Double Angle Identities

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

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

35. $\tan\left(\frac{\theta}{2}\right) = \pm\sqrt{\frac{1-\cos\theta}{1+\cos\theta}}$ $\quad \tan\left(\frac{\theta}{2}\right) = \frac{1-\cos\theta}{\sin\theta} = \frac{\sin\theta}{1+\cos\theta}$

Half- Angle Identities

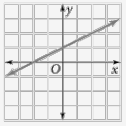
$$\sin(\frac{a}{2}) = \pm\sqrt{\frac{(1-\cos a)}{2}}$$

$$\cos(\frac{a}{2}) = \pm\sqrt{\frac{(1+\cos a)}{2}}$$

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

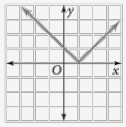
Families of Function

Linear function
$y = mx + b$



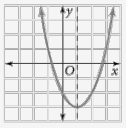
slope = m
y-intercept = b
The greatest exponent is 1.

Absolute value function
$y = |x - a| + b$



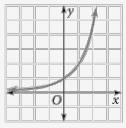
shift $y = |x|$ horizontally a units
shift $y = |x|$ vertically b units
vertex at (a, b)
The greatest exponent is 1.

Quadratic function
$y = ax^2 + bx + c$



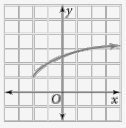
parabola with axis of symmetry at $x = -\frac{b}{2a}$
The greatest exponent is 2.

Exponential function
$y = ab^x$



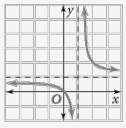
growth for $b > 1$
decay for $0 < b < 1$
The variable is the exponent.

Radical function
$y = \sqrt{x - b} + c$



shift $y = \sqrt{x}$ horizontally b units
shift $y = \sqrt{x}$ vertically c units
The variable is under the radical.

Rational function
$y = \frac{a}{x - b} + c$



vertical asymptote at $x = b$
horizontal asymptote at $y = c$
The variable is in the denominator.

Identities

A. Reciprocal

$\csc = \frac{1}{\sin}$ $\quad \sin\csc = 1$

$\cos\sec = 1$

$\sec = \frac{1}{\cos}$ $\quad \tan\cot = 1$

$\cot = \frac{1}{\tan}$

$\sin = \frac{1}{\csc}$

$\cos = \frac{1}{\sec}$

$\tan = \frac{1}{\cot}$

B. Ratio

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

$\cot = \frac{\cos}{\sin}$

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

$\sin = \frac{\cos}{\cot}$

$\sin = \cos\tan$

$\cos = \sin\cot$

C. Pythagorean

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

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

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

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

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

$\sec^2 - 1 = \tan^2$

$\sec^2 - \tan^2 = 1$

$\csc^2 - 1 = \cot^2$

$\csc^2 - \cot^2 = 1$

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) = x2 graph is U-shaped

cubic function

f(x) = x3 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

Exponential & Logarithmic

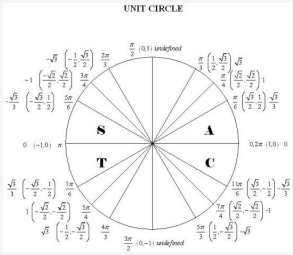
Logarithmic

y = ln x

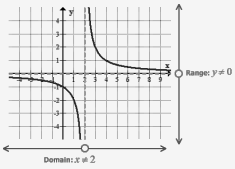
Exponential

y = bx

Unit Circle



Domain & 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.