# A Library of Parent Functions

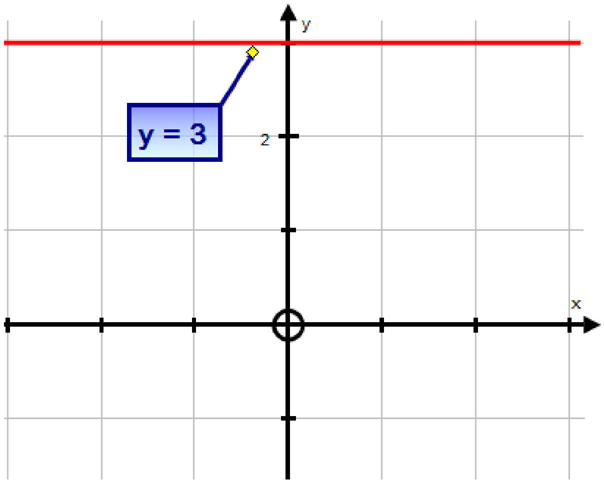
In nature, a mother or a father may have many offspring. In mathematics, a parent function can be transformed into many—in fact, infinitely many— new functions. A family of functions is comprised of these new functions and the parent function. Every function can be classified as a member of a family. Certain functions are identified as parent functions of these families. For example, the function $f(x)=x^2$ or $y=x^2$ is the parent function of the family of quadratic functions.

The basic parent functions are listed below with their graphs:

**Constant Functions**

The constant function is defined to be $f(x)=c$, where *c* is some real number.

Any real input yields the same output, *c*.
A constant function *f* is even, since:
$x \in \mathbb{R}$ , $f(x)=c$ and $f(-x)=c$, and it has a flat horizontal graph. for example, our graph for *y*=3.

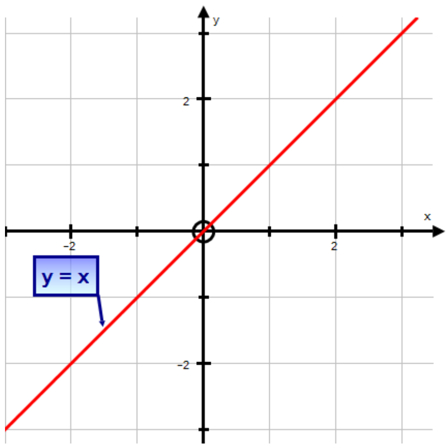



Remark: $f(x)=3$, for example, represents an even function, although 3 is an odd integer. Don't confuse the issue of even and odd functions with even and odd integers.

**The Identity Functions**

The identity function is defined to be $f(x)=x$.It is called an identity function because its output is identical to its input.

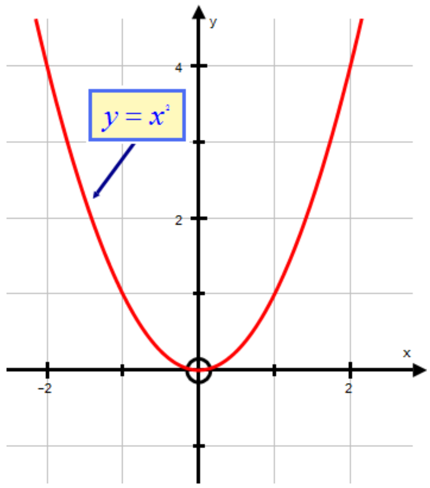
This function comes up in the discussion of inverse functions



**The Quadratic Function** **"BOWLS"**

The squaring function is defined to be $f(x) = x^2$. The graph for the $x^2$ function is called a parabola, which is a type of conic section we will see again later this year.

Because $f$ is an even function, its graph is symmetric about the *y*-axis

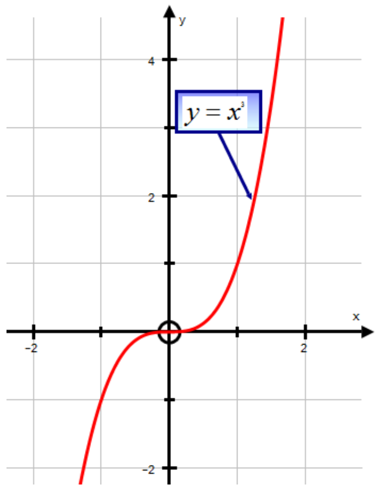



The graphs of $x^2, x^4, x^6$, etc. never fall below the *x*-axis, because the corresponding functions are never negative in value.

The graphs of $x^4, x^6, x^8$, etc. are also symmetric about the *y*-axis (because they also correspond to even functions) and have similar "**bowl**" shapes, but they are not parabolas.

**The Cubic Function** **"SNAKES"**

The cubic function is defined to be $f(x) = x^3$. The graph of the function is shown. The graph of the function is symmetric about the origin because $f$ is an odd function, its graph is symmetric about the origin.




The graphs for $x^5, x^7, x^9$, etc. are also symmetric about the origin (because they also correspond to odd functions) and have similar "snake" shapes.

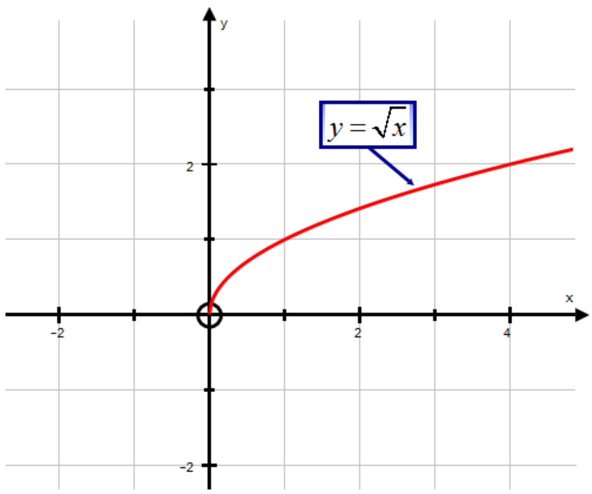
We discussed the graph of the identity function, the straight line may be thought of as a degenerate snake.

**"RADICAL" GRAPHS**

The square root function is defined by $f(x) = \sqrt{x}$.

The domain of $f$ is $[0, +\infty)$. The range of $f$ is $[0, +\infty)$.

This function is neither even nor odd.

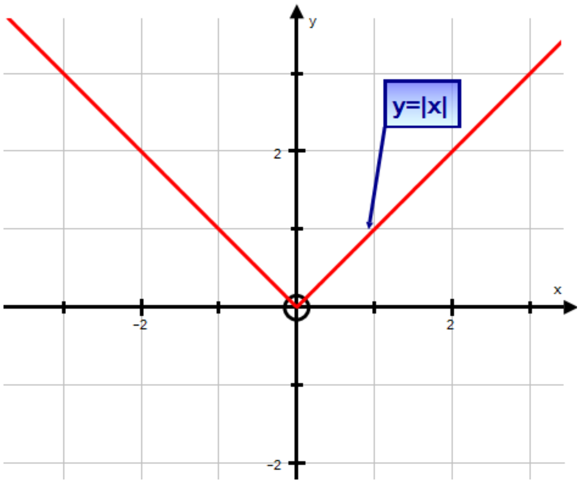


## The Absolute Value Function

The absolute value function is defined to be $f(x)=|x|$

Its piecewise definition is: $f(x)=\begin{cases} x, & if \quad x \geq 0 \\ -x, & if \quad x < 0 \end{cases}$

It is an even function.




## Steps to graph a function:

- Find the x-intercept and the y-intercept and some other points. Construct a table as follows:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| x | 0 | | 1 | 2 | 3 | 4 | -1 |
| y | | 0 | | | | | |

- Write the ordered pairs value of the points
- Plot the points in a Cartesian system
- Join the points and extend the graph