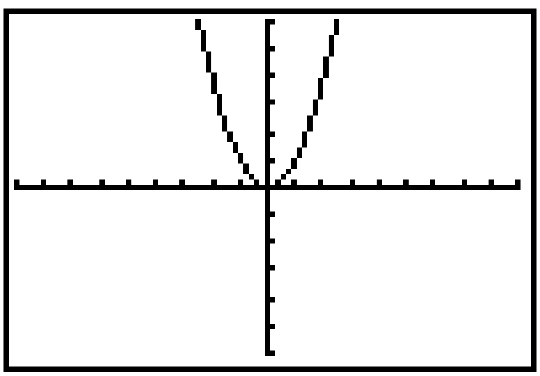
Library of Functions

There are some basic "building block" functions that typically dominate algebra courses. What follows are images from the TI-83 graphing calculator, along with a brief description for 7 of these major functions. For each function, we also include both an x-y table of ordered pairs and the corresponding graph.

In each case, the [Y =] input is shown below, along with the window used for all graphs.

Plot1 Plot2 Plot3	WINDOW
$Y_1 = X^2$	Xmin=-9
$Y_2 = X$	Xmax=9
$Y_3 = \sqrt{(X)}$	Xscl=1
$Y_4 = \text{abs}(X)$	Ymin=-6
$Y_5 = 1/X$	Ymax=6
$Y_6 = X^3$	Yscl=1
$Y_7 = \sqrt[3]{(X)}$	Xres=1

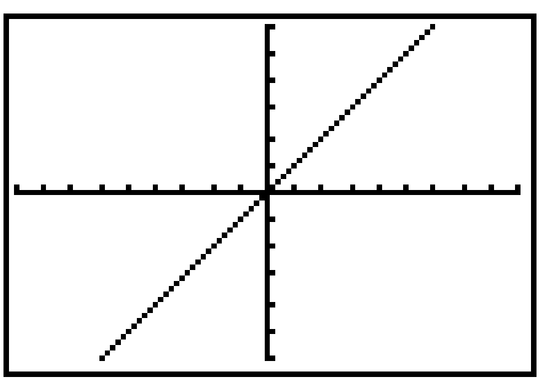
The first function in our chart is the **squaring function** $y = x^2$ whose graph is the parabola shown below. This is a simple **quadratic function**, and its main feature is its vertex, the point given by (0, 0). Its domain includes any real number, and its range is all nonnegative real numbers ($y \geq 0$). This is an even function, with symmetry about the y-axis (the line x = 0).



X	Y_1
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

$Y_1 = X^2$

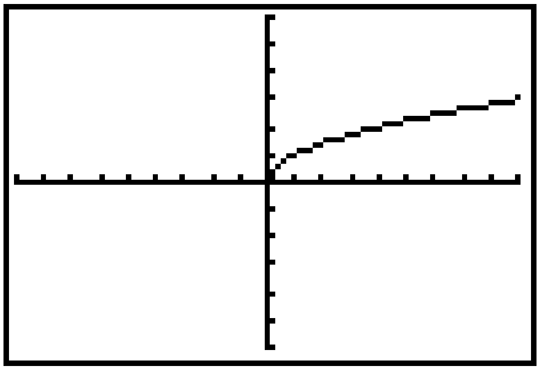
Next, we have the simplest of all **linear functions**, known as the **identity function**, y = x. This line passes through the origin (its x- and y-intercept), and its slope is m = 1. This line "splits" the first and third quadrants, making a 45° angle with the positive x-axis.



X	Y_2
-3	-3
-2	-2
-1	-1
0	0
1	1
2	2
3	3

$Y_2 = X$

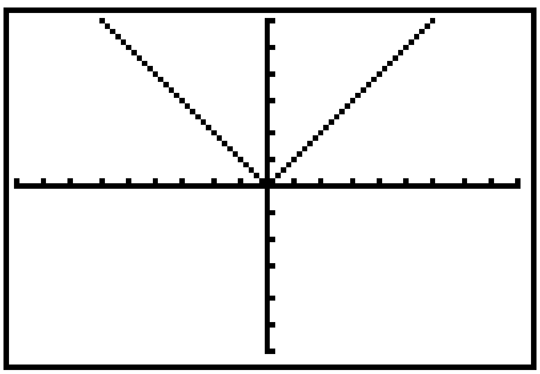
The **square root function**, $y = \sqrt{x}$**,** resembles the squaring function above. Its domain is $x \geq 0$, and its range is $y \geq 0$. Its endpoint is the origin, (0, 0).



X	Y3
-1	ERROR
0	0
1	1
2	1.4142
3	1.7321
4	2
5	2.2361

Y3 = √(X)

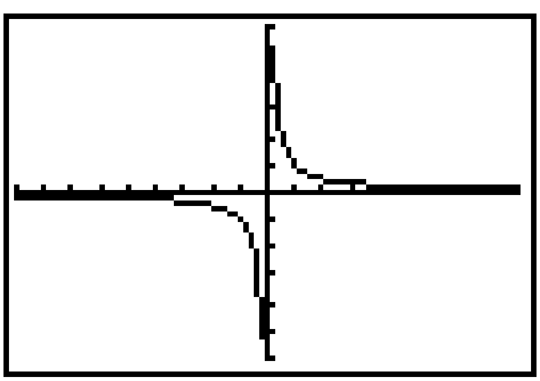
The **absolute value function**, $y = |x|$, makes a "V" shape, splitting both the first and second quadrants. The angle formed by the equation is a right angle, and the minimum point is the origin. Its x- and y-intercepts are also (0, 0). Its domain is all real numbers, and its range is $y \geq 0$. Just like the squaring function, this is an even function.



X	Y4
-3	3
-2	2
-1	1
0	0
1	1
2	2
3	3

Y4 = abs(X)

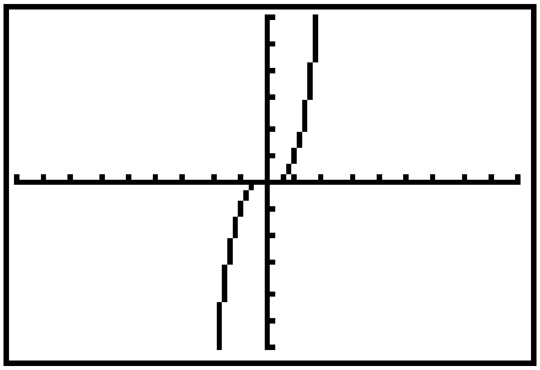
The next function, a **rational function** given by the equation $y = \frac{1}{x}$, has several unique features. The curve approaches the line $y = 0$ as x increases toward positive infinity (+) and approaches the same line as x decreases toward negative infinity (| |). This line is called a horizontal asymptote. Clearly x cannot be zero (a domain issue since division by 0 is not defined). Notice the "ERROR" message in the table below. As x values approach 0 from the right side, y values approach + , and as x values approach 0 from the left side, y values approach | | . The line $x = 0$ is called a vertical asymptote. This is also considered an odd function, with point symmetry about the origin (180° rotational symmetry).



X	Y5
-10	-.1
-1	-1
-.1	-10
0	ERROR
.1	10
1	1
10	.1

Y5 = 1/X

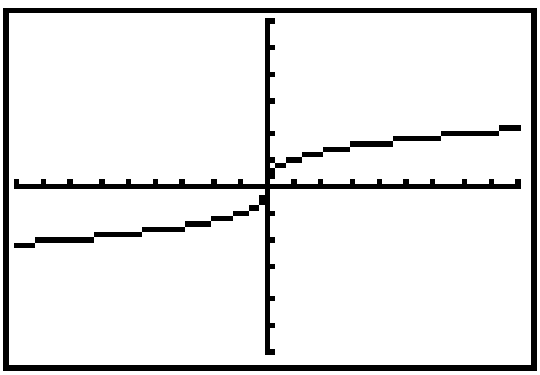
The next two functions are related. The **cubing function**, $y = x^3$, shown below has an inflection point at the origin. This is the point about which the curve has 180° rotational symmetry. The point (0, 0) is also the x- and y-intercept of the graph. Like the rational function above, this is an odd function.



X	Y6
-3	-27
-2	-8
-1	-1
0	0
1	1
2	8
3	27

Y6 = X^3

The **cube root function** is considered the inverse of the cubing function above. [There will be more about inverses in a future installment.] The function given by $y = \sqrt[3]{x}$ has the point (0, 0) as the x- and y-intercept, and the origin is also a point about which the curve has 180° rotational symmetry. You should see some similarities and differences between the cubing and cube root graphs and tables.

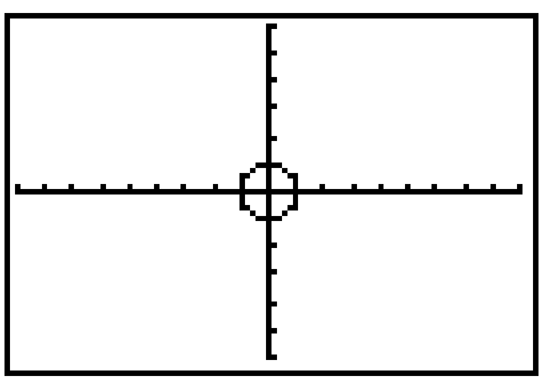


X	Y7
-27	-3
-8	-2
-1	-1
0	0
1	1
8	2
27	3

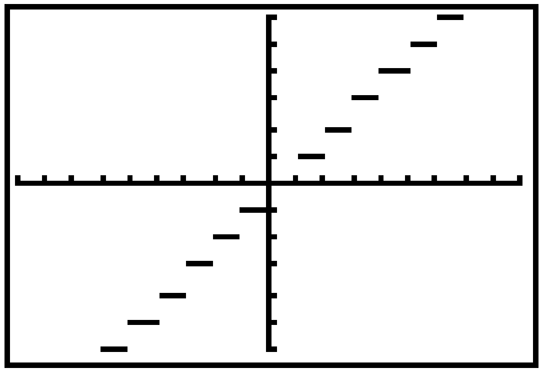
Y7 = ³√(X)

There are many other interesting basic curves. We include two more below, just for fun.

Here is a circle with center (0, 0) and radius 1 unit. The circle is called a **unit circle** and is a major part of the study of trigonometry. Its equation is $x^2 + y^2 = 1$.



And lastly, the "**greatest integer function**" is a type of step function in which the steps are one unit long and the segments are closed on the left side and open on the right side. The equation is given by $y = \text{int}(x)$ or $y = [x]$, and y values are defined as the greatest integer less than or equal to given x values. For instance, the greatest integer less than or equal to 5.1, 5.5 and 5.9 is 5 each time, so the points (5.1, 5), (5.5, 5) and (5.9, 5) are all on one of the steps. Similarly, the greatest integer less than or equal to 2 is 2 and –3 is –3, so the points (2, 2) and (-3, -3) are on the graph; both are left endpoints of a step. The greatest integer less than or equal to –0.1, -0.5 and –0.99 is –1 each time, so the points (-0.1, -1), (-0.5, -1), and (-0.99, -1) are all on one of the steps.



Do your best! Live and learn!