

2.5 TRANSFORMATIONS ON GRAPHS

Types of transformations:

- (1) **Translations** - a "slide"
- (2) **Reflections** - a "flip" about a line
- (3) **Rotations** - a "turn" about a point
- (4) **Dilations** - **compressions** or **stretches**

The first 3 transformations do not affect the "shape" of a graph.

Before we start, try these:

For all the transformation below $f(x) = x^2$. Put $f(x)=x^2$ in Y1 of your calculator and each transformation on Y2. Compare the graphs and describe each transformation.

- 1) $f(x) + 5$ ___Vertical translation/slide up_____
- 2) $f(x - 3)$ ___Horizontal translation/slide up _____
- 3) $f(-x)$ ___Reflection/flip over y-axis_____
- 4) $-f(x)$ ___ Reflection/flip over x-axis _____
- 5) $3 \cdot f(x)$ ___Vertical stretch_____
- 6) $f(2x)$ ___Horizontal compression_____

FOR PROBLEMS 7-12

When executing a transformation you may be manipulating x before you execute the function, manipulating the result you get from the function, or manipulating both.

When the transformation manipulates x , as in **$f(x+2)$** , the point you plot is created as follows:

- The x you plot is the x you start with.
- The y you plot is the y you get when you evaluate the function for the MANIPULATED X .

For $f(x) = 3x + 11$, $f(7) = 32$. Plotted as $(7, 32)$

Given this $f(x)$, **$f(x+2)$** evaluated at $x=7$ would be plotted as follows:

$(1, f(x+2))$ or $(1, 3(7+2)+11)$ or $(1, 38)$

When the transformation manipulates $f(x)$, as in **$5*f(x)$** , the point you plot is created as follow:

- The x you plot is the x you start with.
- The y you plot is the result you get when you evaluate the function for the starting x and then manipulate the functions result.

For $f(x) = 3x + 11$, $f(7) = 32$. Plotted as $(7, 32)$

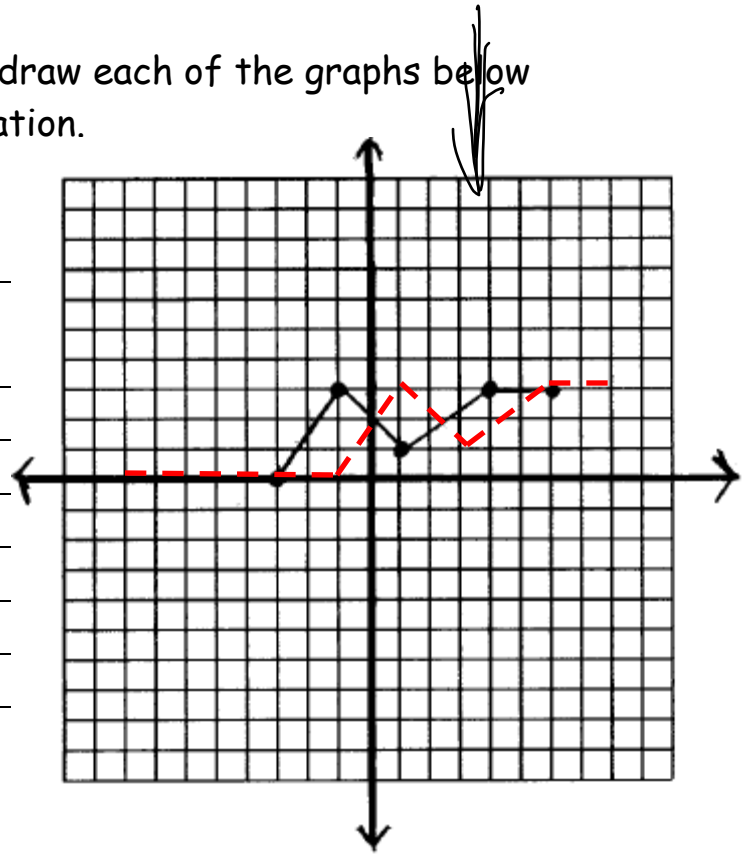
Given this $f(x)$, **$5*f(x)$** evaluated at $x=7$ would be plotted as follows:

$(1, 5*f(x))$ or $(1, 5*(3(7)+11))$ or $(1, 160)$

Complete the table to help you redraw each of the graphs below according to the given transformation.

7) $f(x - 2)$

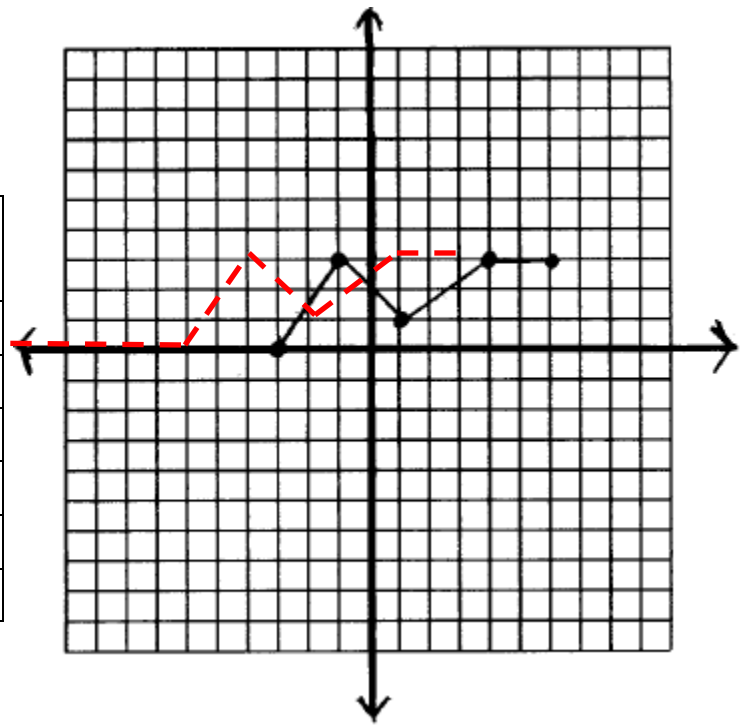
	Old y	Old pt		New Y	New Pt
X	f(x)	(x,y)	x-2	f(x-2)	(x,y)
-3	0	(-3,0)	-5	0	(-3,0)
-1	3	(-1,3)	-3	0	(-1,0)
1	1	(1,1)	-1	3	(1,3)
4	3	(4,3)	2	1.5	(4,1.5)
6	3	(6,3)	4	3	(6,3)



Describe the transformation: horizontal translation right 2

8) $f(x + 3)$

	Old y	Old pt		New Y	New Pt
X	f(x)	(x,y)	x+3	f(x+3)	(x,y)
-3	0	(-3,0)	0	2	(-3,2)
-1	3	(-1,3)	2	1.5	(-1,1.25)
1	1	(1,1)	4	3	(1,3)
4	3	(4,3)	7	Undef.	Undef.
6	3	(6,3)	9	Undef.	Undef.

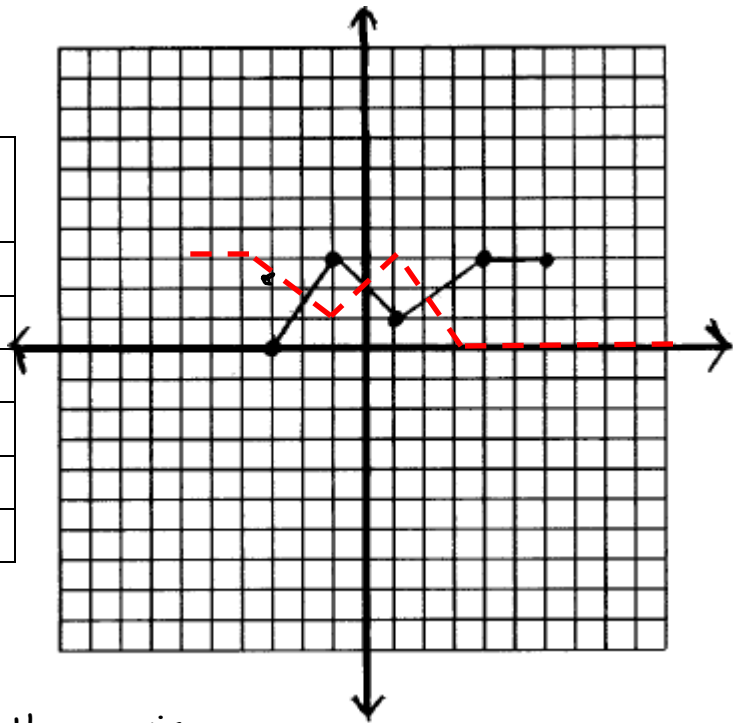


Describe the transformation: horizontal translation left 3

Complete the table to help you redraw each of the graphs below according to the given transformation.

9) $f(-x)$

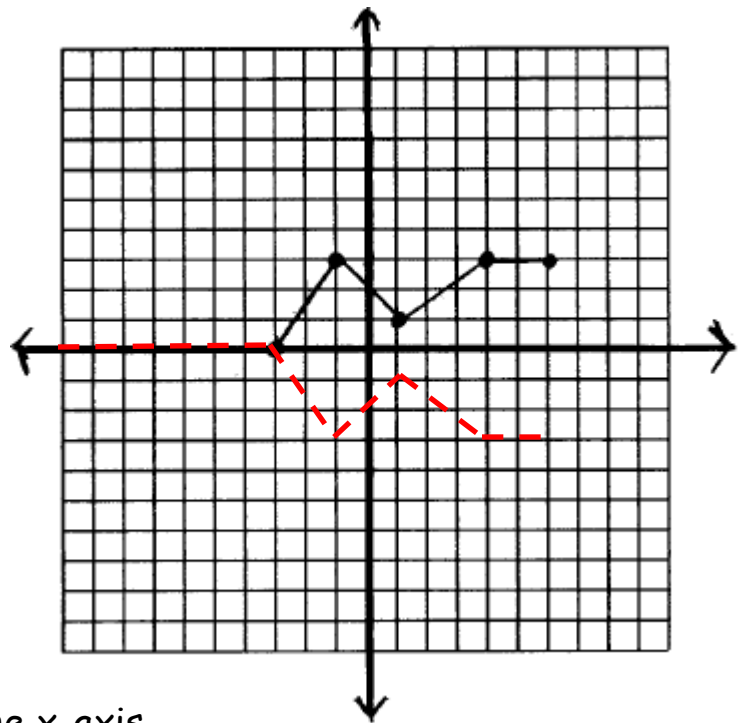
	Old y	Old pt		New Y	New Pt
X	f(x)	(x,y)	-x	f(-x)	(x,y)
-3	0	(-3,0)	3	2.1	(-3,2.1)
-1	3	(-1,3)	1	1	(-1,1)
1	1	(1,1)	-1	3	(1,3)
4	3	(4,3)	-4	0	(4,0)
6	3	(6,3)	-6	0	(6,0)



Transformation: _____ Rotate over the y-axis _____

10) $-f(x)$

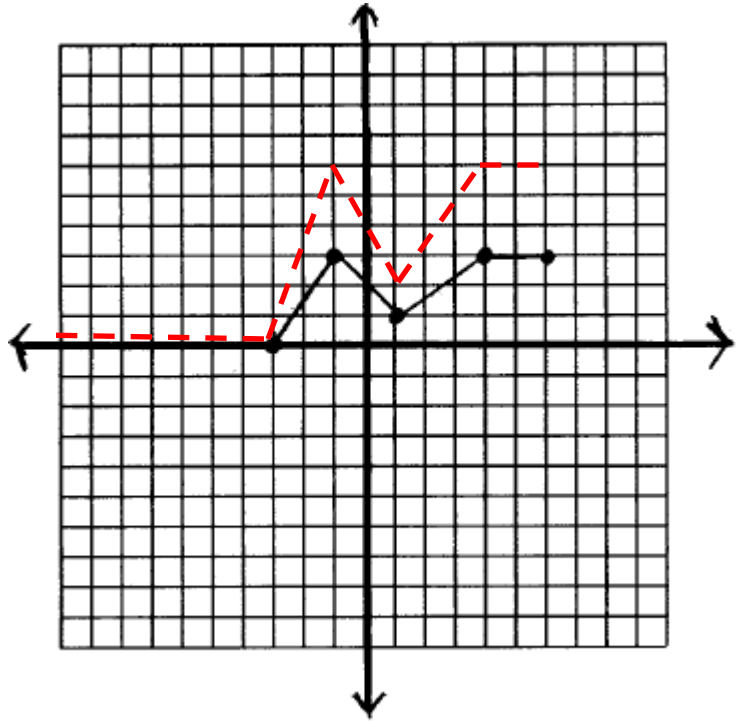
	Old y	Old pt	New Y	New Pt
X	f(x)	(x,y)	-f(x)	(x,y)
-3	0	(-3,0)	0	(-3,0)
-1	3	(-1,3)	-3	(-1,-3)
1	1	(1,1)	-1	(1,-1)
4	3	(4,3)	-3	(4,-3)
6	3	(6,3)	-3	(6,-3)



Transformation: ___rotate over the x-axis___

11) $2 \cdot f(x)$

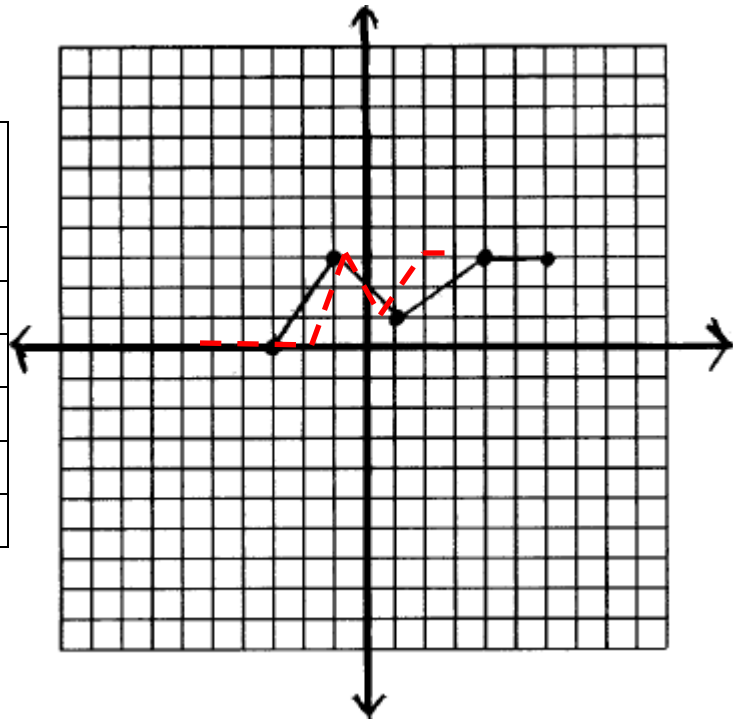
	Old Y	Old pt	New Y	New Pt
X	f(x)	(x,y)	2f(x)	(x,y)
-3	0	(-3,0)	0	(-3,0)
-1	3	(-1,3)	6	(-1,6)
1	1	(1,1)	2	(1,2)
4	3	(4,3)	6	(4,6)
6	3	(6,3)	6	(6,6)



Transformation: _____Vertical stretch_____

12) $f(2x)$

	Old Y	Old pt		New Y	New Pt
X	f(x)	(x,y)	2x	f(2x)	(x,y)
-3	0	(-3,0)	-6	0	(-3,0)
-1	3	(-1,3)	-2	1.5	(-1,1.5)
1	1	(1,1)	2	1.5	(1,1.5)
4	3	(4,3)	8	Undef.	Undef.
6	3	(6,3)	12	Undef.	Undef.



Transformation: _____Horiontal compression_____