<u>Translations of Functions</u>

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.

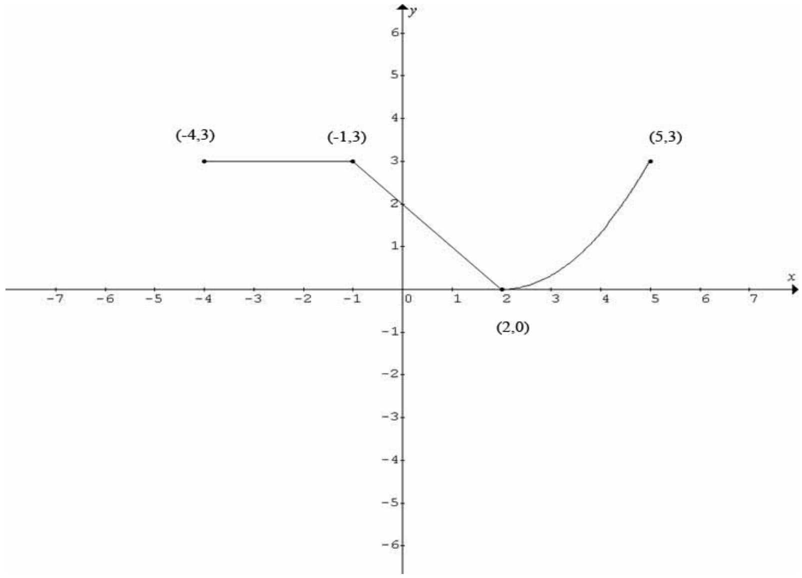
If the number is in the parenthesis, the function is shifting using P.L.N.R.. If the number is after the $f_{(x)}$, simply shift as indicated, + says shift up, - says shift down.

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.

The following is the graph of the function $f_{(x)}$. Use this to graph each function for letters A-D.



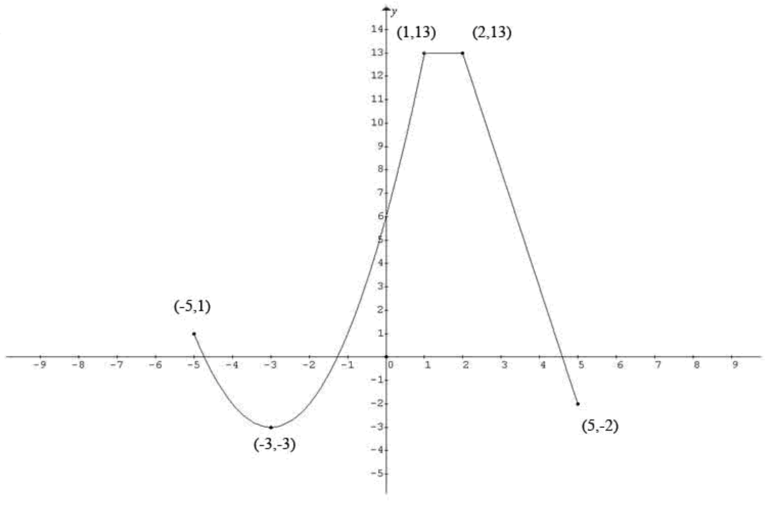
A) $f_{(x+2)}$

B) $f_{(x)} - 3$

C) $-f_{(x)} + 1$

D) $f_{(-x)}$

The following is the graph of the function $f_{(x)}$. Use this to graph each function for letters E-H.



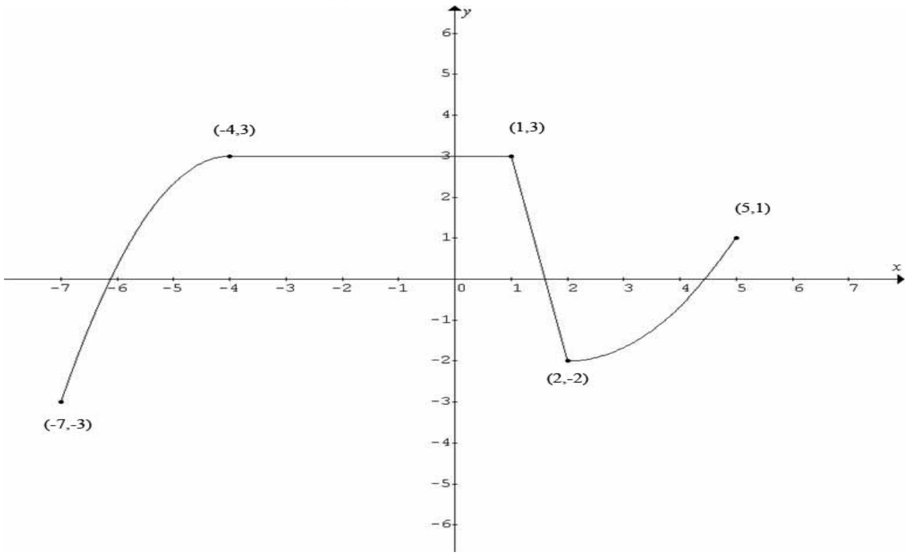
E) $f_{(x-1)}$

F) $\left|f_{(x)}\right|$

G) $f_{(x)} - 4$

H) $f_{(x+2)} - 3$

The following is the graph of the function $f_{(x)}$. Use this to graph each function for letters I-L.



I) $f_{(-x)}$

J) $f_{(x-2)} - 1$

K) $-f_{(x)} + 1$

L) $\frac{1}{3} f_{(x)}$