

QUIZ DATES: \_\_\_\_\_ & \_\_\_\_\_

Math 2 – Honors  
Unit 2 – Quadratic Functions  
Lesson 1 – Transformations

TEST DATE: \_\_\_\_\_

Name \_\_\_\_\_

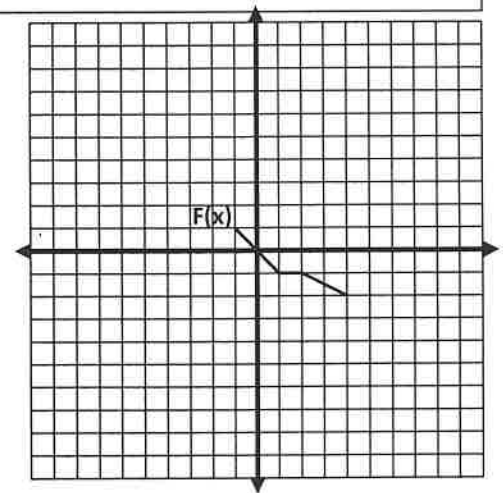
Date \_\_\_\_\_ Pd \_\_\_\_\_

➤ Review:

- A Relation is any set of ordered pairs.
- Domain: set of all x values in a relation
- Range: set of all y values in a relation
- A Function is a relation in which each element of the domain is paired with exactly one element of the range.
- Graphically, a function must pass the vertical line test (VLT) in order to be classified as a function.

➤ Examine the graph of  $F(x)$  to the right:

$x$	$F(x)$
-1	1
1	-1
2	-1
4	-2



1. Is  $F(x)$  a function? Why or why not?

2. What is the domain of  $F(x)$ ?

3. What is the range of  $F(x)$ ?

4. Evaluate each of the following key points on  $F(x)$ :

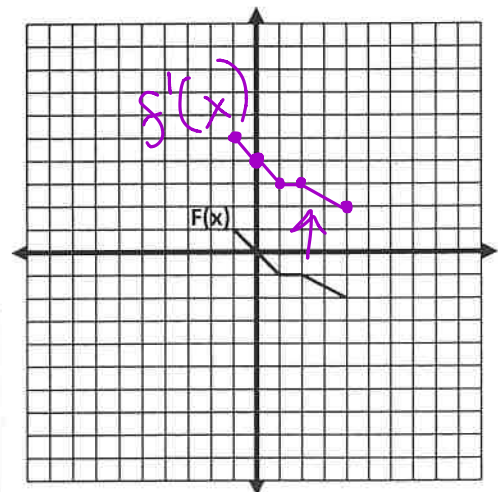
$F(1) = \frac{-1}{1}$     $F(2) = \frac{-1}{2}$     $F(4) = -2$     $F(-1) = 1$

❖ Remember that  $F(x)$  is another name for the  $y$  - values → the equation of the function is  $y = F(x)$ .

➤ Now let's try graphing:  $y = F(x) + 4$ .

➤ Complete the table below for this new function and then graph on the coordinate.

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



Describe the transformation:

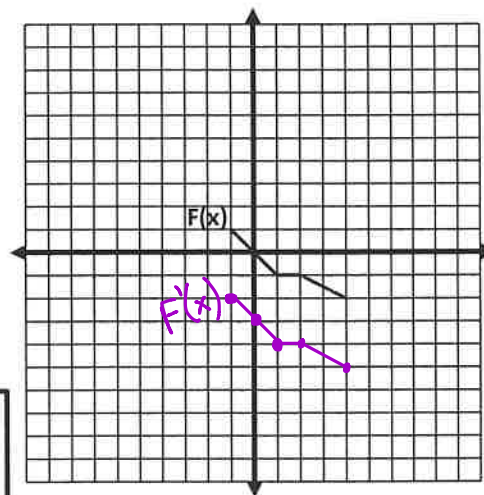
translate up 4

Did the transformation affect the domain or the range of the function?

No

Graph:  $y = F(x) - 3$ .

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



Describe the transformation:

Translate down 3

Did the transformation affect the domain or the range of the function?   
 Yes No

$f(x) \pm a$   
 translate up or down by a

❖ Checkpoint: Describe the affect for the following functions.

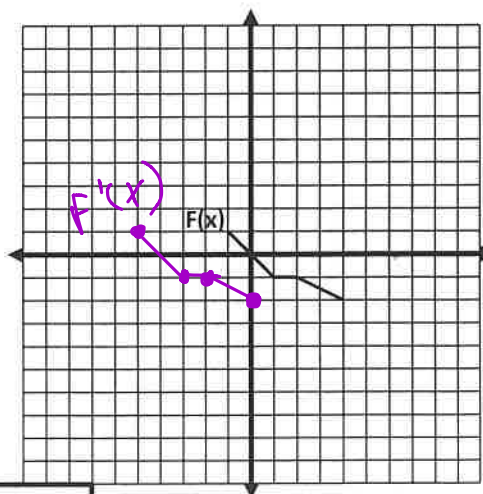
Equation	Effect to the graph
Example: $y = F(x) + 18$	Translate up 18 units
1. $y = F(x) - 10$	" 10
2. $y = F(x) + 3$	" 3
3. $y = F(x) + 32$	" 32
4. $y = F(x) - 1$	" 1

Graph:  $y = F(x + 4)$ .

Complete the table.

$x$	$x + 4$	$y$
-5	-1	1
-3	1	-1
-2	2	-1
0	4	-2

$x+4 = -1 - 5$



Describe the transformation:

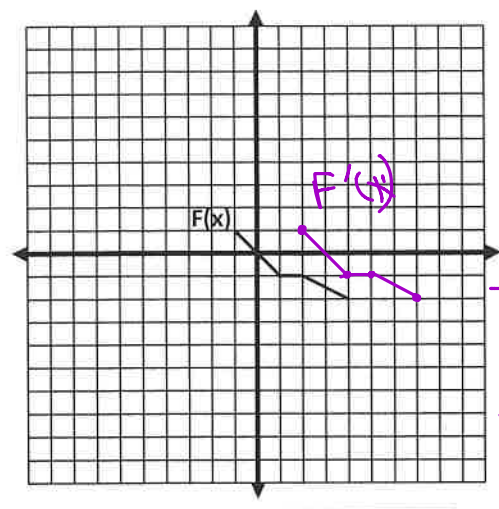
L 4

Did the transformation affect the domain or the range of the function?   
 Domain

➤ Graph:  $y = F(x - 3)$   $\neq 3$

Complete the table.

$x$	$x - 3$	$y$
	-1	
	1	
	2	
	4	



$f(x+a)$   
Left  
or right  
→ opp. what  
you would  
think

Describe the transformation:  $\downarrow 3$   
Did the transformation affect the domain or the range of the function? Domain

❖ **Checkpoint:** Describe the affect for the following functions.

Equation	Effect to the graph
Example: $y = F(x + 18)$	Translate left 18 units
1. $y = F(x - 10)$	" R 10
2. $y = F(x) + 7$	" U 7
3. $y = F(x + 48)$	" L 48
4. $y = F(x) - 22$	" D 22
5. $y = F(x + 30) + 18$	1) " L 30 / 2) " U 18

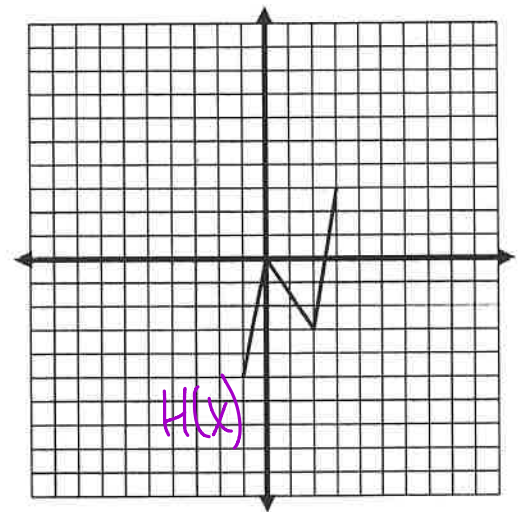
★

→ transformations must be done in order of operations **PEMDAS**

❖ **Checkpoint:** Write the equation for each translation:

Equation	Effect to the graph
Example: $y = F(x + 8)$	Translate left 8 units
1. $y = f(x) + 29$	Translate up 29 units
2. $y = f(x - 7)$	Translate right 7
3. $y = g(x + 45)$	Translate left 45
4. $y = f(x + 5) + 14$	Translate left 5 and up 14
5. $y = (x - 6) - 2$	Translate down 2 and right 6

➤ Now let's look at a new function.  
Its notation is  $H(x)$ .



1. What are the key points?

$(-1, -5), (0, 0), (2, -3), (3, 3)$

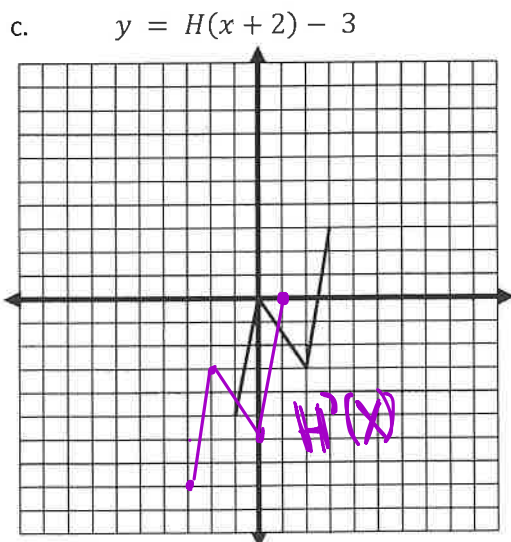
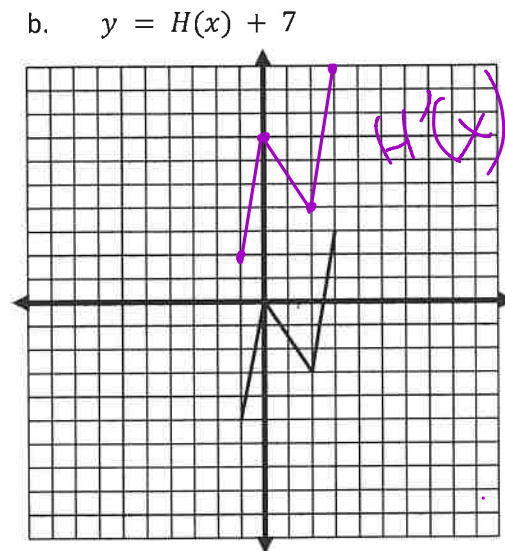
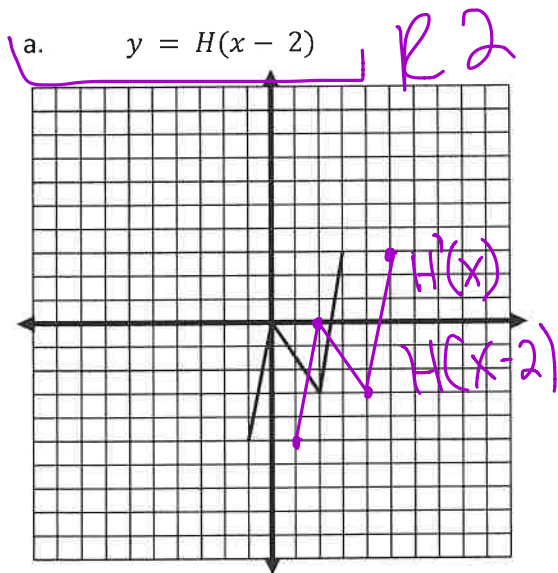
2. Describe the effect on the graph for each of the following.

a.  $H(x - 2)$  R 2

b.  $H(x) + 7$  U 7

c.  $H(x + 2) - 3$  L 2, D 3

3. Use your answers to questions 1 and 2 to help you sketch each graph without using a table. Then state the **DOMAIN & RANGE** of the image.

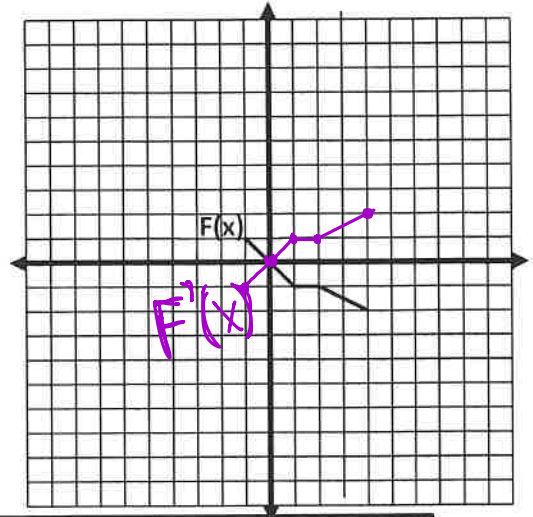


Recall that the equation:  $y = F(x)$  *R x-axis*

➤ Now let's graph:  $y = -F(x)$

$x$	$F(x)$	$y$
-1	1	-1
1	1	1
2	2	1
4	4	2

$(x, y) \rightarrow (x, -y)$

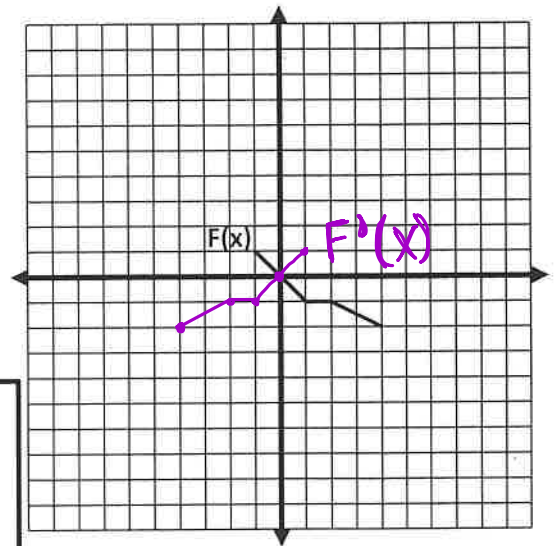


Describe the transformation: *R x-axis*  
 Did the transformation affect the domain or the range of the function? *Range*

➤ Graph:  $y = F(-x)$  *R y-axis*

$x$	$-x$	$y$
	-1	
	1	
	2	
	4	

$(x, y) \rightarrow (-x, y)$

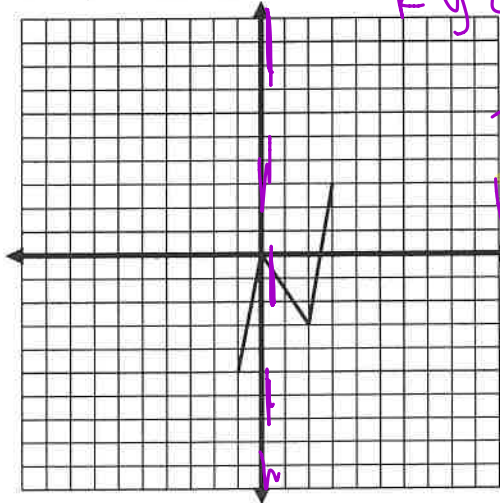


Describe the transformation: *R y-axis*  
 Did the transformation affect the domain or the range of the function? *Domain*

❖ Checkpoint:  $H(x)$  is shown on each grid.

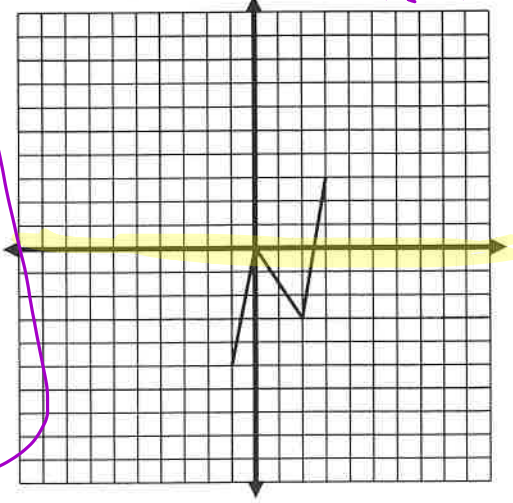
Graph without making a table

1.  $y = H(-x)$  *R y-axis*



*Vertical Reflection*  
*Horizontal Reflection*  
*Vertical Stretch*  
*Horizontal Stretch*

2.  $y = -H(x)$  *R x-axis*

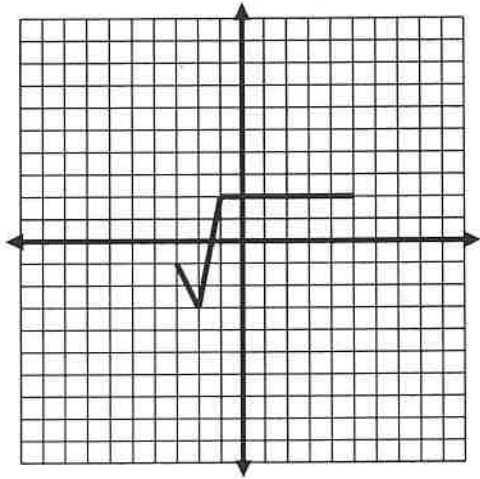


Math 2 – Honors  
 Unit 2 – Quadratic Functions  
 Lesson 1 – Transformations Homework

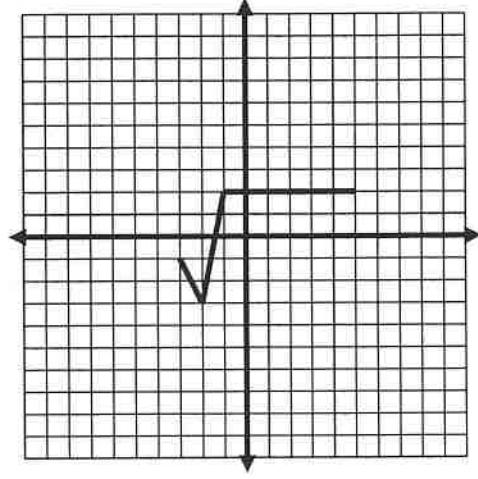
Name \_\_\_\_\_  
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I. On each grid,  $G(x)$  is graphed. Graph the given function.

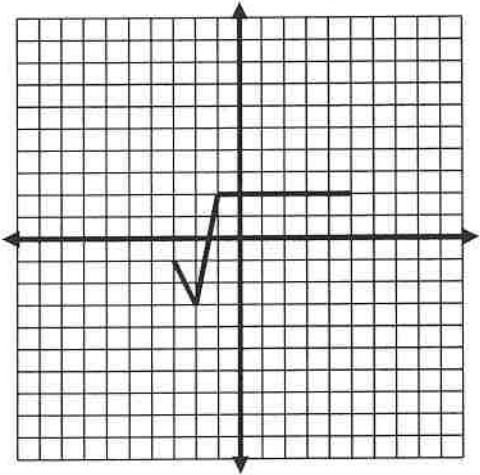
1. Graph:  $y = G(x) - 6$ .



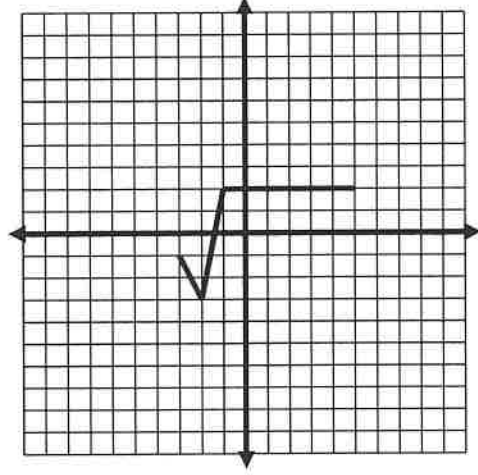
3. Graph:  $y = G(x + 2) + 5$



2. Graph:  $y = G(x + 6)$



4. Graph:  $y = G(x - 4) - 5$



II. Using the understanding you have gained so far, describe the effect to the following functions.

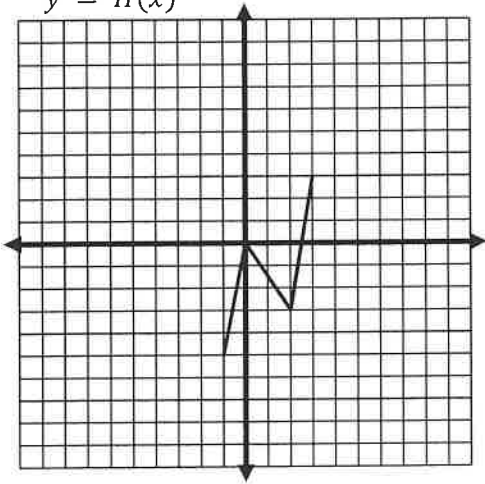
Equation	Effect to Fred's graph
1. $y = F(x) + 82$	T U 82
2. $y = F(x - 13)$	" R 13
3. $y = F(x + 9)$	" L 9
4. $y = F(x) - 55$	" D 55
5. $y = F(x - 25) + 11$	" R 25 then U 11

III. Using the understanding you have gained so far, write the equation that would have the following effect on the graph.

Equation	Effect to the graph
1. $y = f(x+51)$	Translate left 51 units
2. $y = f(x) - 76$	Translate down 76
3. $y = f(x-31)$	Translate right 31
4. $y = f(x-8) - 54$	Translate right 8 and down 54
5. $y = f(x+100) - 12$	Translate down 12 and left 100

IV. Determine the domain and range of each parent function.

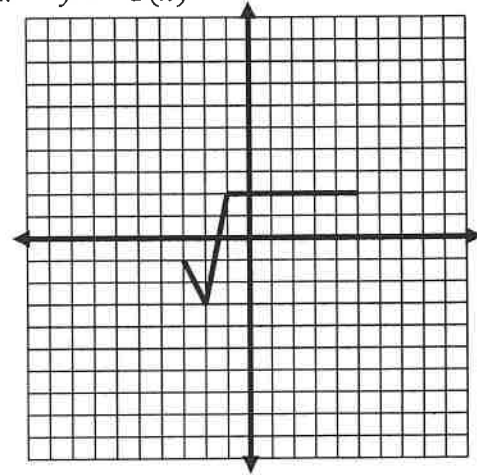
1.  $y = H(x)$



Domain: \_\_\_\_\_

Range: \_\_\_\_\_

2.  $y = G(x)$



Domain: \_\_\_\_\_

Range: \_\_\_\_\_

V. Consider a new function  $y = P(x)$ .  
Domain is  $[-2, 2]$  and range is  $[-3, 1]$

Use your understanding of transformations of functions to determine the domain and range of each of the following functions.

1.  $P(x) + 5$

Domain: \_\_\_\_\_

Range: \_\_\_\_\_

2.  $P(x + 5)$

Domain: \_\_\_\_\_

Range: \_\_\_\_\_

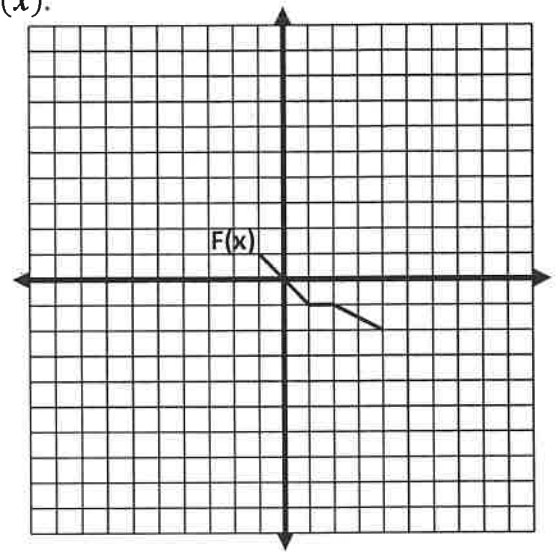
Math 2 – Honors  
 Unit 2 – Quadratic Function  
 Lesson 2 – Transformations Continued

Name \_\_\_\_\_  
 Date: \_\_\_\_\_ Pd: \_\_\_\_\_

➤ Now let's return to the function whose equation is  $y = F(x)$ .

Complete the chart with the key points.

$x$	$F(x)$
-1	1
0	0
1	-1
2	-1
4	-2



➤ Let's suppose that  $y = 4F(x)$  *Dilation*  
 $(x, y) \rightarrow (x, 4y)$

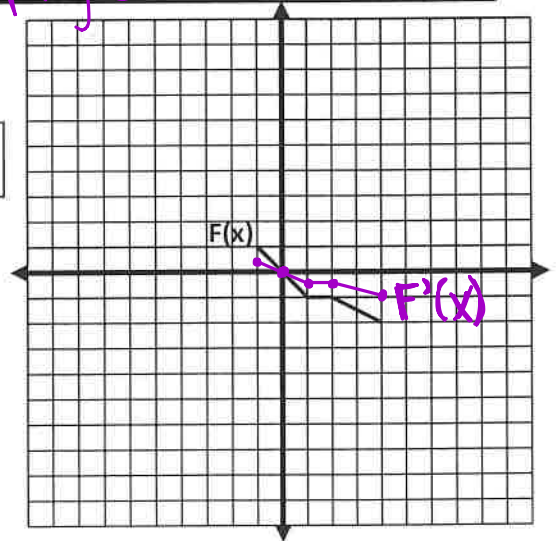
$x$	$F(x)$	$y$
-1	1	$1 \times 4 = 4$
1	-1	$-1 \times 4 = -4$
2	-1	$-1 \times 4 = -4$
4	-2	$-2 \times 4 = -8$

Describe the transformation:  
*Dilate by Scale Factor of 4*  
 Did the transformation affect the domain or the range of the function?  
*Range*

➤ Graph:  $y = \frac{1}{2}F(x)$

$x$	$F(x)$	$y$
-1	1	$\frac{1}{2}$
1	-1	$-\frac{1}{2}$
2	-1	$-\frac{1}{2}$
4	-2	-1

$(x, y) \rightarrow ( \quad )$



Describe the transformation:  
*Dilate by Scale factor of 1/4*  
 Did the transformation affect the domain or the range of the function?  
*Range*

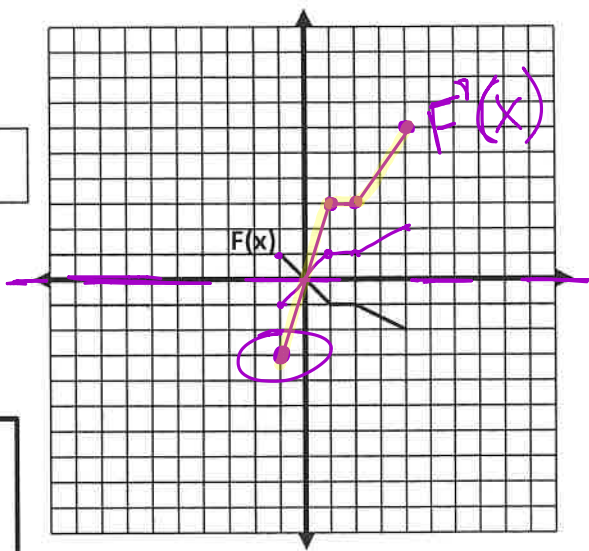


➤ Graph:  $y = -3F(x)$

$x$	$F(x)$	$y$
-1	1	-3
1	-1	3
2	-1	3
4	-2	6

$(x, y) \rightarrow (x, -3y)$

OUTHIO



Describe the transformations:  
 $\text{R}_x\text{-axis, D by S.F. 3}$   
 Did the transformation affect the domain or the range of the function?  
 Range

➤ **Checkpoint:** Let's revisit  $H(x)$ .

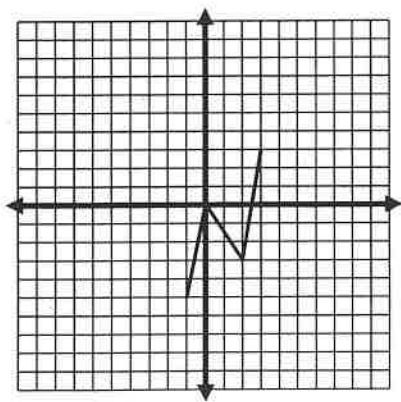
1. Describe the effect on Harry's graph for each of the following.

Example:  $y = -5H(x)$  Each point is reflected across the x-axis and stretched by a factor of 5

- a.  $y = 3H(x)$  stretch by S.F. of 3
- b.  $y = -2H(x)$  R<sub>x</sub>-axis, S by S.F. of 2
- c.  $y = \frac{1}{2}H(x)$  Compression by S.F. of 1/2

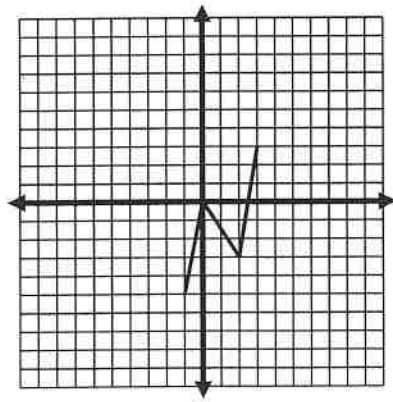
2. Sketch each graph without using a table. Then state the DOMAIN & RANGE of the image.

a.  $y = 3H(x)$



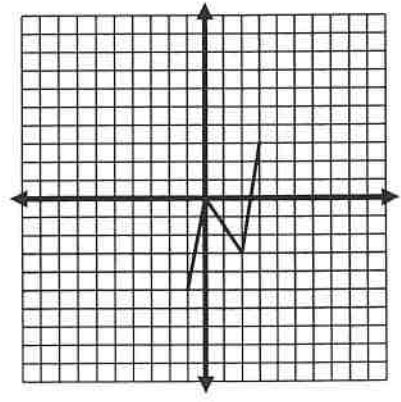
$(x, y) \rightarrow ( \quad )$

b.  $y = -2H(x)$



$(x, y) \rightarrow ( \quad )$

c.  $y = \frac{1}{2}H(x)$

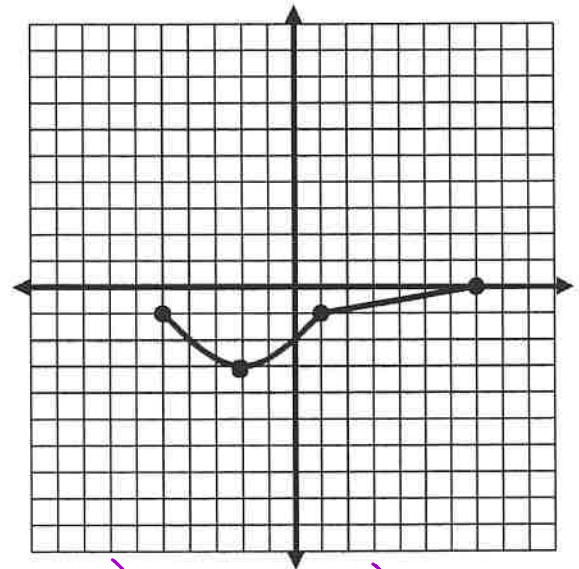


$(x, y) \rightarrow ( \quad )$

➤ The graph of  $D(x)$  is shown.

List the key points of  $y = D(x)$ .

Since  $D(x)$  is our original function, we will refer to it as the **parent function**.



**Note:** In transformational graphing where there are multiple steps, it is important to perform the **translations** last.

1) L3 2) S by 2 3) U 5

➤ **Example:** Let's explore the steps to graph  $y = 2D(x + 3) + 5$ , without using tables.

Step 1. The transformations represented in this new function are listed below in the order they will be performed. (See note above.)

- Vertical stretch by 2 (~~Multiply y - coordinate by 2~~)
- Translate left 3
- Translate up 5

$(x, y) \rightarrow ( \quad )$

Step 2. Follow the process used in Step 1 above to perform all the transformations on the other 3 points.

Step 3. After completing Step 2, you will have all four key points for the graph. Be sure you use a curve in the appropriate place.

✓ What are the **domain** and **range** of  $y = D(x)$ ?

✓ What are the **domain** and **range** of  $y = D(x)$  after the transformations?

1) R<sub>x</sub>-axis 2) D<sub>4</sub>

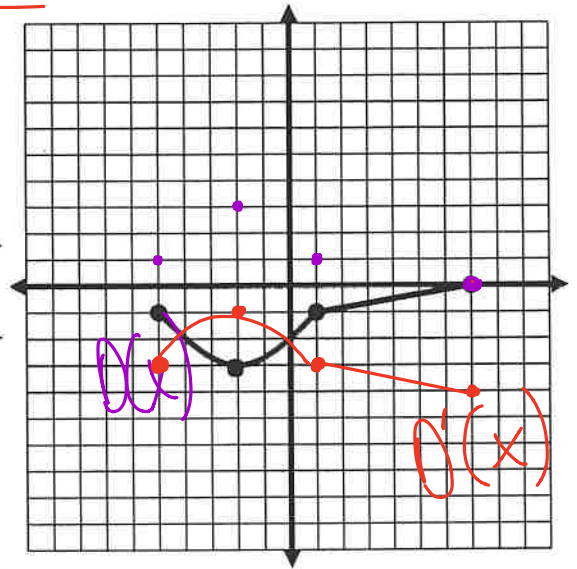
Graph:  $y = -D(x) - 4$

- List the transformations needed to sketch the graph.  
(Remember, to be careful with order.)

- R<sub>x</sub>-axis
- D<sub>4</sub>

- Plot the new points and sketch the graph.

3.  $(x, y) \rightarrow ( \quad )$



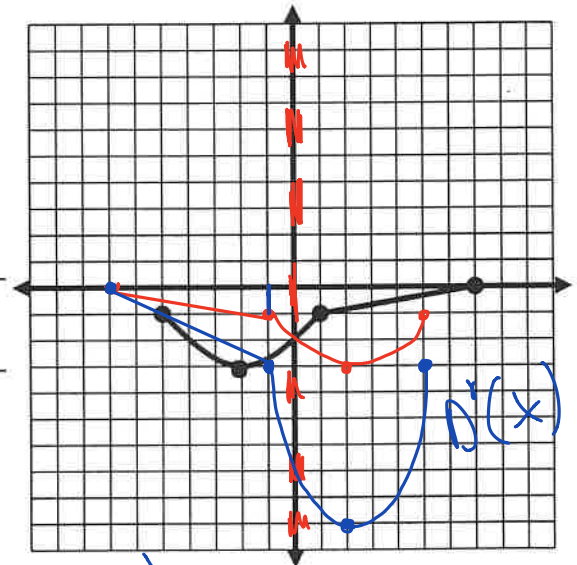
Graph:  $y = \underline{3}D(\underline{-x})$

- List the transformations needed to sketch the graph.  
(Remember, to be careful with order.)

- R<sub>y</sub>-axis
- S by S.F. of 3

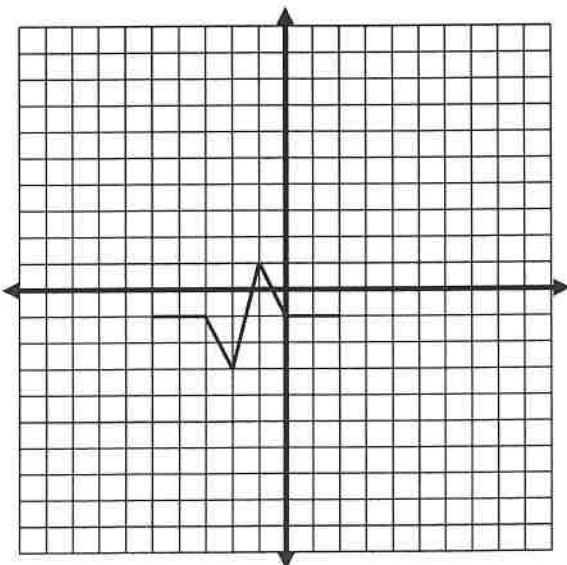
- Plot the new points and sketch the graph.

3.  $(x, y) \rightarrow ( \quad )$



Checkpoint:

Graph:  $y = 3C(x) + 5$

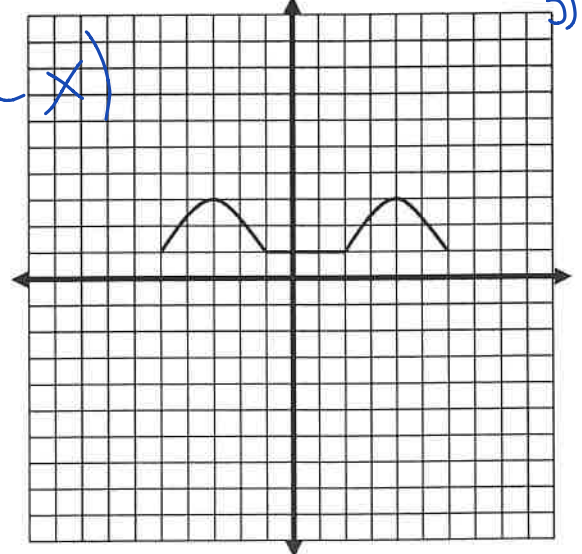


$y = -f(x)$

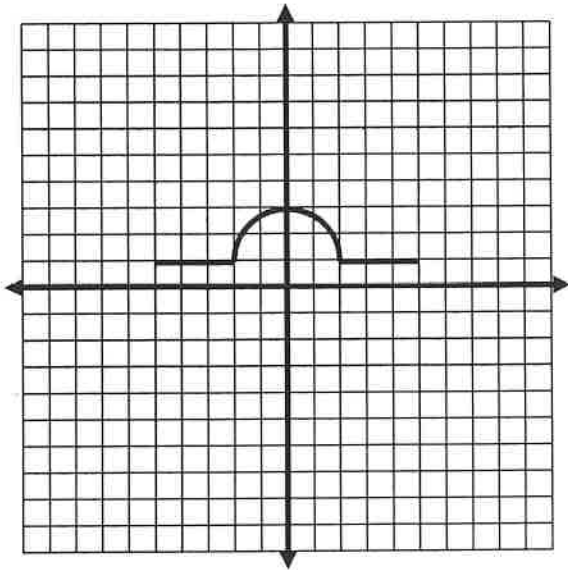
1) R<sub>3</sub>  
2) R<sub>x</sub>-axis  
3) D<sub>6</sub>

Graph:  $y = -G(x - 3) - 6$

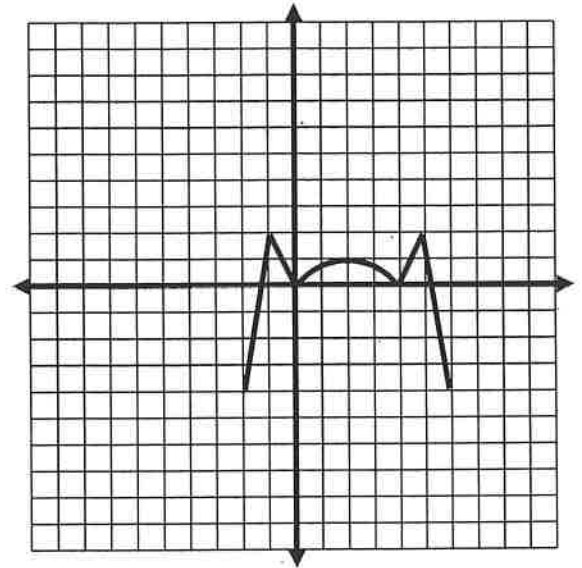
$y = f(-x)$



Graph:  $y = -3H(x)$



Graph:  $y = B(-x) + 8$



➤ Finally, let's examine a reflection in the line  $y = x$ .

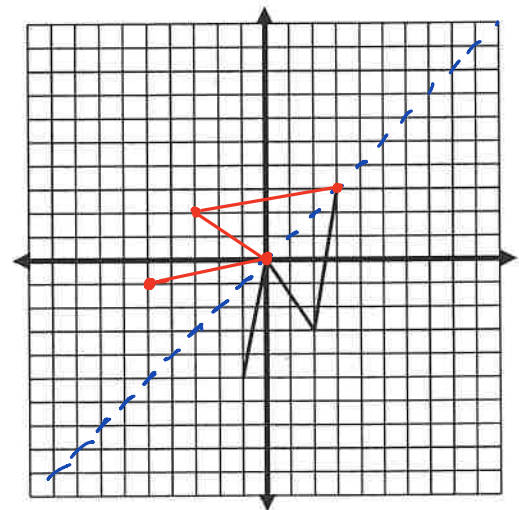
- Graph this line  $y = x$  on the grid.
- Complete the charts below with the characteristic points:

$y = H(x)$

$x$	$y$

Reflection

$x$	$y$



- Describe what happens when we reflect in the line  $y = x$ .

$(x, y) \rightarrow ( \quad , \quad )$

- What is the domain of  $H(x)$ ?  $[-1, 3]$   
 What is the range of  $H(x)$ ?  $[-5, 3]$

6. A reflection in the line  $y = x$ , shows a graph's **inverse**. Look at the graph of the inverse. Is the inverse a function? Explain how you know.

- What is the domain of the reflection?  $[-5, 3]$   
 What is the range of the reflection?  $[-1, 3]$

No fails  
VLT