Algebra I
Lesson 5.9 – Transforming Linear Functions
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Families. How many times have you heard, "You look just like your mother!" or "You certainly see the family resemblance." Maybe you have thought that about your friend who looks exactly like one of the parents. Well, functions have family bonds too. Functions will look like their **parent function.**

Vocabulary

family of functions – a set of functions whose graphs have basic characteristics in common.
parent function – the most basic function in a family; strip away all coefficients, negative signs, constants, etc you get the parent function.
transformation – a change in position or size of a figure

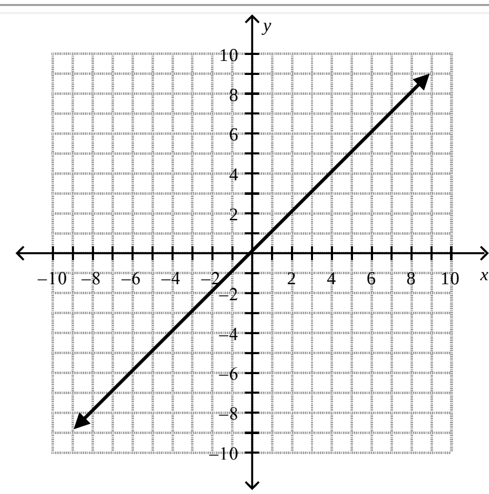
1. *translation – every point is moved the same distance and same direction; the graph slides in a direction*
2. *rotations – the graph is rotated about a point*
3. *reflections – a reflection across a line producing a mirror image; a "flip" of the image across a line*

Linear Parent Function:
When we think of a linear equation we come up with, $y = 4x - 3\ or\ something\ like\ that.$ As in the definition, take everything away except for the $x\ and\ y$ what do you get?
$y = 4x + 3$ this leaves us with $\boldsymbol{y = x}$. Using function notation we have for our linear parent function as being defined as:

$$f(x) = x \quad or \quad y = x$$

What do you notice?

Any linear function can be graphed by transforming the parent function.



Translation

If we take our slope-intercept form: $y = mx + b$, we know that b is our y-intercept and when $b \neq 0$ we will see the line move up or the y-axis.

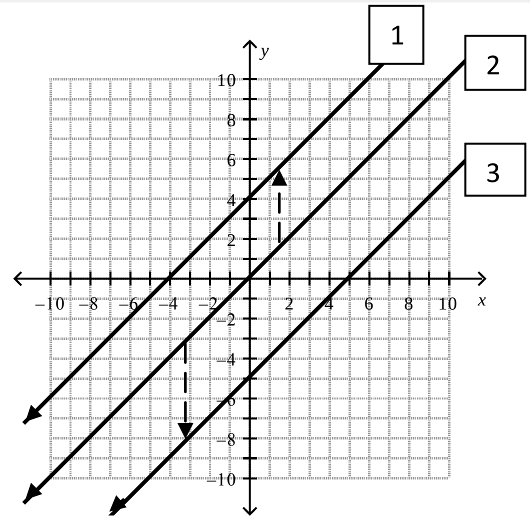
Graph:

1. $y = x + 4$
2. $y = x$
3. $y = x - 5$

Note the slide up of 4 units on graph 1.

The slide down 5 units on graph 3

How do these vertical translations show up in the x-intercepts?



Rotation

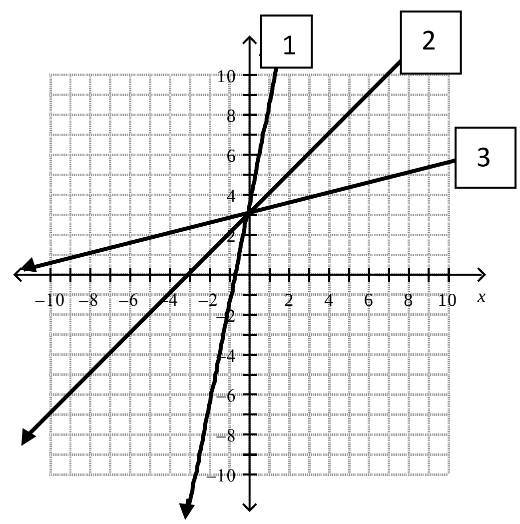
When we change the slope, m it causes a rotation of the graph about the point $(0, b)$. This is seen by a change in the line's steepness.

Graph:

1. $f(x) = \frac{1}{4}x + 3$
2. $f(x)y = x + 3$
3. $f(x) = 5x + 3$

Note how the parent function seems to rotate about the point (0, 3) Almost looks like spokes on a bicycle wheel with (0, 3) as the axle.

The greater the absolute value of the slope the steeper the graph. The smaller the absolute value of the slope the flatter. *Remember flat – fractions.*



Reflection

When the slope m is multiplied by – 1, in $f(x) = mx + b$, the graph is reflected across the y-axis.

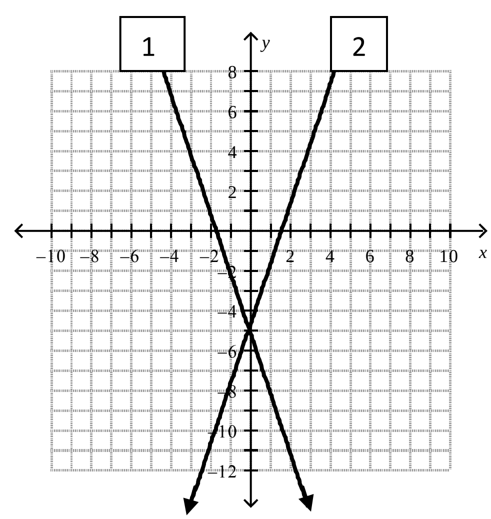
Graph:

1. $f(x) = -3x - 5$
2. $f(x) = 3x - 5$

Note the positive and negative slopes.

Note the mirror reflection across the y-axis.

Note that we had ***multiple*** *transformations: Translation* down 5 units, *Rotation* by multiplying f(x) by 3, and *Reflection* by multiplying f(x) by – 1.



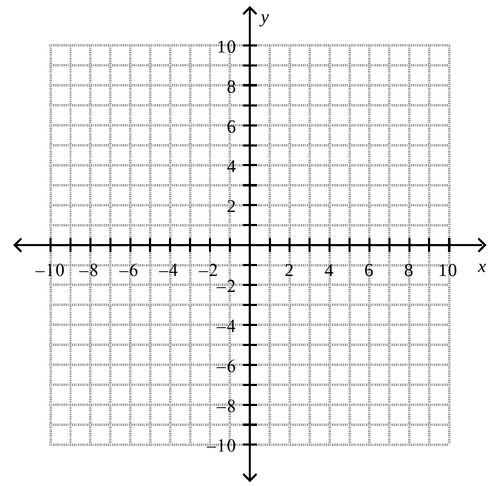
Graph f(x) and g(x) and describe the transformation of f(s) to g(x).

$$f(x) = x, \quad g(x) = x - 5$$

$$f(x) = x + 1, \quad g(x) = \frac{1}{2}x + 1$$

$$f(x) = \frac{1}{5}x + 3, \quad g(x) = x - 2$$

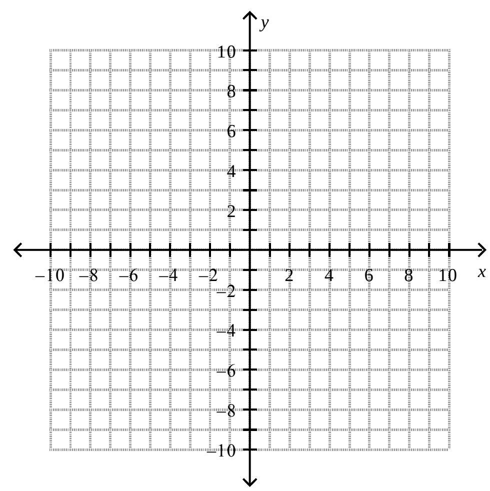
$$f(x) = -x, \quad g(x) = -\frac{1}{2}x - 3$$



Graph h(x) and reflect it across the y-axis, write the reflected function.

$$h(x) = -\frac{1}{5}x,$$

$$h(x) = -\frac{1}{3}x - 6$$



Graph $3x - 8y = 24$ using intercepts