Algebra Cheat Sheet

Distance Formula: If $P_1 = (x_1, y_1)$ and $P_2 = (x_2, y_2)$, the distance from $P_1$to P_2 is

$$d(P_1, P_2) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Midpoint Formula: If $P_1 = (x_1, y_1)$ and $P_2 = (x_2, y_2)$, the midpoint for P_1 and P_2 is :

$$(x_m, y_m) = \left(\frac{x_2 + x_1}{2}, \frac{y_2 + y_1}{2} \right)$$

Standard equation of a Circle: The standard of a circle of radius r with center (h, k) is

$$(x - h)^2 + (y - k)^2 = r^2$$

Slope Formula: The slope m of the line containing the points $P_1 = (x_1, y_1)$ and $P_2 = (x_2, y_2)$ is

$m = \frac{y_2 - y_1}{x_2 - x_1}$ if $x_1 \neq x_2$

m is undefined if $x_1 = x_2$

Point-Slope equation of a Line: The equation of a line with slope m containing the point (x_1, y_1) is

$$y - y_1 - m(x - x_1)$$

Slope-Intercept equation of a Line: The equation of a line with slope m and y-intercept b is

$$y = mx + b$$

Quadratic Formula:
The solution(s) of the quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$ are

$$x = \frac{-\mathrm{b} \pm \sqrt{b^2 - 4ac}}{2a}$$

If $b^2 - 4ac > 0$, there are two unequal real solutions.

If $b^2 - 4ac = 0$, there is a repeated real solution.

If $b^2 - 4ac < 0$, there are two complex solutions that are not real.

Factoring Formulas

$$x^2 - a^2 = (x+a)(x-a)$$
$$x^2 + 2ax + a^2 = (x+a)^2$$
$$x^2 - 2ax + a^2 = (x-a)^2$$

Properties of Logarithms:

1. $\log_a(MN) = \log_a M + \log_a N$
2. $\log_a\left(\frac{M}{N}\right) = \log_a M - \log_a N$
3. $\log_a M^r = r \log_a M$
4. $\log_a M = \frac{\log M}{\log a} = \frac{\ln M}{\ln a}$

Arithmetic Sequence:

$$a_n = a_1 + (n-1)d$$

Arithmetic Sequence:

$$S = \frac{n(n-1)}{2}d$$

Geometric sequence:

$$\boldsymbol{a_n = a_1 \,.\, R^{n-1}}$$

Geometric series:

$$S = a\frac{1-r^n}{1-r}$$

Geometric Series: If $|r| < 1$ (CONVERGENT)

$$S = \frac{a}{1-r}$$

Permutations/Combinations:

$0! = 1 \qquad 1! = 1$

$n! = n(n-1)\cdot \ldots \cdot (3)(2)(1)$

$$P(n,r) = \frac{n!}{(n-r)!}$$

$$C(n,r) = \binom{n}{r} = \frac{n!}{(n-r)!\,r!}$$

Compounding Interest

The following formula finds the future value of a lump sum.

$A = P\left(1 + \frac{r}{n}\right)^{n \cdot t}$ r = annual rate

Compound period

Principal (the amount you have today)

Accumulate (Future Value)

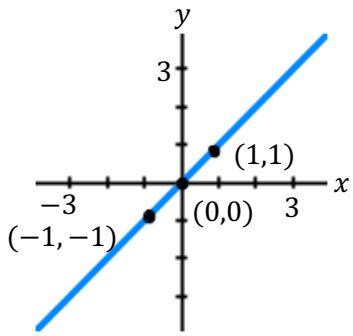
$A = P \cdot e^{r \cdot t}$

Continuously Compounded

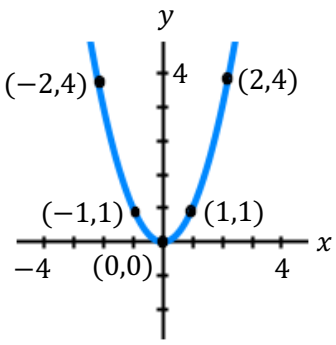
Yearly :	$n = 1$
Monthly:	$n = 12$
Quarterly:	$n = 4$
Semi-annual:	$n = 2$
Daily:	$n = 365$
Weekly:	$n = 52$

Library of Functions:

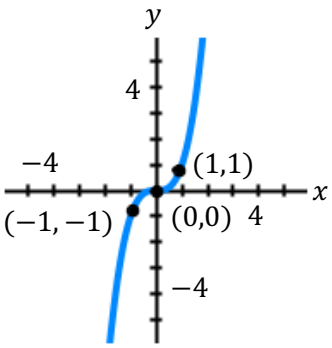
Identity Function: $f(x) = x$



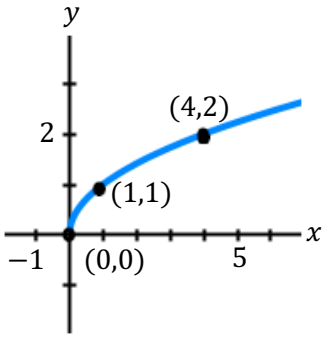
Square Function: $f(x) = x^2$



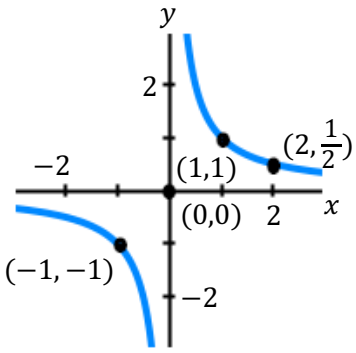
Cube Function: $f(x) = x^3$



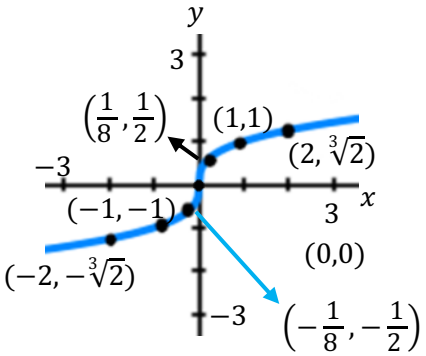
Square Root Function: $f(x) = \sqrt{x}$



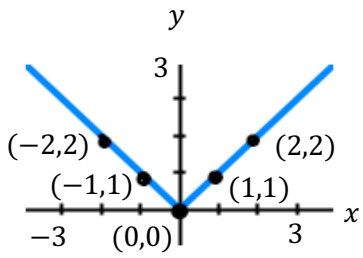
Reciprocal Function: $f(x) = \frac{1}{x}$



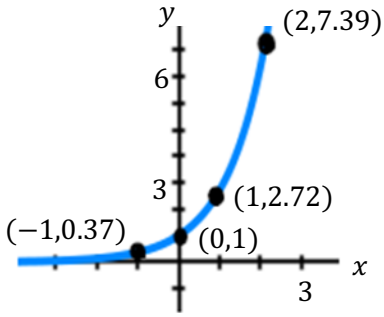
Cube Root Function: $f(x) = \sqrt[3]{x}$



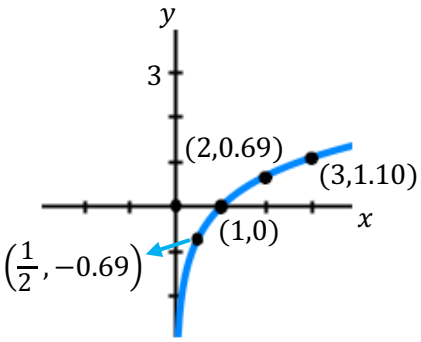
Absolute Value Function: $f(x) = |x|$



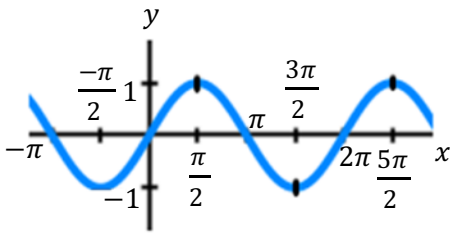
Exponential Function: $f(x) = e^x$



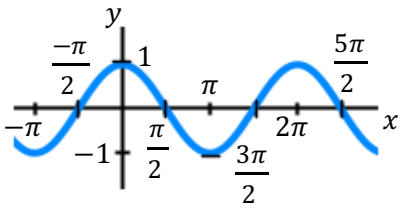
Natural Logarithm Function: $f(x) = \ln x$



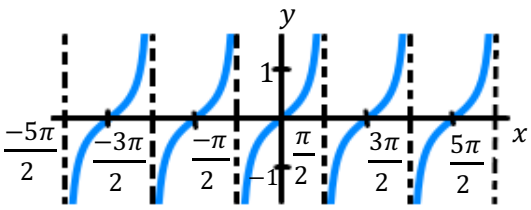
Sine Function: $f(x) = \sin x$



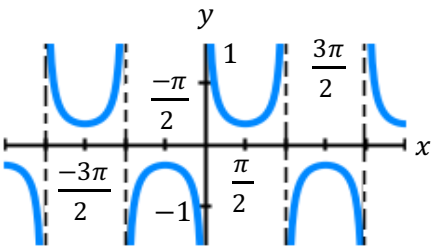
Cosine Function: $f(x) = \cos x$



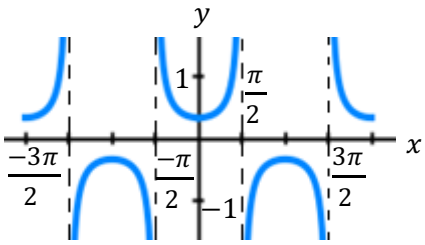
Tangent Function: $f(x) = \tan x$



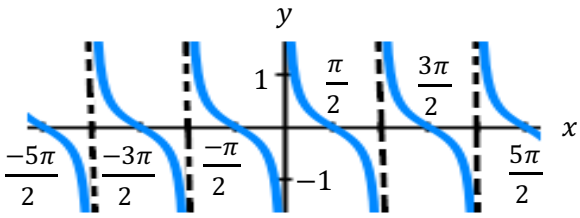
Cosecant Function: $f(x) = \csc x$



Secant Function: $f(x) = \sec x$



Cotangent Function: $f(x) = \cot x$



Transformation Rules

Transformation makes graphing easier if you follow these rules.

Function Notation	**Type of Transformation**	**Movement of Graph**	**Change to Coordinate Point**
$f(x)+k$	Vertical translation up k units	Shifts **up** k units	**Add k to y** $(x, y+k)$
$f(x)\pm k$	Vertical translation down k units	Shifts **down** k units	**Subtract** k from y $(x, y-k)$
$f(x+h)$	Horizontal translation left h units	Slides graph **left h units**	**Subtract h from x** $(x-h, y)$
$f(x-h)$	Horizontal translation right h units	Slides graph **right h units**	**Add h to x** $(x+h, y)$
$-f(x)$	Vertical reflection over $x-axis$	Flips graph over $x-axis$	Take the opposite value of y $(x, -y)$
$f(-x)$	Horizontal reflection over $y-axis$	Flips graph over $y-axis$	Take the opposite value of x $(-x. y)$
$af(x)$	Vertical stretch for $\|a\|>0$	Pulls y values away from $x-axis$	Multiply y by a (x, ay)
$af(x)$	Vertical compression for $0<\|a\|<1$	Pushes y values toward $x-axis$	Multiply y by a (x, ay)

$f(bx)$	Horizontal compression for $\|b\| > 0$	Pulls x-values away from $y-axis$	Divide x by b $\left(\frac{x}{b}, y\right)$
$f(bx)$	Horizontal stretch for $0 < \|b\| < 1$	Pushes x values towards $x-axis$	Divide x by b $\left(\frac{x}{b}, y\right)$