Transformations of Functions

We will now look at graphing a function without actually knowing the equation. Based on the graph of a function, it will be possible to shift, or translate the graph in any manner indicated.

For example, if given the picture of a graph and told "This is the graph of the function $f_{(x)}$***." Proceed to first identify the coordinate of any vertex seen. These will serve as a guide for the graph of the function's translation.***

To graph the function of $f_{(x+6)}$***, the function will need to shift to the left 6 spaces. To accomplish this, subtract 6 from all x values in the original function. The results will be the coordinates for the new graph. Likewise, to graph*** $f_{(x-4)}$***, this function will need to shift to the right 4 spaces, so add 4 to all x values.***

In order to graph $f_{(x)}+5$***, the function will shift up 5 spaces, requiring that 5 be added to all y values. If asked to graph*** $f_{(x)}-3$***, the will function shift down 3 spaces, meaning subtract 3 from all y values.***

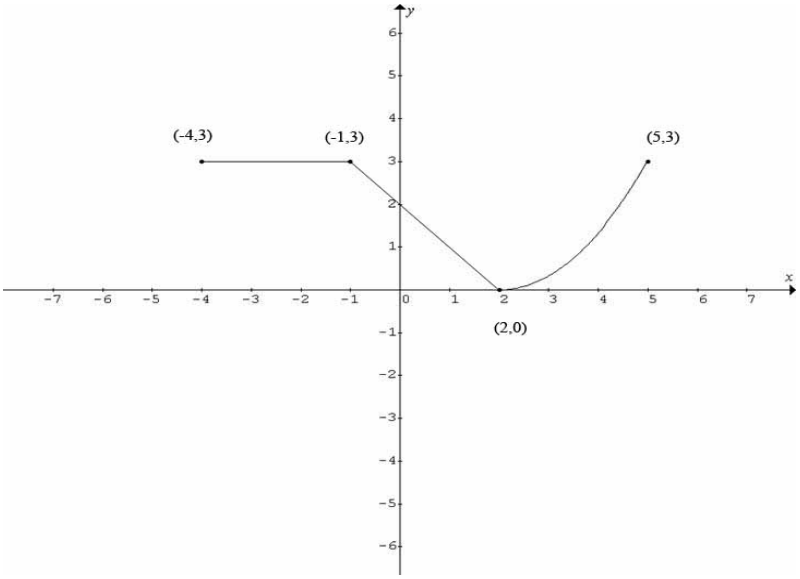
If the number is in the parenthesis, the function is shifting using P.L.N.R.. If the number is after the $f_{(x)}$***, simply shift as indicated, + says shift up, - says shift down.***

Any number in front of the $f_{(x)}$ ***will affect the scale of the function. This means it will affect the rate at which the function grows. When graphing, for example,*** $-f_{(x)}$***, change the sign of all y values on the graph of the function. This will cause the graph of the function to flip upside down. A number other than -1 can also be used. Lets say we need to graph*** $3f_{(x)}$***, this means the actual curve will increase 3 times as fast. It will therefore, be necessary to multiply all y values by 3. This will result in the coordinates for the new function. If the 3 were grouped with the x such as*** $f_{(3x)}$***, the horizontal change is the inverse of what it appears to be. So instead of multiplying x values by 3, divide by 3.***

When graphing $f_{(-x)}$***, take the opposite of the x values of the function. This will cause the graph of the function to flip along a vertical axis.***

Combinations of these rules will be encountered throughout your study of functions, for example, to shift right 3 and up 6. Just stick with the rules and the graph will be translated to its new location. If faced with a problem such as $2f_{(x)}+3$***, <u>follow the order of operations</u>. Multiply all y values by 2 first, then add 3 to each. Referring to the previous two topics, quadratic functions and absolute value functions, you will find references to these rules and examples throughout.***

Use the graph of the following function , $f(x)$, for each of the questions below.



1. State the domain of $f(x)$.

2. State the range of $f(x)$.

3. Find the intervals in which the value of the function is increasing, decreasing, and constant.

4. Graph $f(x+3)$

5. Graph $f(x-4)$

6. Graph $f(x)+3$

7. Graph $f(x)-4$

8. Graph $f(x-2)+4$

9. Graph $f(x+3)-2$

10. Graph $-f(x)$

11. Graph $4-f(x-2)$

12. Graph $f(-x)$