

Reciprocal Identities

$$\csc x = 1/\sin x$$

$$\sec x = 1/\cos x$$

$$\cot x = 1/\tan x$$

Half-angle identities

$$\sin (x/2) = \text{radical}((1 - \cos x) / 2)$$

$$\cos (x/2) = \text{radical}((1 + \cos x) / 2)$$

$$\tan (x/2) = (\sin x / 1 + \cos x)$$

Transformations

Translations

$g(x) = f(x) + k$ is the graph of $f(x)$ translated k units up when $k > 0$ and k units down when $k < 0$.

$g(x) = f(x - h)$ is the graph of $f(x)$ translated h units right when $h > 0$ and h units left when $h < 0$.

Reflections

$g(x) = -f(x)$ is the graph of $f(x)$ reflected in the x -axis.

$g(x) = f(-x)$ is the graph of $f(x)$ reflected in the y -axis.

Dilations

$g(x) = a \cdot f(x)$ is the graph of $f(x)$ expanded vertically if $a > 1$ and compressed vertically if $0 < a < 1$.

$g(x) = f(ax)$ is the graph of $f(x)$ compressed horizontally if $a > 1$ and expanded horizontally if $0 < a < 1$.

Domain and range

Domain: The domain of a function is the set of all possible input values (often the "x" variable), which produce a valid output from a particular function. It is the set of all real numbers for which a function is mathematically defined.

Range: The range is the set of all possible output values (usually the variable y , or sometimes expressed as $f(x)$), which result from using a particular function.

Cotangent/Tangent

$$\tan x = \sin x / \cos x$$

$$\cot x = \cos x / \sin x$$

Double-angle identities

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

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

$$\tan 2x = (2 \tan x / 1 - \tan^2 x)$$

Parent functions

constant function

$f(x) = a$ graph is a horizontal line

identity function

$f(x) = x$ points on graph have coordinates (a, a)

quadratic function

$f(x) = x^2$ graph is U-shaped

cubic function

$f(x) = x^3$ graph is symmetric about the origin

square root function

$f(x) = \sqrt{x}$ graph is in first quadrant

reciprocal function

$f(x) = 1/x$ graph has two branches

absolute value function

$f(x) = |x|$ graph is V-shaped

Pythagorean Identities

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

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

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

You can convert the first identity into the second and third by dividing both sides by $\cos^2 x$ or $\sin^2 x$.

Exponential and logarithmic

Logarithmic

$$y = \ln x$$

Exponential

$$y = b^x$$