Name: _____ Group Members: _____

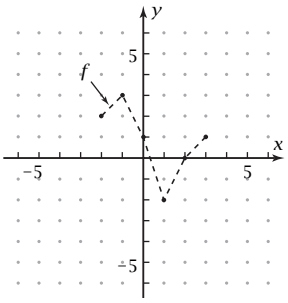
Exploration 1-3a: Translations and Dilations, Numerically

Date: _____

Objective: By calculating values and plotting points, discover the effect on a function graph of adding and multiplying by constants.

1. The table shows values of a **pre-image** function $y = f(x)$. The graph of f is a set of line segments connecting the points, shown dashed in the figure. Find values of the **image** function $g(x) = f(x) + 3$. For instance, $g(-2) = 2 + 3 = 5$. Plot the graph of this transformed function.

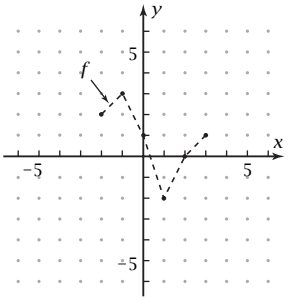
x	$f(x)$	$g(x)$
−2	2	
−1	3	
0	1	
1	−2	
2	0	
3	1	



2. The transformation in Problem 1 is a **vertical translation** by 3 units. Give the meaning of a vertical translation.

3. Use the values of $f(x)$ in Problem 1 to make a table of values of a new image function, $g(x) = f(x - 3)$. For instance, $g(1) = f(1 - 3) = f(-2) = 2$. Plot the image of this transformed function.

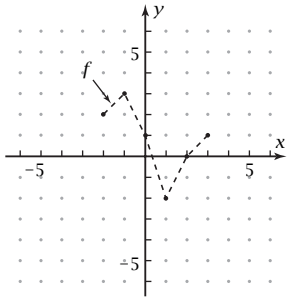
x	$g(x) = f(x - 3)$
1	
2	
3	
4	
5	
6	



4. Describe the transformation in Problem 3.

5. Use the values of $f(x)$ in Problem 1 to make a table of values of a new image function, $g(x) = 2f(x)$. For instance, $g(-1) = 2f(-1) = 2 \cdot 3 = 6$. Plot the image of this transformed function.

x	$g(x) = 2f(x)$
−2	
−1	
0	
1	
2	
3	



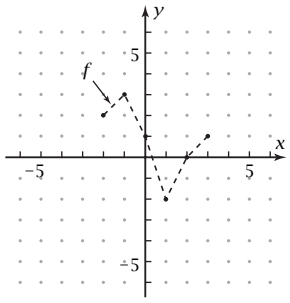
6. The transformation in Problem 5 is a **vertical dilation** by a factor of 2. Give the meaning of a vertical dilation, and explain how it differs from a vertical translation.

7. Use the values of $f(x)$ in Problem 1 to make a table of values of a new image function, $g(x) = f\left(\frac{1}{2}x\right)$. For instance,

$$g(-2) = f\left(\frac{1}{2} \cdot (-2)\right) = f(-1) = 3$$

Plot the image of this transformed function.

x	$g(x) = f\left(\frac{1}{2}x\right)$
−4	
−2	
0	
2	
4	
6	



8. The transformation in Problem 7 is a **horizontal dilation.** By what factor is the graph dilated? How is that factor related to the $\frac{1}{2}$ in $f\left(\frac{1}{2}x\right)$?

9. What did you learn as a result of doing this Exploration that you did not know before?