


Average Rate of Change (slope):

$$m_{sec} = \frac{f(b) - f(a)}{b - a}$$

Write the equation of a tangent:

You need a slope and a point.

$$y_2 - y_1 = m(x_2 - x_1)$$

Log Properties

1. $\log_a(xy) = \log_a x + \log_a y$
2. $\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y$
3. $\log_a x^r = r \log_a x$
4. $\log_a 1 = 0$
5. $\log_a(a^x) = x$
6. $a^{\log_a x} = x$
7. $\log_a x = y \Leftrightarrow a^y = x$
8. $\ln 1 = 0$

The numerical value of e is $e = 2.718\dots$

Interval Notation

Let a and b be real numbers. Suppose that $a \leq b$.

Notation	Type of Interval	Definition
(a, b)	open bounded interval	$a < x < b$
$[a, b]$	closed bounded interval	$a \leq x \leq b$
$[a, b)$	half-open interval	$a \leq x < b$
$(a, b]$	half-open interval	$a < x \leq b$
(a, ∞)	open unbounded interval	$a < x$
$(-\infty, b)$	open unbounded interval	$x < b$
$(-\infty, \infty)$	open unbounded interval	all real numbers
$[a, \infty)$	closed unbounded interval	$a \leq x$
$(-\infty, b]$	closed unbounded interval	$x \leq b$

Absolute Value

1. $|-x| = |x|$
2. $|x|^2 = x^2$
3. $|x - y| = |y - x|$
4. $|xy| = |x||y|$
5. $|x| < b$ if and only if $-b < x < b$

Values of Trigonometric Functions for Common Angles

θ	$\sin \theta$	$\cos \theta$	$\tan \theta$
0	0	1	0
$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$
$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1
$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
$\frac{\pi}{2}$	1	0	" ∞ "
π	0	-1	0

Must know both inverse trig and trig values:

EX. $\tan \frac{\pi}{4} = 1$ and $\sin^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{6}$

ODD and EVEN:

$$\sin(-x) = -\sin x \text{ (odd)}$$

$$\cos(-x) = \cos x \text{ (even)}$$

Trigonometric Identities
Pythagorean Identities:

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

The other two are easy to derive by dividing by $\sin^2 \theta$ or $\cos^2 \theta$.

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

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

Double Angle Formulas:

$$\sin 2x = 2 \sin x \cos x$$

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

Power-Reducing Formulas:

$$\cos^2 x = \frac{1}{2}(1 + \cos 2x)$$

$$\sin^2 x = \frac{1}{2}(1 - \cos 2x)$$

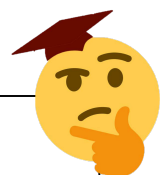
Quotient Identities:

$$\tan \theta = \frac{\sin \theta}{\cos \theta} \quad \cot \theta = \frac{\cos \theta}{\sin \theta}$$

Reciprocal Identities:

$$\csc x = \frac{1}{\sin x} \quad \text{or} \quad \sin x \csc x = 1$$

$$\sec x = \frac{1}{\cos x} \quad \text{or} \quad \cos x \sec x = 1$$



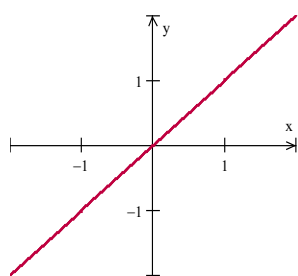
Transforming Graphs

Function	Type of Modification
$y = f(x + c)$	shift f $y = f(x)$ to the left by c units
$y = f(x - c)$	shift the graph of $y = f(x)$ to the right by c units
$y = f(x) + c$	shift the graph of $y = f(x)$ upward by c units
$y = f(x) - c$	shift the graph of $y = f(x)$ downward by c units
$y = cf(x)$	stretch the graph of $y = f(x)$ vertically by a factor of c
$y = f(cx)$	stretch the graph of $y = f(x)$ horizontally by a factor of c
$y = -f(x)$	reflect the graph of $y = f(x)$ in the x -axis
$y = f(-x)$	reflect the graph of $y = f(x)$ in the y -axis

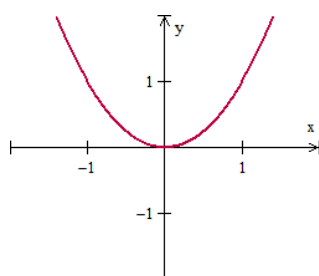
Miscellaneous

Let a and b be real numbers.

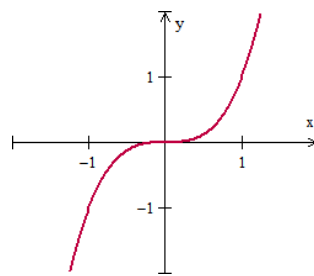
- $(a + b)^2 = a^2 + 2ab + b^2$.
- $(a - b)^2 = a^2 - 2ab + b^2$.
- $(a + b)(a - b) = a^2 - b^2$.
- Quadratic equation $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ provided $b^2 - 4ac \geq 0$.
- Any vertical line has the equation $x=a$
any horizontal line has the equation $y=b$



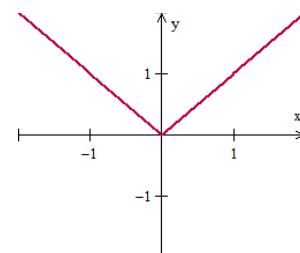
$y = x$



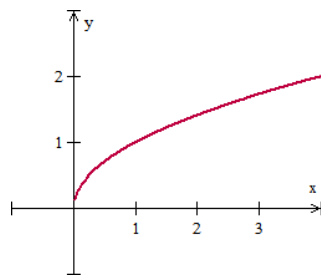
$y = x^2$



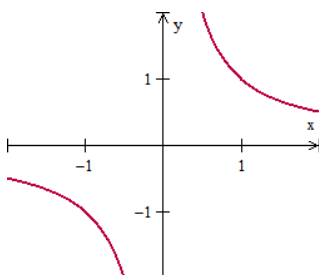
$y = x^3$



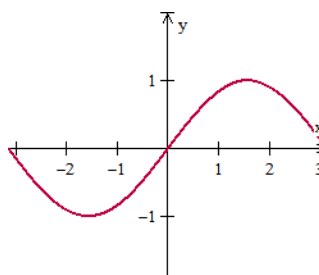
$y = |x|$



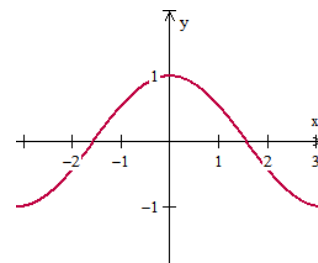
$y = \sqrt{x}$



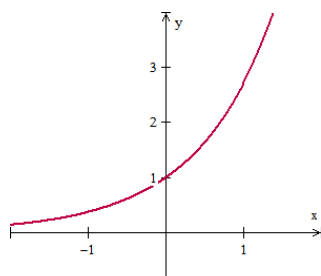
$y = \frac{1}{x}$



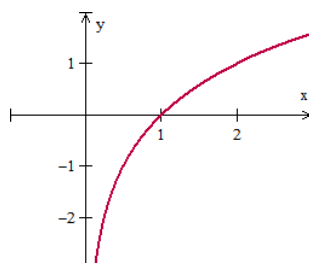
$y = \sin x$



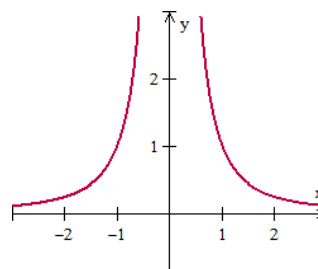
$y = \cos x$



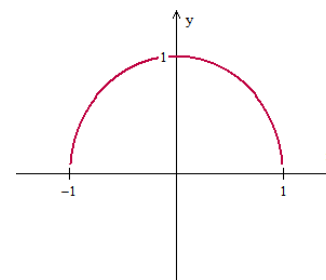
$y = e^x$



$y = \ln x$



$y = \frac{1}{x^2}$



$y = \sqrt{a^2 - x^2}$