each side of the following to get the other supplement angle identities.

$$\sin(\pi - \theta) = \sin(\theta)$$
$$\cos(\pi - \theta) = -\cos(\theta)$$
$$\tan(\pi - \theta) = -\tan(\theta)$$

Negative angle Identities

Take reciprocals on each side of the following to get the other negative angle identities.

$$\sin(-\theta) = -\sin(\theta)$$
$$\cos(-\theta) = \cos(\theta)$$
$$\tan(-\theta) = -\tan(\theta)$$

Addition and Subtraction Identities

$$\sin(A + B) = \sin(A)\cos(B) + \cos(A)\sin(B) \qquad \sin(A - B) = \sin(A)\cos(B) - \cos(A)\sin(B)$$

$$\cos(A + B) = \cos(A)\cos(B) - \sin(A)\sin(B) \qquad \cos(A - B) = \cos(A)\cos(B) + \sin(A)\sin(B)$$

$$\tan(A + B) = \frac{\tan(A) + \tan(B)}{1 - \tan(A)\tan(B)} \qquad \tan(A - B) = \frac{\tan(A) - \tan(B)}{1 + \tan(A)\tan(B)}$$

Useful Equations

$$\text{degrees} = \text{radians}\frac{180^\circ}{\pi} \qquad s = r\theta$$

Sum Identities

$$\sin(A) + \sin(B) = 2\sin\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$$
$$\sin(A) - \sin(B) = 2\cos\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right)$$
$$\cos(A) + \cos(B) = \cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$$
$$\cos(A) - \cos(B) = -\sin\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right)$$

Product Identities

$$\sin(A)\cos(B) = \frac{1}{2}(\sin(A+B) + \sin(A-B))$$
$$\cos(A)\cos(B) = \frac{1}{2}(\cos(A+B) + \cos(A-B))$$
$$\sin(A)\sin(B) = \frac{1}{2}(\cos(A-B) - \cos(A+B))$$

Double Angle Identities

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

$$\sin(2\theta) = 2\sin(\theta)\cos(\theta)$$

$$\cos(2\theta) = \cos^2(\theta) - \sin^2(\theta) = 2\cos^2(\theta) - 1 = 1 - 2\sin^2(\theta)$$

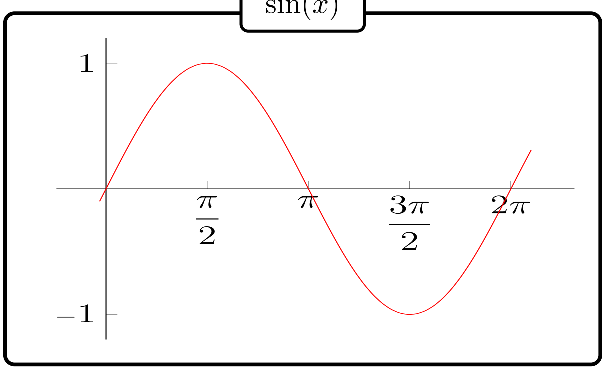
Half-Angle Identities

$$\sin\left(\frac{\theta}{2}\right) = \pm\sqrt{\frac{1-\cos(\theta)}{2}}$$

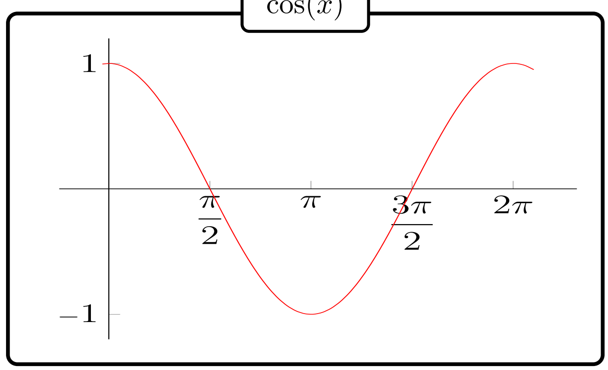
$$\cos\left(\frac{\theta}{2}\right) = \pm\sqrt{\frac{1+\cos(\theta)}{2}}$$

$$\tan(\theta) = \pm\sqrt{\frac{1-\cos(\theta}{1+\cos(\theta}}$$

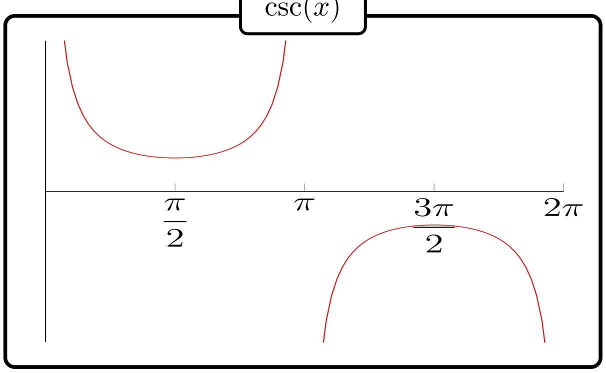
sin(x)



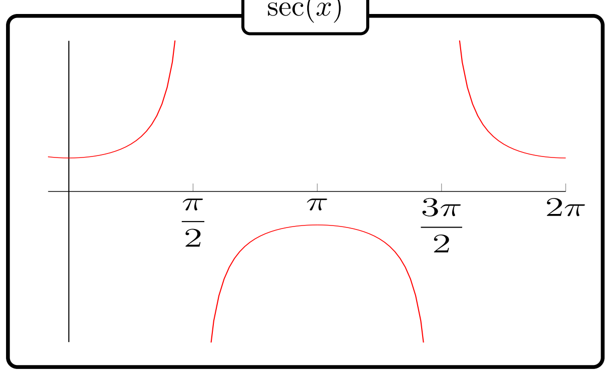
cos(x)



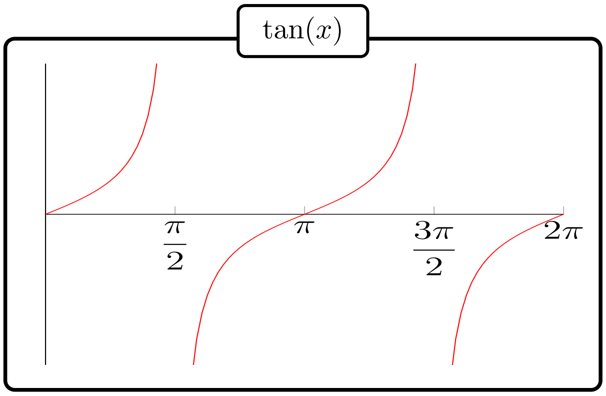
csc(x)



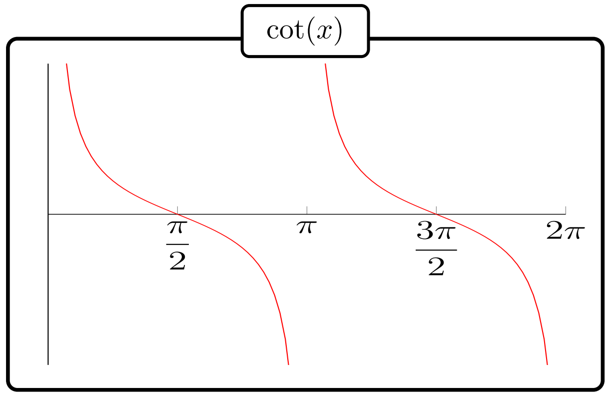
sec(x)

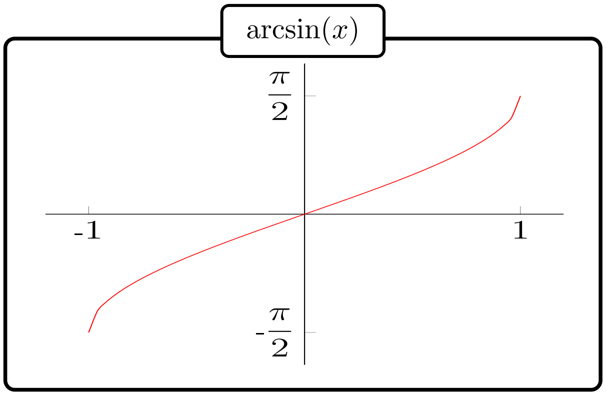


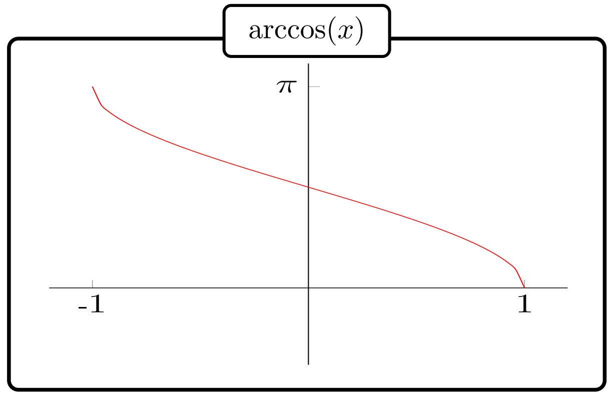
tan(x)

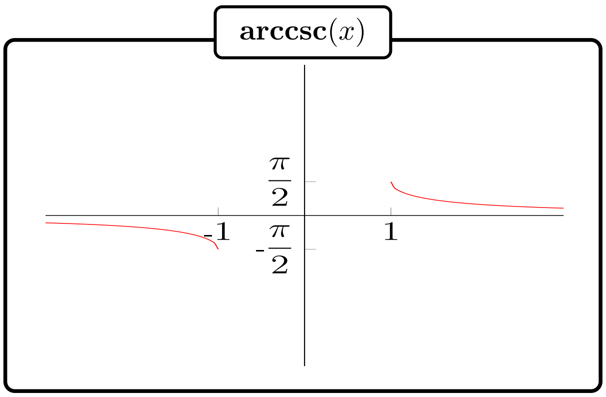


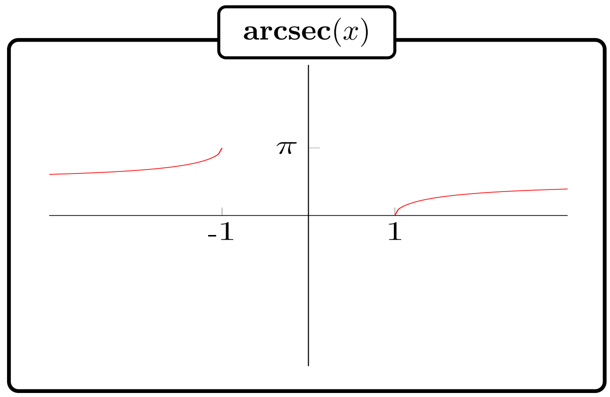
cot(x)

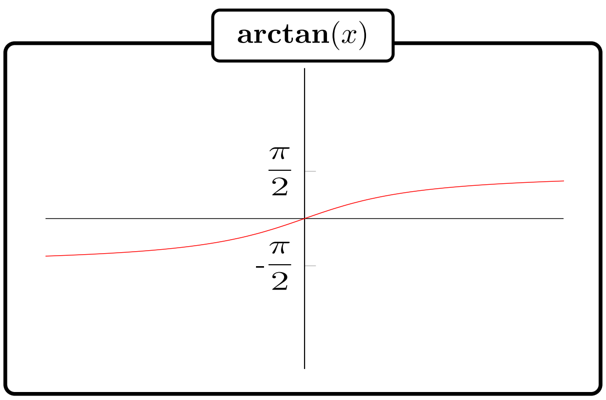


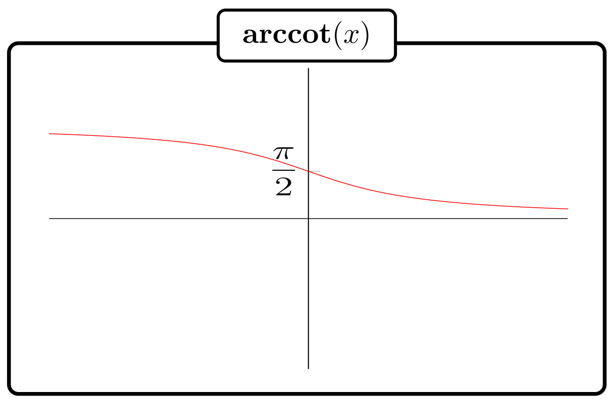

arcsin(x)
$\frac{\pi}{2}$
-1
1
-$\frac{\pi}{2}$


arccos(x)
π
-1
1


arccsc(x)
$\frac{\pi}{2}$
-1
1
-$\frac{\pi}{2}$


arcsec(x)
π
-1
1


arctan(x)
$\frac{\pi}{2}$
-$\frac{\pi}{2}$


arccot(x)
$\frac{\pi}{2}$