$$\frac{a}{c}+\frac{b}{c}=\frac{a+b}{c} \qquad \frac{a}{c}+\frac{b}{d}=\frac{ad+bc}{cd} \qquad \frac{a}{c}-\frac{b}{d}=\frac{ad-bc}{cd} \qquad \frac{a}{c}\cdot\frac{b}{d}=\frac{ab}{cd}$$

$$\frac{a}{c}\div\frac{b}{d}=\frac{a}{c}\cdot\frac{d}{b}=\frac{ad}{cb} \qquad \frac{a}{b}=\frac{c}{d} \Leftrightarrow a=\frac{bc}{d} \Leftrightarrow ad=bc \qquad \frac{\frac{a}{b}}{\frac{c}{b}}=\frac{a}{c} \qquad \frac{\frac{a}{b}}{\frac{a}{c}}=\frac{c}{b}$$

$a^0=1$	$\sqrt{xy}=\sqrt{x}\sqrt{y}$
$a^m\cdot a^n=a^{m+n}$	$\sqrt{\frac{x}{y}}=\frac{\sqrt{x}}{\sqrt{y}}$
$\left(a^m\right)^n=a^{mn}$	$\sqrt[n]{x}=x^{\frac{1}{n}}$
$\frac{a^m}{a^n}=a^{m-n}$	$\sqrt[n]{x^m}=x^{\frac{m}{n}}$
$a^{-n}=\frac{1}{a^n}$	
$(ab)^m=a^mb^m$	
$\left(\frac{a}{b}\right)^m=\frac{a^m}{b^m}$	

$(a-b)(a+b)=a^2-b^2$	$a^2+2ab+b^2=(a+b)^2$
$(a-b)^2=a^2-2ab+b^2$	$a^2-b^2=(a-b)(a+b)$
$(a+b)^2=a^2+2ab+b^2$	$a^2+b^2=(a-ib)(a+ib)$
$(a-b)^3=a^3-3a^2b+3ab^2-b^3$	$a^3-b^3=(a-b)\left(a^2+ab+b^2\right)$
$(a+b)^3=a^3+3a^2b+3ab^2+b^3$	$a^3+b^3=(a+b)\left(a^2-ab+b^2\right)$
$x^2+(a+b)+ab=(x+a)(x+b)$	$a^2-2ab+b^2=(a-b)^2$

$$ax^2+bx+c=0 \quad \Rightarrow \quad \boxed{x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}}$$

✓ $ax^2+bx+c\geq 0 \rightarrow$ *if* $a>0 \Rightarrow x\leq x_1,\ x\geq x_2$

✓ $ax^2+bx+c\leq 0 \rightarrow$ *if* $a>0 \Rightarrow x_1\leq x\leq x_2$

$|X| < c$ are the numbers that satisfy $-c < X < c$.

$|X| > c$ are the numbers that satisfy $X < -c$ or $X > c$.

The Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{k}a^{n-k}b^k + \ldots + \binom{n}{n-1}ab^{n-1} + b^n$$

$$Slope = m = \frac{Vertical\ Change}{Horizontal\ Change} = \frac{Rise}{Run} = \frac{y_2 - y_1}{x_2 - x_1}$$

Equation of a line: $y = mx + b$ (***b***: *y* - intercept)

$y = m(x - x_1) + y_1$ (*Given:* **slope and one point**)

Two slopes m_1 *and* m_2 are: ***Parallel*** (//) if $m_1 = m_2$

Perpendicular (⊥) $m_1 \cdot m_2 = -1$

Two points (x_1, y_1) and (x_2, y_2)

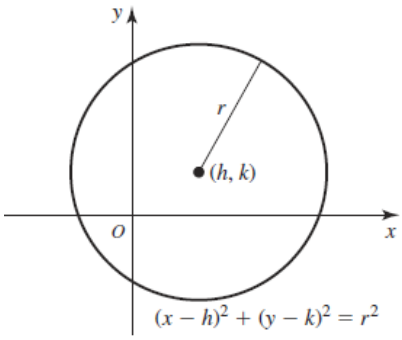
Distance between 2 points: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

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

Equation of a circle with a center (*h*, *k*) and radius *r*:

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

(*Diameter* = 2.*r*)



Reflected across y-axis

Reflected across x-axis

$\begin{cases} |c| > 1 \Rightarrow \text{Shrinking Horizontally} \\ 0 < |c| < 1 \Rightarrow \text{Stretching Horizontally} \end{cases}$

$$y = -\,a\,f(-\,c\,(x \pm b)) \pm d$$

$\begin{cases} |a| > 1 \Rightarrow \text{Stretching Vertically} \\ 0 < |a| < 1 \Rightarrow \text{Shrinking Vertically} \end{cases}$

$\begin{cases} +b \text{ Shifted Left} \\ -b \text{ Shifted Right} \end{cases}$

$\begin{cases} +d \text{ Shifted up} \\ -d \text{ Shifted Down} \end{cases}$

$e^0 = 1$	$e^1 = 2.7183$	$\ln e = 1$
$\log_a a = 1$	$\log_b 1 = 0$	$\ln 1 = 0$
$\log_b b^x = x$	$a^{\log_a x} = x$	
$e^x e^y = e^{x+y}$	$\frac{e^x}{e^y} = e^{x-y}$	$a^x = a^y \Leftrightarrow x = y$

$$y = \log_b x \quad \Leftrightarrow \quad x = b^y$$

$$\log_b M = \frac{\log_a M}{\log_a b} \qquad \Rightarrow \log_b M = \frac{\log M}{\log b} = \frac{\ln M}{\ln b}$$

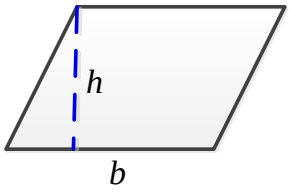
$\log_b MN = \log_b M + \log_b N$	$\log_b M^p = p \log_b M$	$\log_b \frac{M}{N} = \log_b M - \log_b N$

Exponential Growth / Decay: $P(t) = P_o e^{kt}$

Growth Rate and Doubling Time: $kT = \ln 2; \quad k = \frac{\ln 2}{T}; \quad T = \frac{\ln 2}{k}$

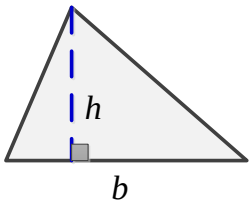
Geometry

Parallelogram



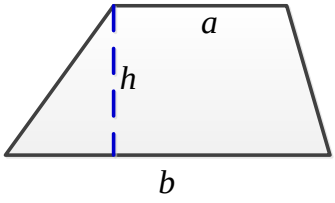
$A = bh$

Triangle



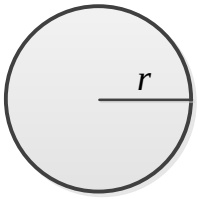
$A = \frac{1}{2}bh$

Trapezoid



$A = \frac{1}{2}(a+b)h$

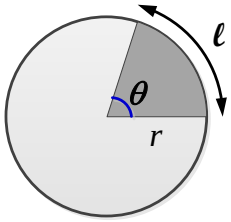
Circle



$A = \pi r^2$

$C = 2\pi r$

Sector

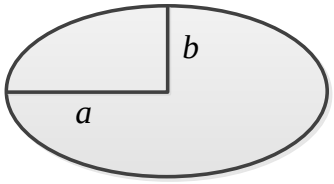


$A = \frac{1}{2}r^2\theta$

$S = r\theta \quad \theta \text{ in rad}$

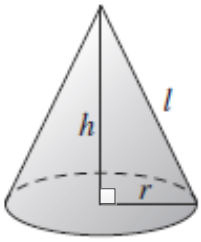
$\ell = 2\pi\theta r^2$

Ellipse



$A = \pi ab$

Cone

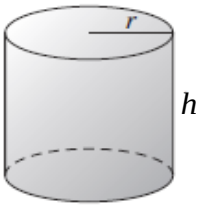


$V = \frac{1}{3}\pi r^2 h$

$A = \pi r\ell \quad (cone)$

$Surface\ Area = \pi r\ell + \pi r^2$

Cylinder

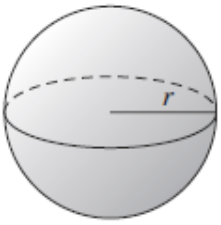


$V = \pi r^2 h$

$A = 2\pi rh \quad (side)$

$Surface\ Area = 2\pi rh + 2\pi r^2$

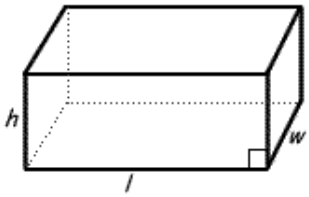
Sphere



$V = \frac{4}{3}\pi r^3$

$A = 4\pi r^2$

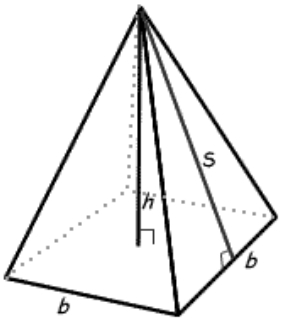
Rectangular Prism



$A = 2(wh + lw + lh)$

$V = lwh$

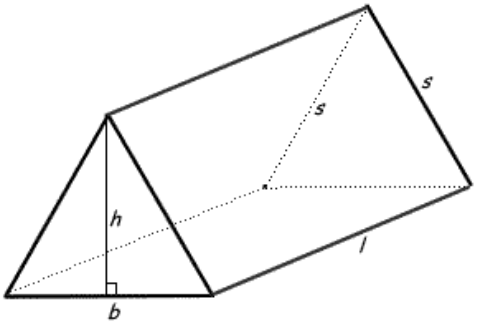
Square Based Pyramid



$A = 2bs + b^2$

$V = \frac{1}{3}b^2h$

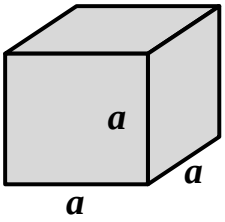
Triangular Prism



$A = bh + 2ls + lb$

$V = \frac{1}{2}(bh)l$

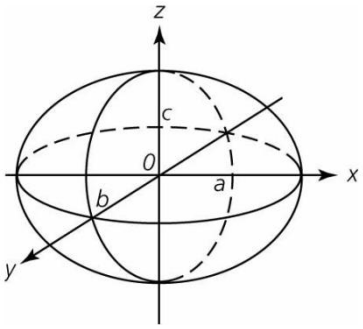
Cube



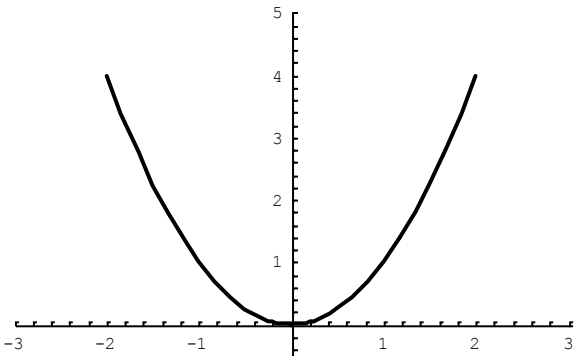
$Surface\ Area = 6a^2$

$V = a^3$

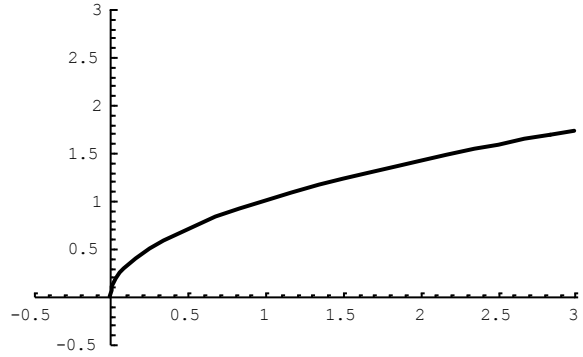
Ellipsoid



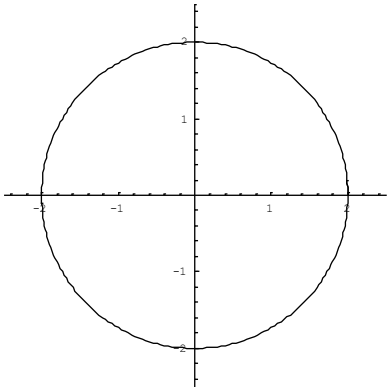
$V = \frac{4}{3}\pi abc$



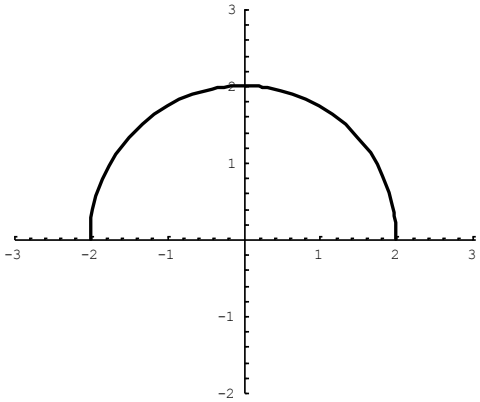
$y = x^2$



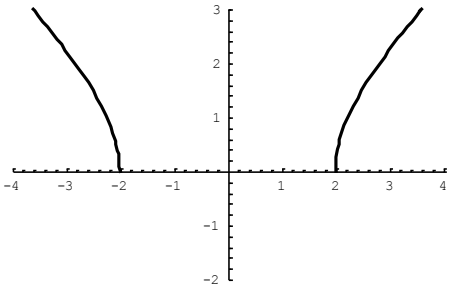
$y = \sqrt{x}$



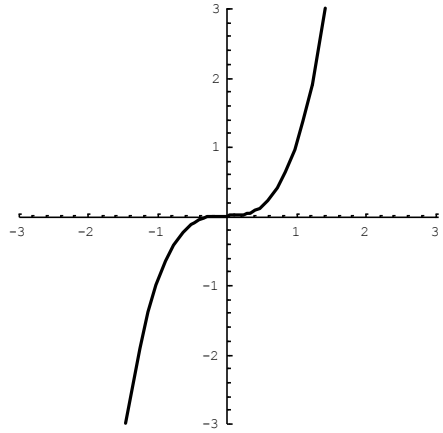
$y^2 + x^2 = 4$



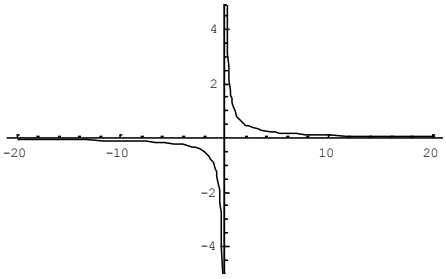
$y = \sqrt{4 - x^2}$



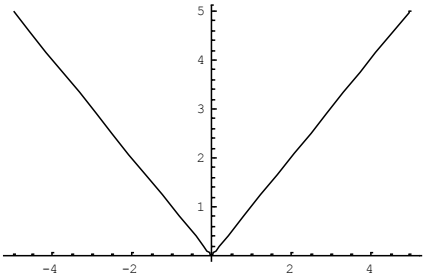
$y = \sqrt{x^2 - 4}$



$y = x^3$



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



$y = |x|$