Readiness for Calculus
… Functions (Definitions, Descriptions)

Domain and Range

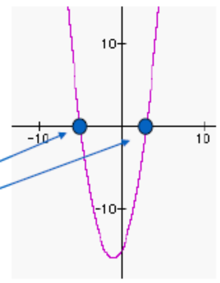
The **domain** of a function is the set of values that we are allowed to plug into our function. This set is the x values in a function such as $f(x)$.

The **range** of a function is the set of values that the function assumes. This set is the values that the function shoots out after we plug an x value in. They are the y values.

Roots (Zeros)

Here is the graph of our polynomial function:

$$y = x^2 + 2x - 15$$



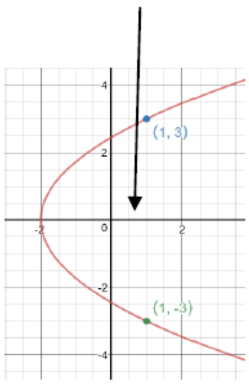
The *Zeros* of the Polynomial are the values of x when the polynomial equals zero. In other words, the *Zeros* are the x-values where *y equals zero*.

Graphical Test for Symmetry

X-Axis Symmetry:

If the point (x, y) is on the graph, the point $(x, -y)$ is also on the graph.

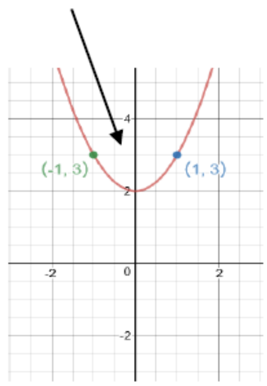
The X-Axis acts like a mirror.



Y-Axis Symmetry:

If the point (x, y) is on the graph, the point $(-x, y)$ is also on the graph.

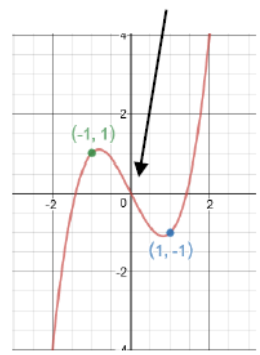
The Y-Axis acts like a mirror.



Origin Symmetry:

If the point (x, y) is on the graph, the point $(-x, -y)$ is also on the graph.

If you spin the picture upside down about the Origin, the graph looks the same!



Symmetry

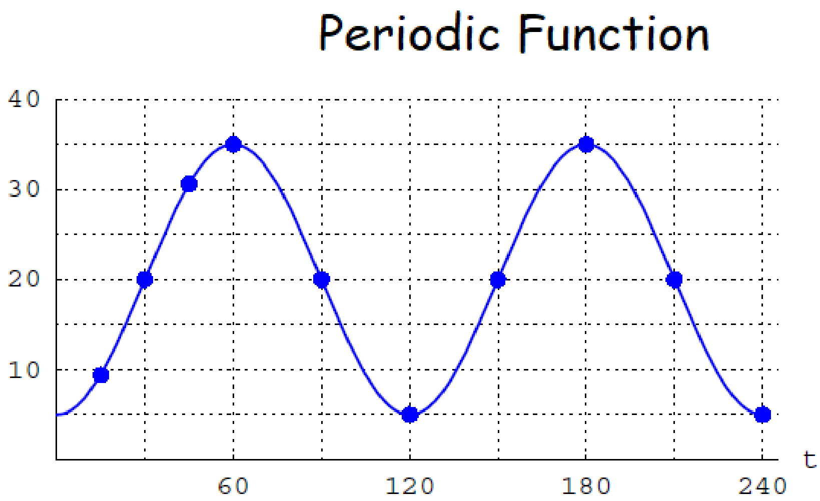
***Even** Functions have <u>Y-Axis</u> Symmetry!*

***Odd** Functions have <u>Origin</u> Symmetry!*

Odd Function … Even Function

A function is an **even function** if $f(x) = f(-x)$ for all values of x in the domain of f. In other words, even functions are symmetric across the y-axis. In the graphs of even functions, if the point (x, y) is on the graph, then the point (−x, y) is too. If a polynomial function contains only even-numbered exponents and constant terms (and no absolute value signs), then it must be an even function.

A function is an **odd function** if $f(-x) = -f(x)$ for all values of x in the domain of f. In other words, even functions are rotationally symmetric around the origin. In the graphs of odd functions, if the point (x, y) is on the graph, then the point (−x, −y) is too. If a polynomial function contains only odd-numbered exponents (and no constant terms or absolute value signs), then it must be an odd function.



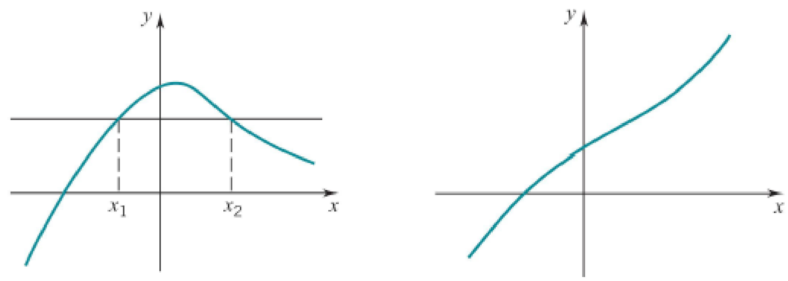
Definition. A function f is called *periodic* if its output values repeat at regular intervals. Graphically, this means that if the graph of f is shifted horizontally by p units, the new graph is identical to the original. Given a periodic function f:

1. The *period* is the horizontal distance that it takes for the graph to complete one full cycle. That is, if p is the period, then $f(t + p) = f(t)$.
2. The *midline* is the horizontal line midway between the function's maximum and minimum output values.
3. The *amplitude* is the vertical distance between the function's maximum value and the midline.

One-to-One Function

Definition of the One-To-One Functions

What are One-To-One Functions? Geometric Test



f is not one-to-one: $f(x_1) = f(x_2)$

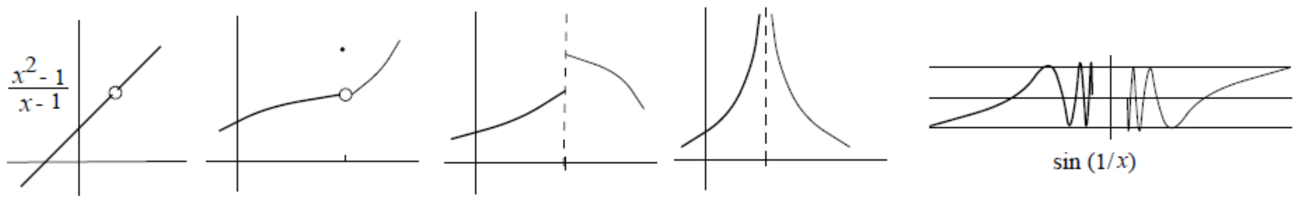
f is one-to-one:

Horizontal Line Test

- If some horizontal line intersects the graph of the function more than once, then the function is not one-to-one.
- If no horizontal line intersects the graph of the function more than once, then the function is one-to-one.

Discontinuous Functions

Types of Discontinuity



removable *removable* *jump* *infinite* *essential*