Math 126

Section 1.2 Graphing Equations

Sketching Graphs

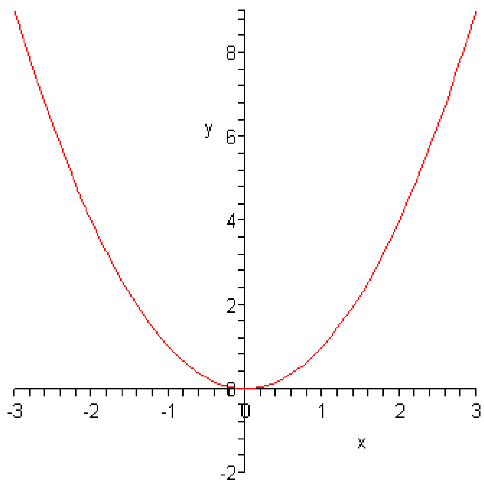
Basic Families of Graphs

Example 1 (The Standard Parabola)

Graph $y = x^2$

x	y
-2	$(-2)^2 = 4$
-1	$(-1)^2 = 1$
0	$(0)^2 = 0$
1	$(1)^2 = 1$
2	$(2)^2 = 4$

Plot the following values (-2,4),(-1,1),(0,0),(1,1),(2,4) from the table will give the following graph.

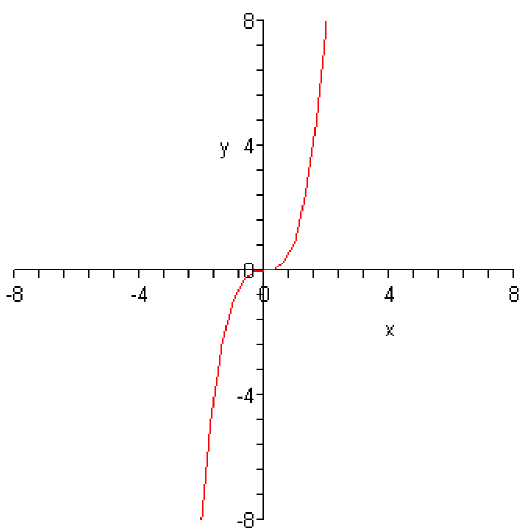


Example 2 (The standard "cubic" graph)

Graph $y = x^3$

x	$y = x^3$
-2	$(-2)^3 = -8$
-1	$(-1)^3 = -1$
0	$0^3 = 0$
1	$1^3 = 1$
2	$2^3 = 8$

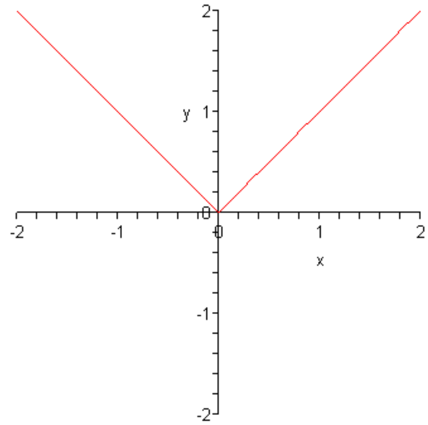
Plot the values from the table will result in the following graph



Example 3 (The Standard Absolute Value Graph)
Graph $y = |x|$

x	$y = \|x\|$
-2	$\|-2\| = 2$
-1	$\|-1\| = 1$
0	$\|0\| = 0$
1	$\|1\| = 1$
2	$\|2\| = 2$

Plot the values from the table will give you a v-shaped graph

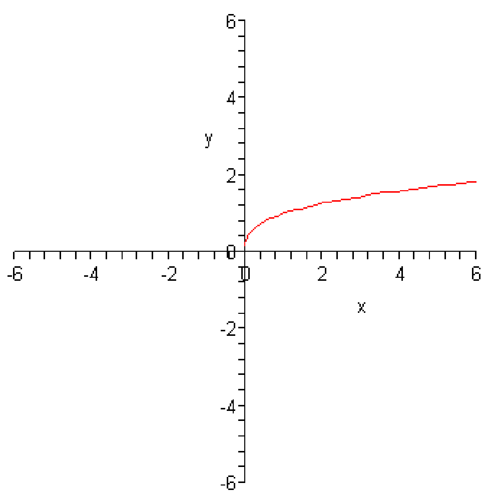


Example 4 (Standard Square Root Graph)

Graph $y = \sqrt{x}$
Again, use a table of values to make a graph of the equation

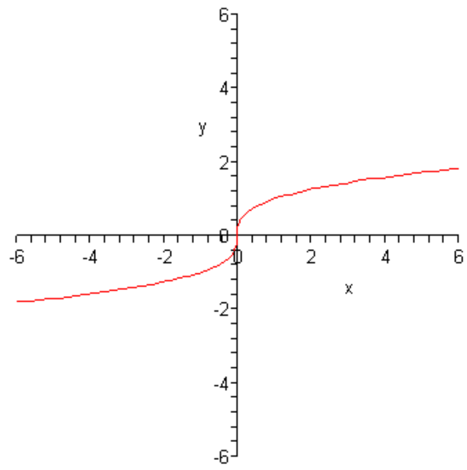
x	$y = \sqrt{x}$
0	$\sqrt{0} = 0$
1	$\sqrt{1} = 1$
4	$\sqrt{4} = 2$
9	$\sqrt{9} = 3$

Resulting Graph



Example 5

The graph of $y = \sqrt[3]{x}$



Horizontal and Vertical Translations (Shifts)

Horizontal Translation: An operation that moves the graph of an equation to the left or right while at the same time preserves the shape of the graph.

Vertical Translation: An operation that moves the graph of an equation to the left or right while at the same time preserves the shape of the graph.

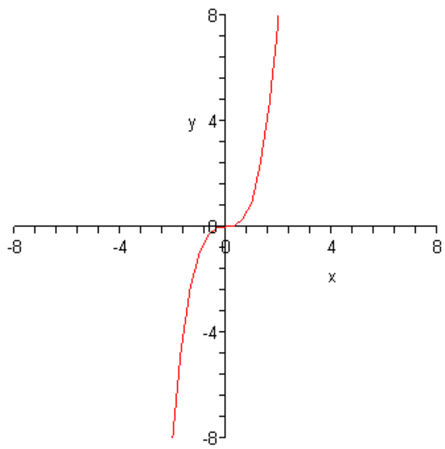
Example 6

Example of a Vertical Translation

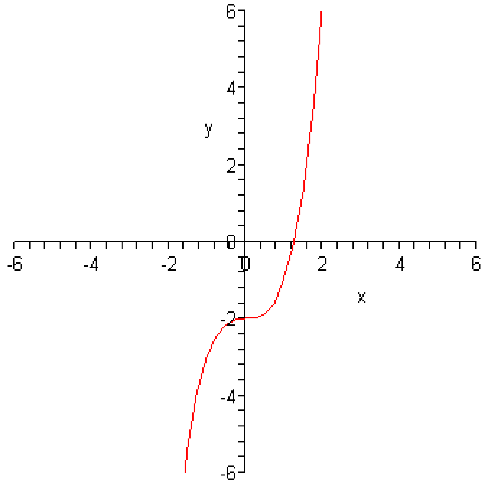
$y = x^3 - 2$

Since the -2 lies outside the x^3 term, the value -2 indicates a vertical translation of 2 units. The negative sign in value of -2 indicates that the translation will move the graph of $y = x^3$ down two units as shown below:

The graph of $y = x^3 - 2$



The graph of $y = x^3 - 2$ shifted down to units



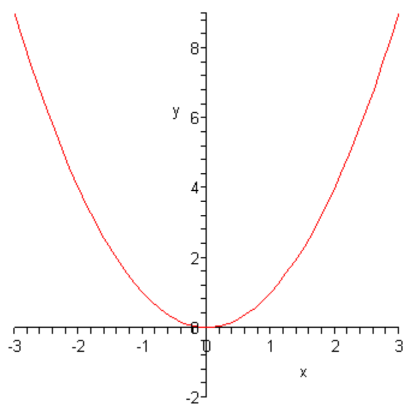
Example 7

Example of a Horizontal Translation

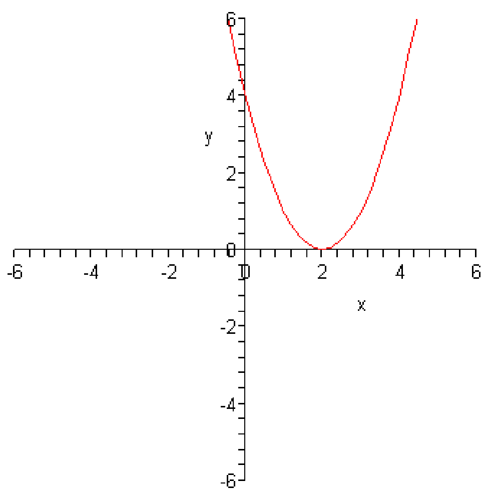
$y = (x - 2)^2$

In this example, the -2 inside the parentheses indicates that there is a horizontal translation of two units to the right. A negative sign inside the parentheses will always result in a shift to the right.

The original graph of $y = x^2$

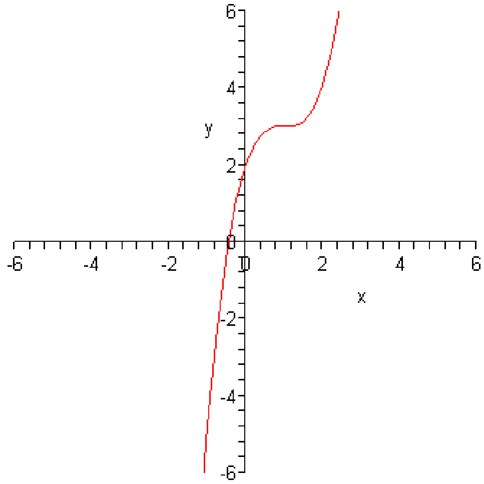


The graph of $y = x^2$ after a horizontal translation of 2 units to the right



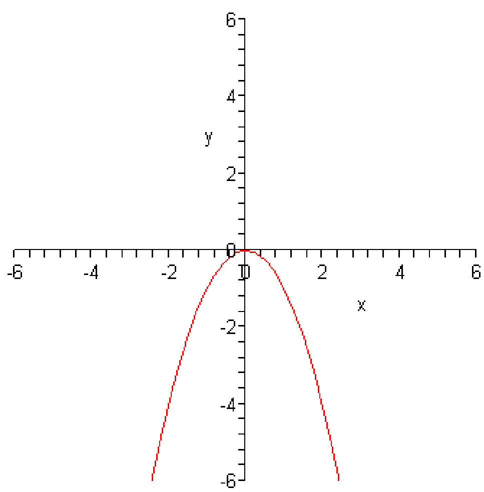
Example 8

The graph of $y = (x-1)^3 + 3$



Example 9 The graph of $y = -x^2$

The graph of $y = -x^2$ is the inverted graph of $y = x^2$. The negative sign in front of the x^2 term simple turns the graph of $y = x^2$ upside down.



Finding the Intercepts

Example 10

Sketch a graph of the equation. Find the intercepts.

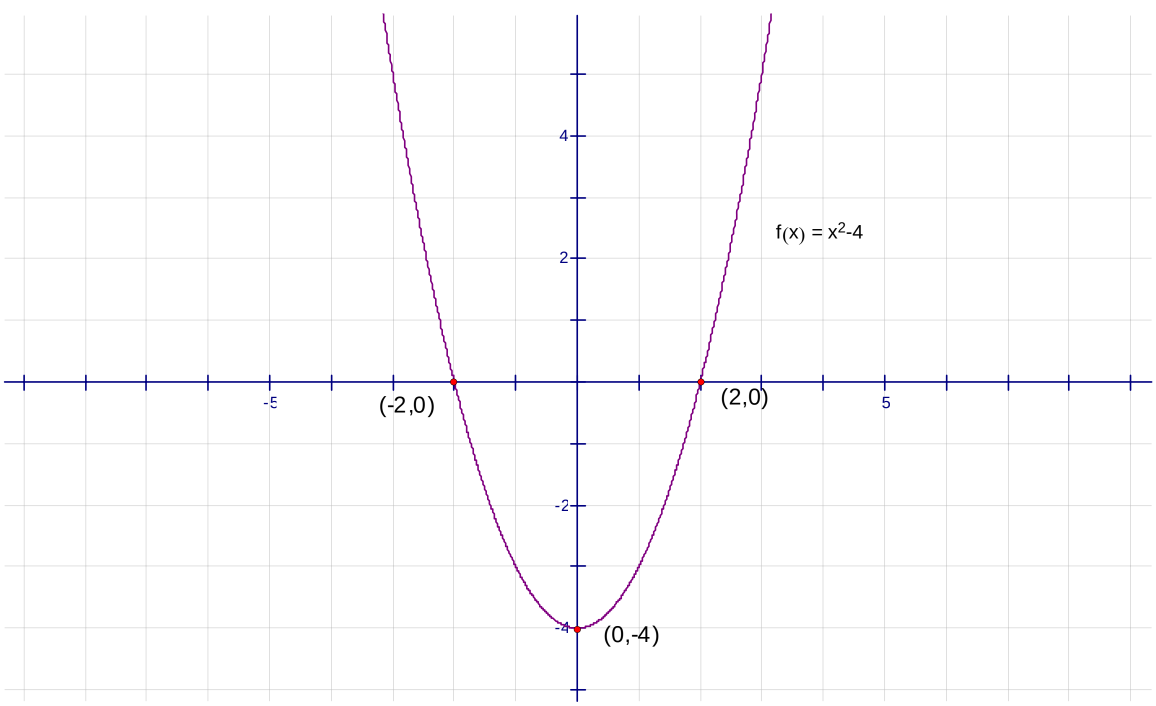
$y = x^2 - 4$

x-intercept

$$
\begin{aligned}
&Let\ \ y = 0 \\
&0 = x^2 - 4 \\
&0 = (x-2)(x+2) \\
&x - 2 = 0\ or\ \ x + 2 = 0 \\
&\quad\ x = 2 \qquad\quad x = -2 \\
&\quad (2,0) \qquad\ \ (-2,0)
\end{aligned}
$$

y-intercept

$$
\begin{aligned}
&y = 0 - 4 \\
&y = -4 \\
&(0,-4)
\end{aligned}
$$



Example 11

Sketch a graph of the equation. Find the intercepts.

$y = x^3 + 1$

Intercepts

$Let\ \ y = 0$

$0 = x^3 + 1$

$x^3 = -1$

$\sqrt[3]{x^3} = \sqrt[3]{-1}$

$x = -1$

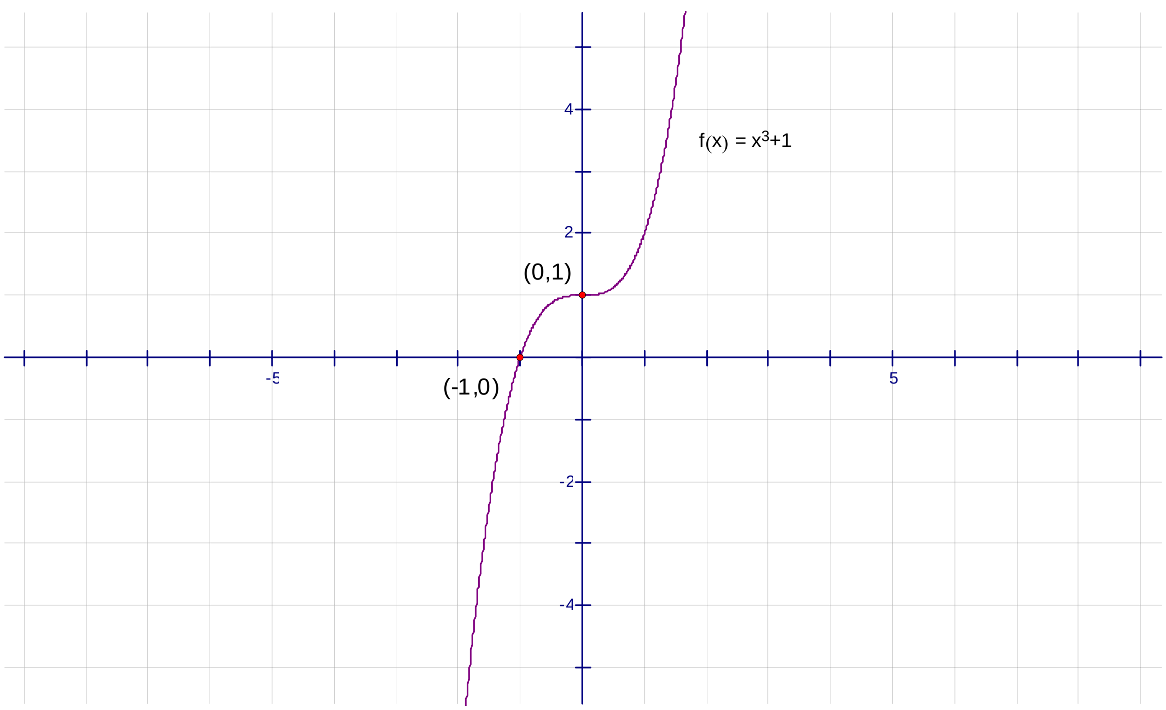
$(-1,0)$

$Let\ \ x = 0$

$y = 0^3 - 1$

$y = -1$

$(0,-1)$



Example 13

Sketch a graph of the following function. Label all intercepts

$y = 2x - 4$

Intercepts

$Let\ \ y = 0$
$0 = 2x - 4$
$2x = 4$
$\frac{2x}{2} = \frac{4}{2}$
$x = 2$
$(2,0)$

$Let\ \ x = 0$
$y = 2(0) - 4$
$y = -4$
$(0,-4)$