Lesson 2.6 Warm Up (Clickers)

1. Write the equation of a line in slope-intercept form that goes through the points (-5, 7) and (0, -2).

2. Graph the equation y = 1/2x - 3.

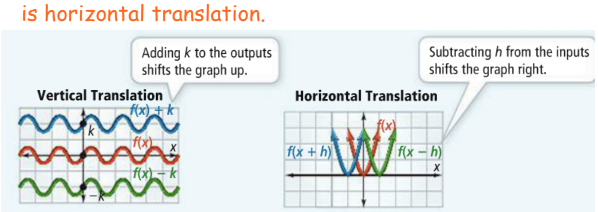
Lesson 2.6 Families of Functions

Essential Understanding: There are sets of functions, called families, in which each function is a transformation of a special function called the parent.

The linear functions form a family of functions. Each linear function is a transformation of the function y = x. The function y = x is the parent function.

A parent function is the simplest for in a set of functions that form a family. Each function in the family is a transformation of the parent function.

One type of transformation is a translation. A translation shifts the graph of the parent function horizontally vertically, or both without changing shape or orientation. For a positive constant k and a parent function f(x), f(x) + k is a vertical translation. For a positive constant k and a parent function f(x), f(x + k) is horizontal translation.



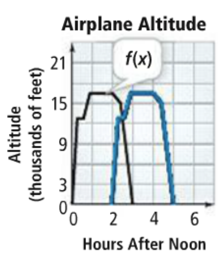
Ex. How are the functions y = x and y = x - 2 related? How are their graphs related?

Ex. What is the graph of $y = x^2 - 1$ translated up 5 units?

1 How are the graphs of y = 2x and y = 2x - 3 related?

2 What is the equation of the graph y = 3x translated up 2 units?

Ex. The graph shows the projected altitude f(x) of an airplane scheduled to depart an airport at noon. If the plane leaves two hours late, what function represents this transformation?

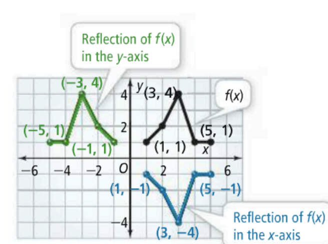


A <u>reflection</u> flips the graph of a function across a line, such as the x- or y-axis. Each point on the graph of the reflected function is the same distance from the line of reflection as its corresponding point on the graph of the original function.

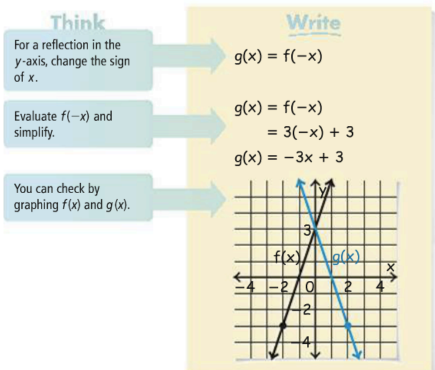
When you reflect a graph in the y-axis, the x-values change signs and the y-values stay the same.

When you reflect a graph in the x-axis, the x-values stay the same and the y-values change signs.

For a function $f(x)$, the reflection in the y-axis is $f(-x)$ and the reflection in the x-axis is $-f(x)$.



Ex. Let g(x) be the reflection of f(x) = 3x + 3 in the y-axis. What is a function rule for g(x)?



Ex. Let h(x) be the reflection of f(x) = 3x + 3 on the x-axis. What is a function rule for h(x)? (hint: since it is across the x-axis the 'y' needs to be -y or h(x) = -h(x).)

Ex. Let g(x) be the reflection of f(x) = 2x - 7 over the x-axis. What is the function rule for g(x)?

3 Let g(x) be the reflection of f(x) = -5x - 7 over the y-axis. What is the function rule for g(x)?

A <u>vertical stretch</u> multiplies all y-values of a function by the same factor greater than 1. A <u>vertical compression</u> reduces all y-values of a function by the same factor between 0 and 1. For a function f(x) and a constant a, y = af(x) is a vertical stretch when a>1 and a vertical compression when 0 < a <1.

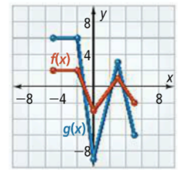
The table at the right represents the function $f(x)$. What are corresponding values of $g(x)$ and possible graphs for the transformation $g(x) = 3f(x)$?

x	$f(x)$
−5	2
−2	2
0	−3
3	1
5	−2

Step 1 Multiply each value of $f(x)$ by 3 to find each corresponding value of $g(x)$.

x	$f(x)$	$3f(x)$	$g(x)$
−5	2	3(2)	6
−2	2	3(2)	6
0	−3	3(−3)	−9
3	1	3(1)	3
5	−2	3(−2)	−6

Step 2 Use the values from the table in Step 1. Draw simple graphs for $f(x)$ and $g(x)$.



Concept Summary Transformations of $f(x)$

Vertical Translations
Translation up k units, $k > 0$
$y = f(x) + k$
Translation down k units, $k > 0$
$y = f(x) - k$

Horizontal Translations
Translation right h units, $h > 0$
$y = f(x - h)$
Translation left h units, $h > 0$
$y = f(x + h)$

Vertical Stretches and Compressions
Vertical stretch, $a > 1$
$y = af(x)$
Vertical compression, $0 < a < 1$
$y = af(x)$

Reflections
In the x-axis
$y = -f(x)$
In the y-axis
$y = f(-x)$

Ex. The graph of g(x) is the graph of f(x) = 4x compressed vertically by the factor 1/2 and then reflected in the y-axis. What is a function rule for g(x)?

Ex. What transformations change the graph of f(x) to the graph of g(x)?

$f(x) = 2x^2$ $g(x) = 6x^2 - 1$

4 The graph of $g(x)$ is the graph of $f(x) = x$ stretched vertically by a factor of 2 and then translated down 3 units. What is the function rule for $g(x)$?

Ex. What transformations change the graph of $f(x) = x^2$ to the graph of $g(x) = (x + 4)^2 - 2$? (use the correct function notation)