Name: _____ Date: _____ Per: _____

Algebra 2: Lesson 6-1 Transformations of Functions

Learning Goals:
1) What is a translation and how do we represent that translation of a function in its equation?

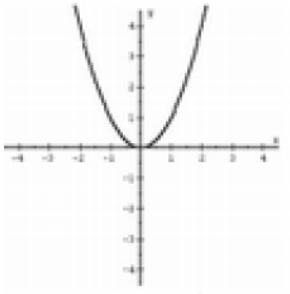
Warm – Up:

$-x - 5y - 4z = 6$
$x + 3y + 4z = -10$
$2x - 3y - 4z = -2$

Parent Functions

Functions that belong to the same family share key characteristics. The parent function is the most basic function in a family. Functions in the same family are transformations of their parent function.

Below are the four parent functions we will work with in this unit. (There are others!)



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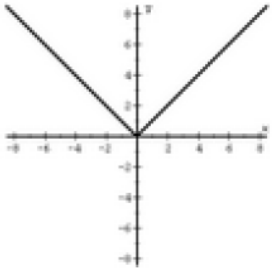
Eqn: _____



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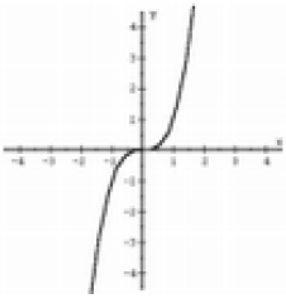
Eqn: _____



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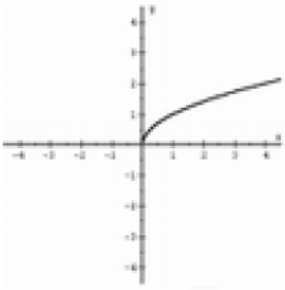
Eqn: _____



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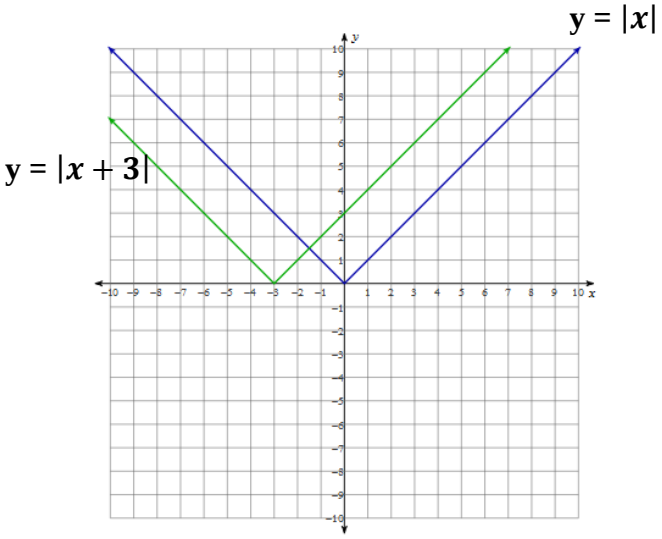
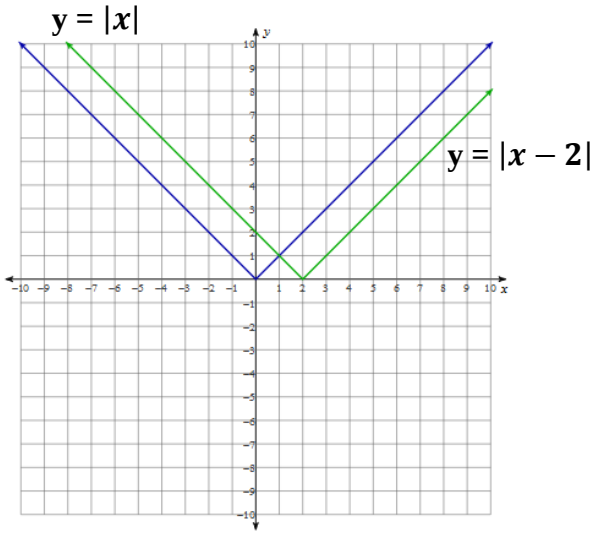
Eqn: _____

Exercise 1: Compare the graph of the function $y = |x + 3|$ and $y = |x - 2|$ to the graph of the parent function $\boldsymbol{y = |x|}$



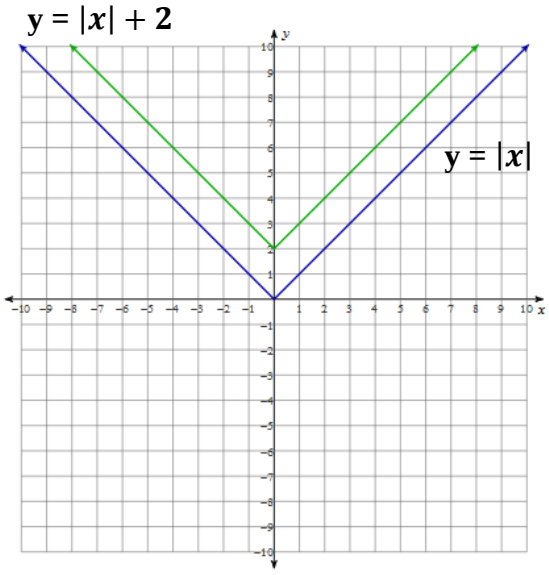


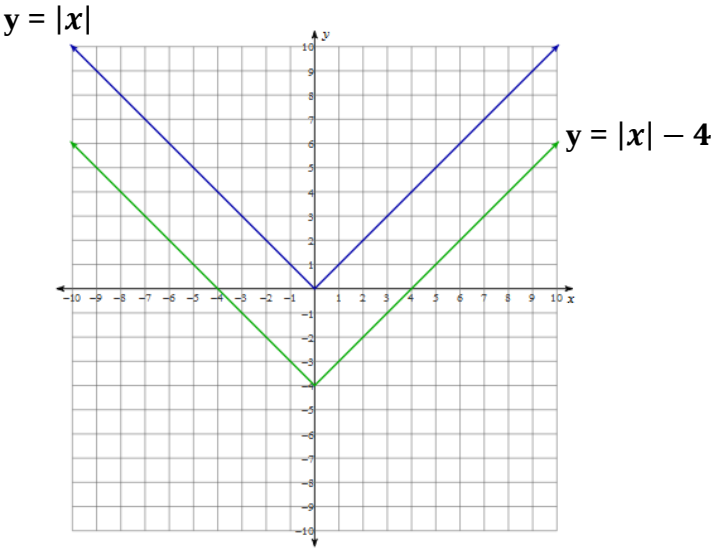
SUMMARY

When $y=|x + h|$ the graph is shifted _____

When $y=|x - h|$ the graph is shifted _____

Exercise #2: Compare the graph of the function $y = |x| + 2$ and $y = |x| - 4$ to the graph of the parent function $\boldsymbol{y = |x|}$





SUMMARY

When $y=|x| + k$ the graph is shifted _____

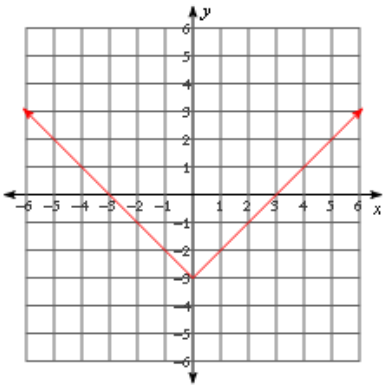
When $y=|x| - k$ the graph is shifted _____

A translation is a shift of a graph vertically, horizontally, or both. The resulting graph is the same size and shape as the original but is in a different position in the plane.

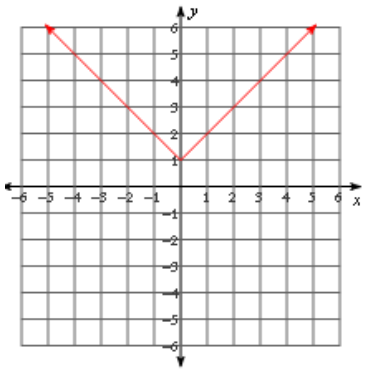
Graphs of Absolute Value Functions
• If $y=\|x+h\|$, the graph translates h units to the _____
• If $y=\|x-h\|$, the graph translates h units to the _____
• If $y=\|x\|+k$, the graph translates k units to the _____
• If $y=\|x\|-k$, the graph translates k units to the _____

Practice: Writing equations of an absolute value finction from its graph.
Write an equation for each translation of $y=|x|$ shown below.

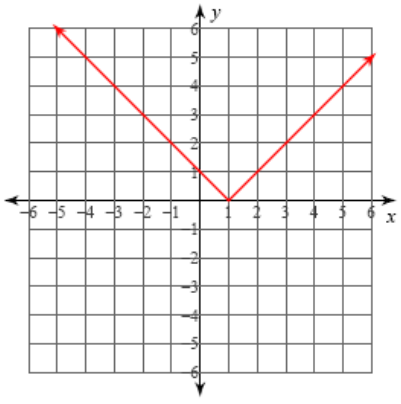
a)



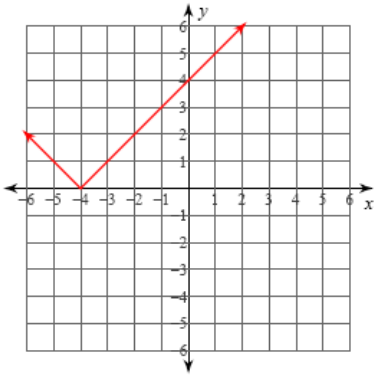
b)



c)



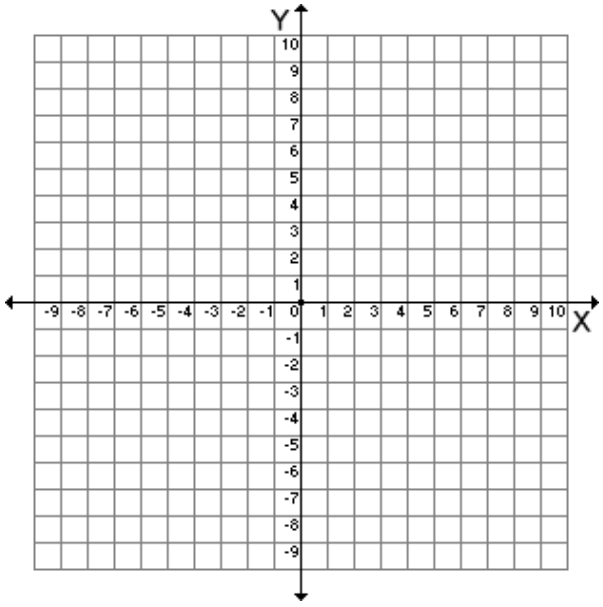
d)



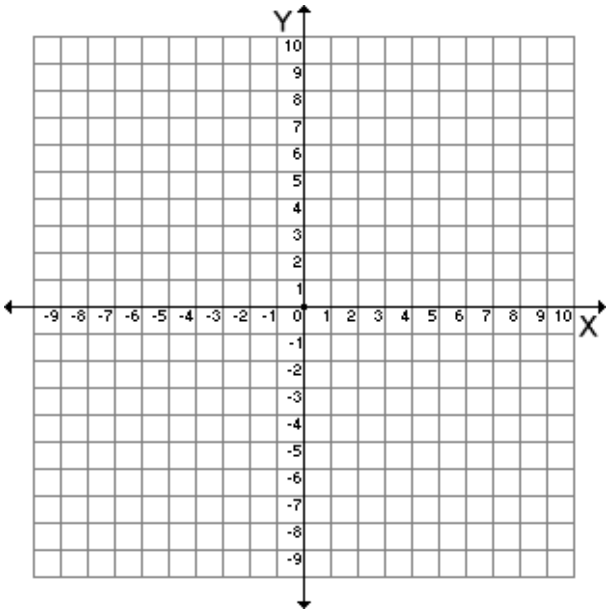
Vertical and Horizontal Translations

Graph each translation.

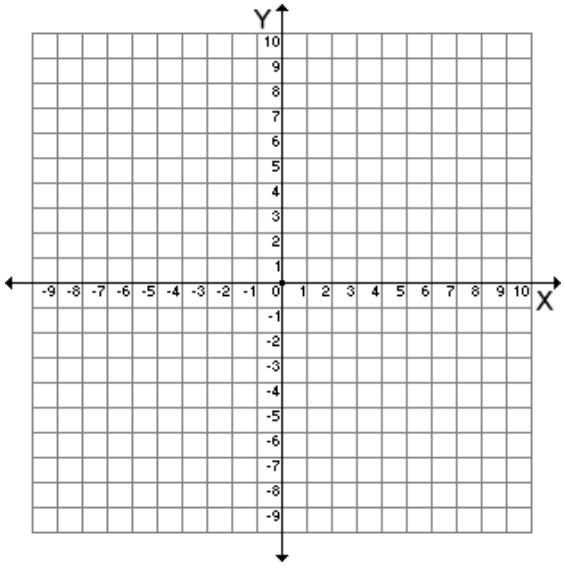
e) $y=|x|+5$



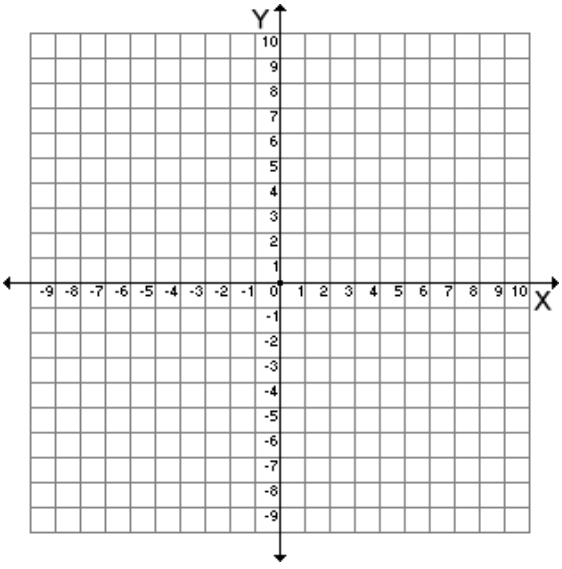
f) $y=|x-4|$



g) $y=|x-6|-2$

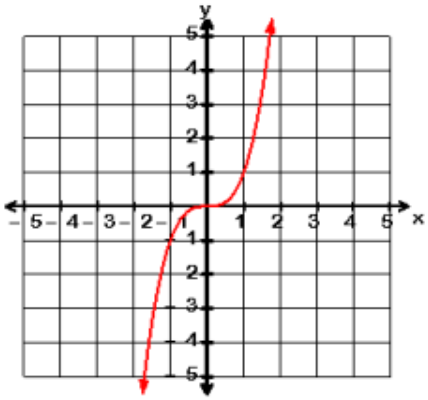


h) $y=|x+8|+3$

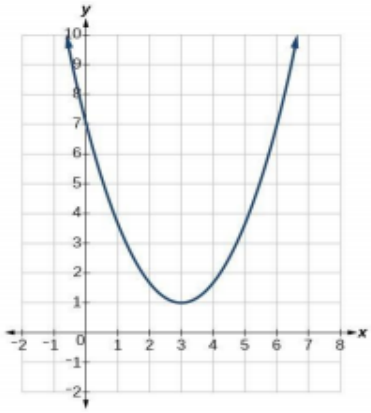


Practice with Translations

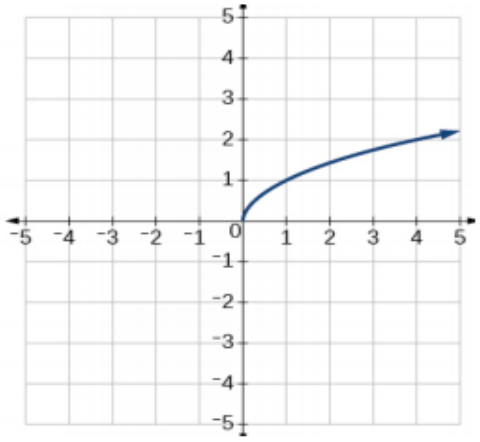
5) Given the graph of $f(x)$ below, graph $g(x) = f(x-5)$ and state the transformation that occurs.



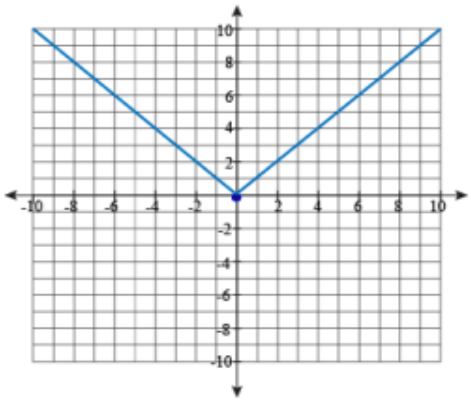
6) Given the graph of $f(x)$ below, graph $g(x) = f(x)-3$ and state the transformation that occurs.



7) Given the graph of $f(x)$ below, graph $g(x) = f(x-1)+3$ and state the transformation that occurs.



8) Given the graph of $f(x)$ below, graph $g(x) = f(x+2)-1$ and state the transformation that occurs.



9)

a. If $g(x) = f(x) - 2$, how is the graph of $f(x)$ translated to form the graph of $g(x)$?

b. If $h(x) = f(x-4)$, how is the graph of $f(x)$ translated to form the graph of $h(x)$?

SUMMARY

A translation is a shift of a graph vertically, horizontally, or both. The resulting graph is the same size and shape as the original but is in a different position in the plane.

Graphs of Absolute Value Functions
• If $y=\|x+h\|$, the graph translates h units to the left
• If $y=\|x-h\|$, the graph translates h units to the right
• If $y=\|x\|+k$, the graph translates k units to the up
• If $y=\|x\|-k$, the graph translates k units to the down

$y = a|x - h| + k$; **Vertex = (h, k)**

Exit Ticket

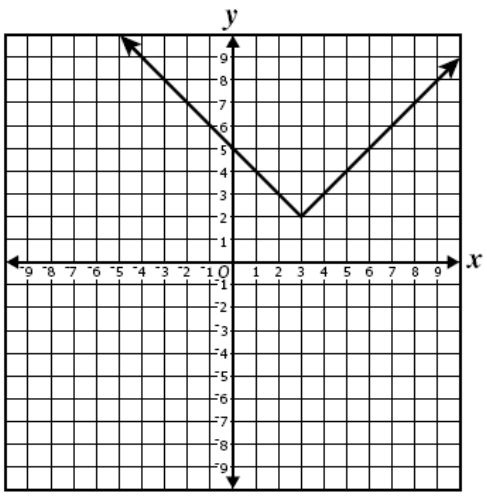
The graph *most* accurately represents which of the following functions?

A $y=\left|x+3\right|+2$

B $y=\left|x-3\right|+2$

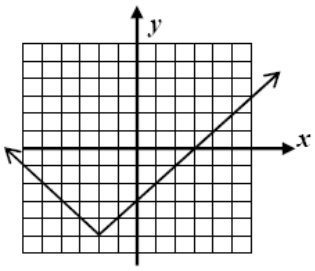
C $y=\left|x-2\right|+3$

D $y=\left|x+2\right|+3$



Algebra 2: 6-1 Transformation of Absolute Value Functions

1. Which equation describes the graph shown below?

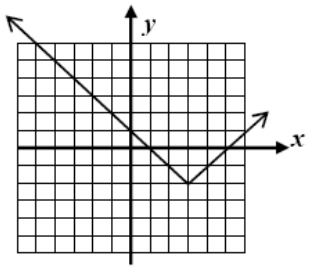


(1) $y=|x+2|-5$ (3) $y=|x-2|-5$

(2) $y=|x+5|+2$ (4) $y=|x-5|-2$

_____

2. Which equation describes the graph shown below?

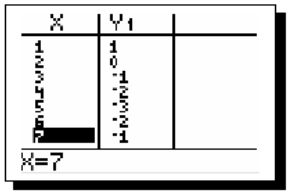


(1) $y=|x+3|-2$ (3) $y=|x-3|-2$

(2) $y=|x-2|-3$ (4) $y=|x+2|+3$

_____

3. Lorraine entered an absolute value function in her graphing calculator and produced the table shown below. What are the coordinates of the turning point of this absolute value function?



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

(2) $(7,-1)$ (4) $(5,-3)$

_____

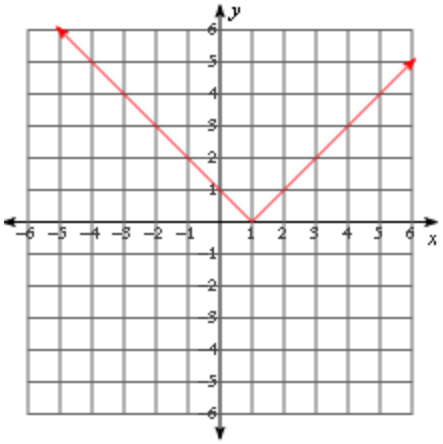
4. If a quadratic function f(x) has a turning point at (-3, 7) then where does the quadratic function *g* defined by $g(x)=f(x+4)+5$ have a turning point?

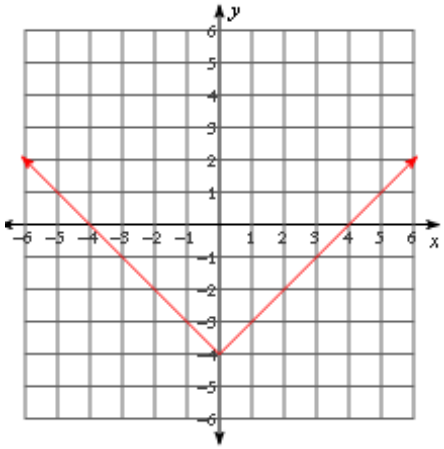
(1) (-7,12) (2) (-4, 5)
(3) (1, 12) (4) (4, 5)

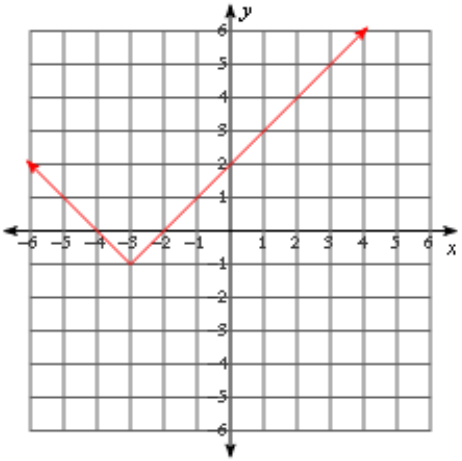
_____

In examples 5 – 13, write an equation for each translation of y = $|x|$.

5. 9 units up _____
6. 6 units down _____
7. right 4 units _____
8. left 12 units _____
9. 8 units up, 10 units left _____
10. 3 units down, 5 units right _____

11.  _____

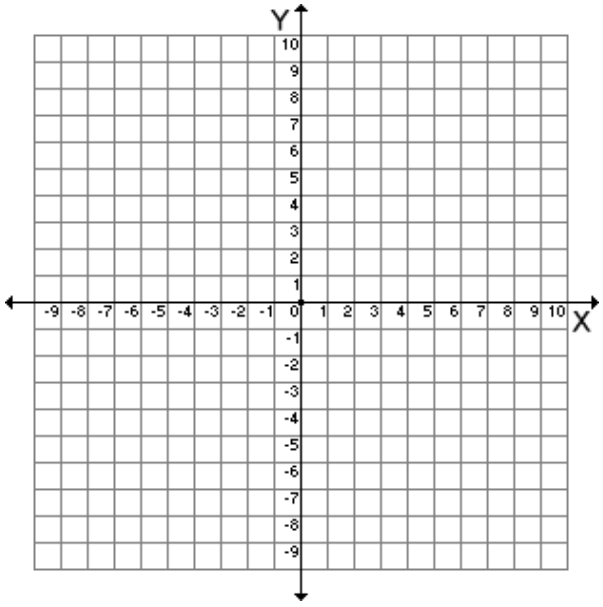
12.  _____

13.  _____

In examples 14 and 15, identify the vertex and graph each.

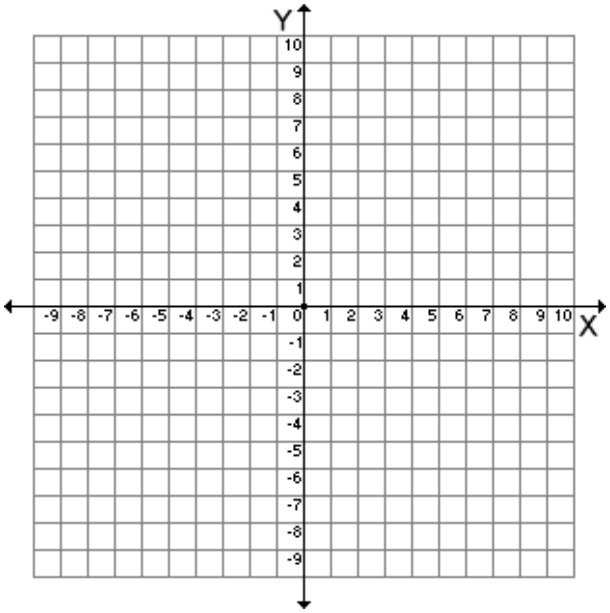
14) $y = |x - 1|$

Vertex: (___, ___)

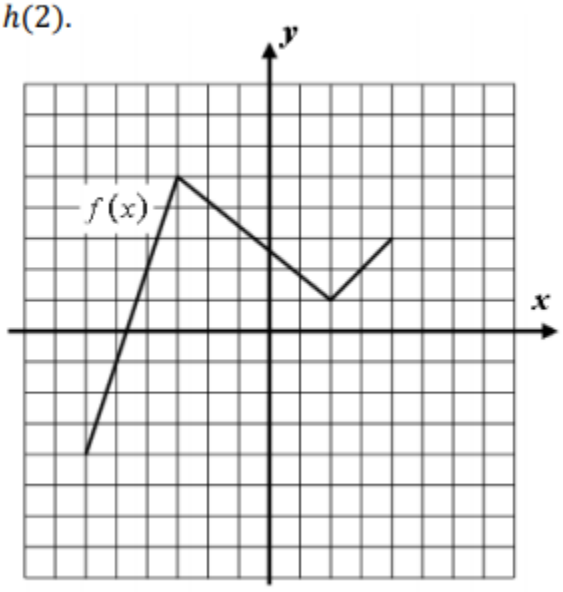


15) $y = |x + 2| - 7$

Vertex: (___, ___)



16) Given the function f(x) shown below, create a graph for $h(x) = f(x) + 2$. Find the value of $h(2)$.



Algebra 2: 6- 2 –TRANSFORMATION OF QUADRATICS AND OTHER FUNCTIONS

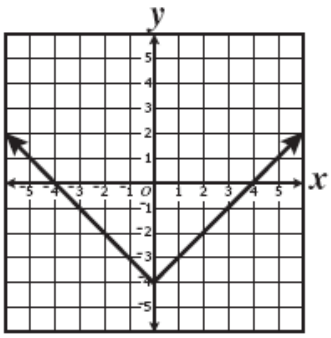
SWBAT: Transform Quadratic and Other functions

Warm – Up:

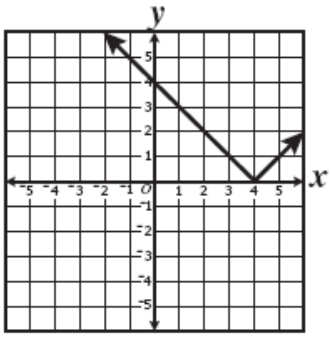
1. **Which graph best represents the following equation?**

$$y = |x - 4|$$

F



H



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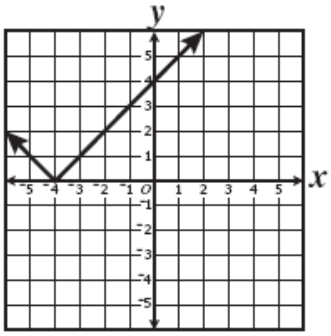
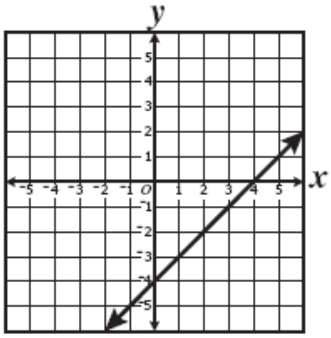
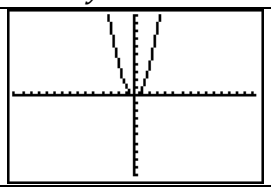
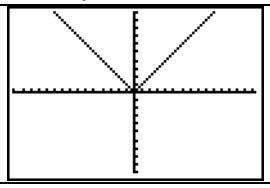
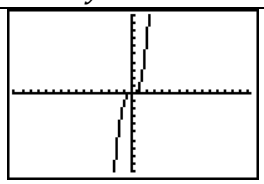
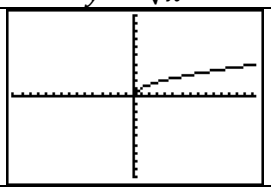


J



2. The vertex of y = $|x + 2|$ - 3 is

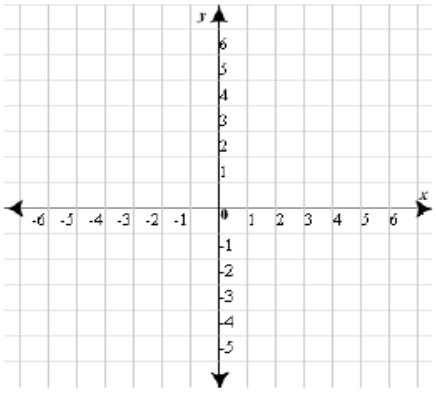
(1) (2, 3)
(2) (-2, 3)
(3) (-2, -3)
(4) (2, -3)

Type	Quadratic	Absolute Value	Cubic	Square Root
Basic Function	$y = x^2$	$y = \|x\|$	$y = x^3$	$y = \sqrt{x}$
Sketch of basic function				
Vertex Form	$y = a(x-h)^2 + k$ Vertex: (h, k)	$y = a\|x-h\| + k$ Vertex: (h, k)	$y = a(x-h)^3 + k$ Vertex: (h, k)	$y = a\sqrt{x-h} + k$ Vertex: (h, k)

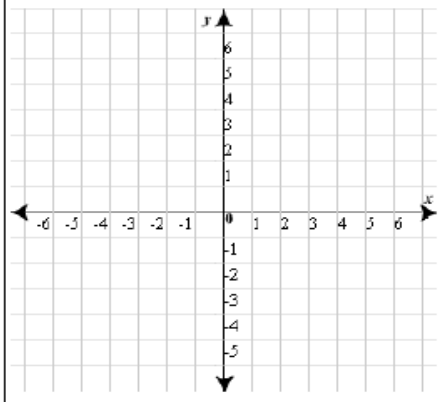
Example 1:

State the transformation that occurs and then sketch the graph of the function without using your calculator.

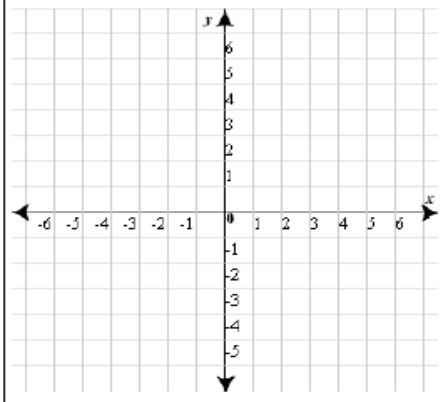
a) $f(x) = |x-1| + 4$



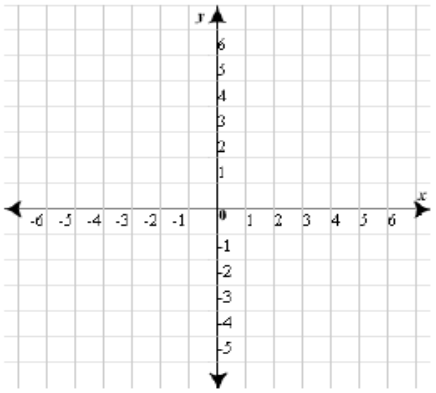
b) $g(x) = \sqrt{x+2} - 1$



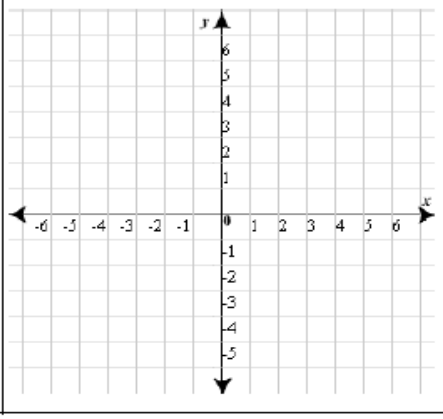
c) $h(x) = (x+3)^3 + 2$



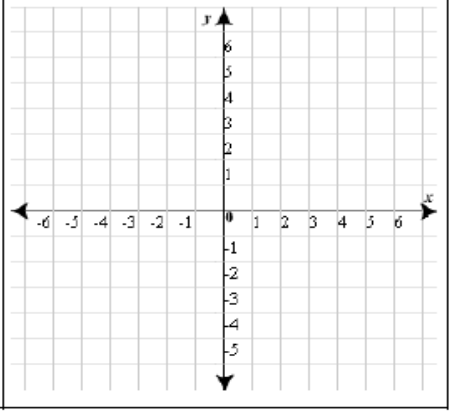
d) $f(x) = (x-5)^2$



e) $g(x) = |x-2| - 3$

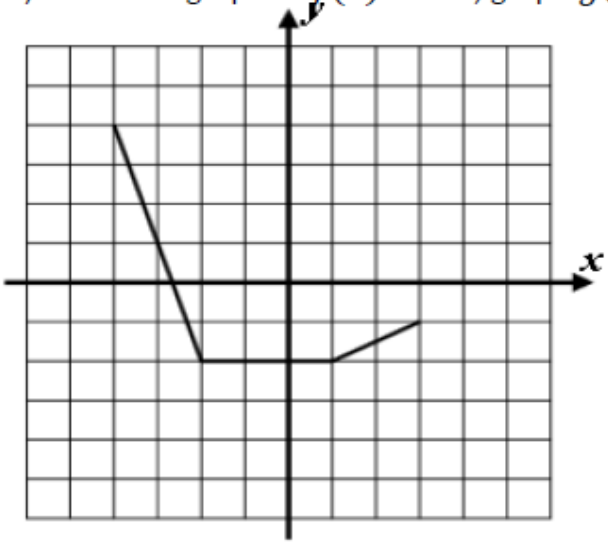


f) $h(x) = \sqrt{x} + 4$

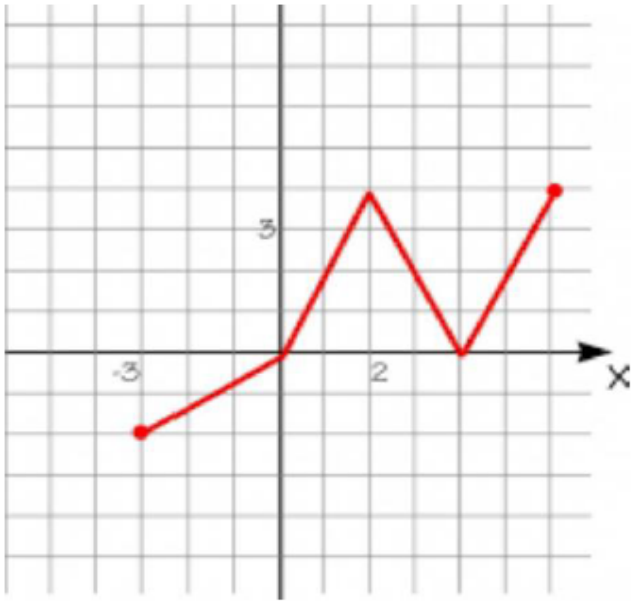


Example 2:

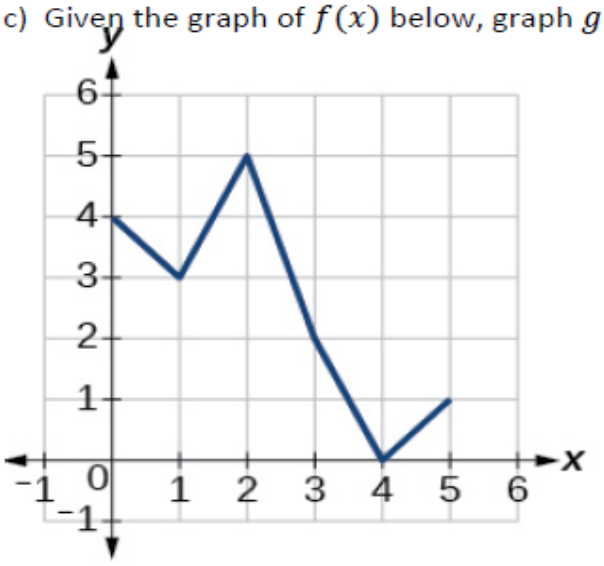
a) Given the graph of $f(x)$ below, graph $g(x) = f(x-3)+1$. State the value of $g(0)$.



b) Given the graph of $g(x)$ below, graph $h(x) = g(x+2)-3$. State the value of $h(-2)$.



c) Given the graph of $f(x)$ below, graph $g(x) = f(x-2)-1$. State the value of $g(3)$.



Example 3: State the parent function and the translation that is occurring in each of the given functions.

Function	Parent Function	Translations
$f(x) = x^2 - 10$		
$g(x) = \lvert x + 2 \rvert$		
$h(x) = \sqrt{x-1} + 6$		
$f(x) = (x-4)^3 - 5$		

Example 4:

If the equation of a parabola is $f(x)$ and the vertex is (-2, 5), state the vertex after the given translations:

a) $f(x-2)+2$

b) $f(x)-5$

c) $f(x+1)-3$

d) $f(x-6)$

SUMMARY

A translation is a shift of a graph vertically, horizontally, or both. The resulting graph is the same size and shape as the original but is in a different position in the plane.

Graphs of Absolute Value Functions
• If $y=\|x+h\|$, the graph translates h units to the left
• If $y=\|x-h\|$, the graph translates h units to the right
• If $y=\|x\|+k$, the graph translates k units to the up
• If $y=\|x\|-k$, the graph translates k units to the down

$y = a|x - h| + k$; Vertex = (h, k)

Exit Ticket

***Exercise* #2:** If the parabola $y=x^2$ were shifted 6 units left and 2 units down, its resulting equation would be which of the following? Verify by graphing your answer and seeing if its turning point is at $(-6,-2)$.

(1) $y=(x+6)^2+2$ (3) $y=(x-6)^2-2$

(2) $y=(x+6)^2-2$ (4) $y=(x-6)^2+2$

_____

***Exercise* #3:** Which of the following represents the turning point of the function $f(x)=(x-8)^2-4$?

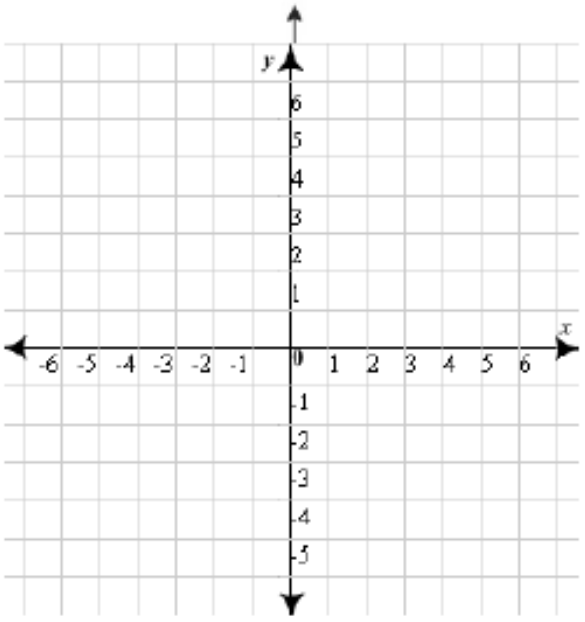
(1) $(-8,-4)$ (3) $(-8,4)$

(2) $(8,4)$ (4) $(8,-4)$

_____

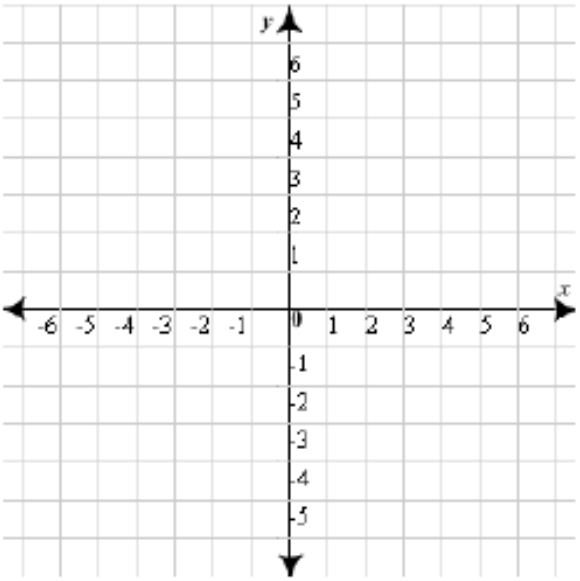
Algebra 2: 6-2 Transformation of Other Functions – Homework

1) Sketch the graph of $f(x) = \sqrt{x-1} + 4$

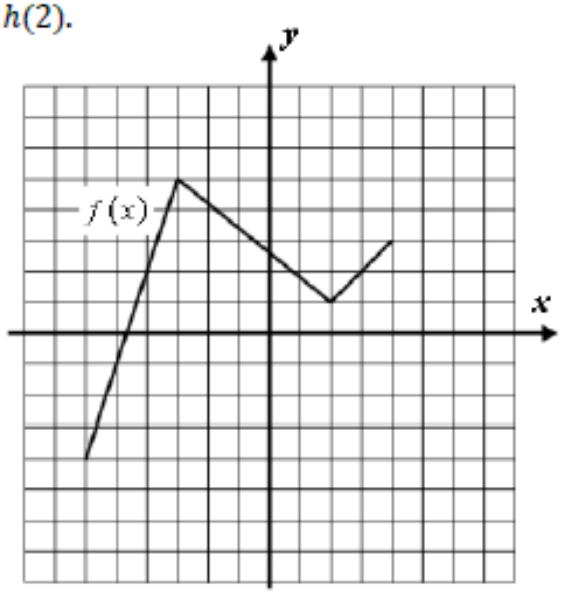


#4

2) Sketch the graph of $f(x) = |x+3| - 2$



3) Given the function f(x) shown below, c a graph for $h(x) = f(x) + 2$. Find the value of $h(2)$.



4) If a quadratic function f(x) has a turning point at (-3, 7) then where does the quadratic function g defined by $g(x) = f(x+4) + 5$ have a turning point?

(1) (-7,12) (2) (-4, 5)
(3) (1, 12) (4) (4, 5)

5) State the parent function and transformation that is occurring in each function below in the order it is occurring.

Function	Parent Function	Translations
$f(x)=x^2+3$		
$g(x)=\lvert x-2\rvert-1$		
$h(x)=\sqrt{x-1}+6$		
$f(x)=(x+4)^3$		

6) Solve the following system of equations algebraically.

$$-3x+2y-6z=6$$
$$5x+7y-5z=6$$
$$x+4y-2z=8$$

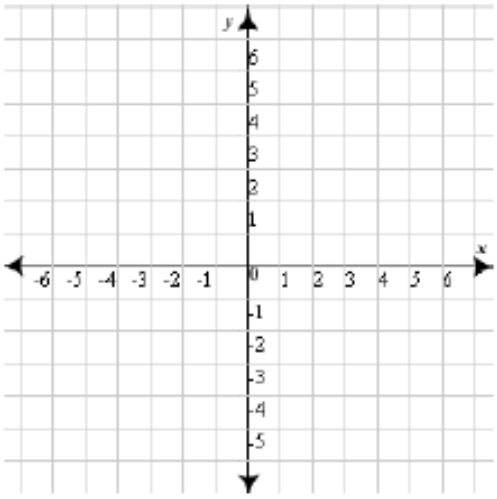
Algebra 2: 6 - 3 –REFLECTIONS OF FUNCTIONS

SWBAT: Reflect graphs of functions

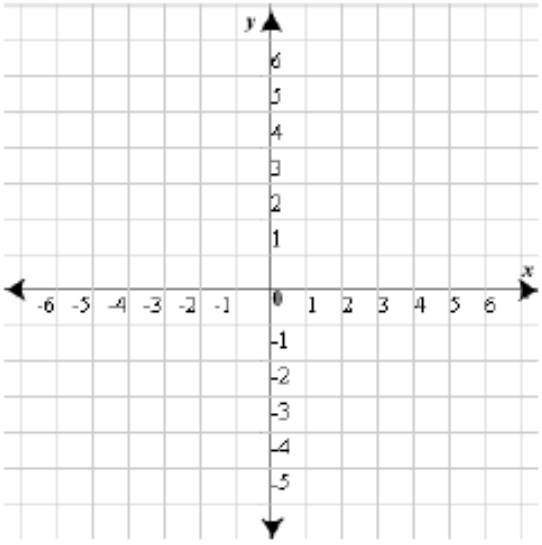
Warm – Up

State the transformation that is occurring, then sketch the graph of the function without using your calculator.

a) $f(x) = (x-3)^2 + 2$



b) $g(x) = \sqrt{x+1} - 3$



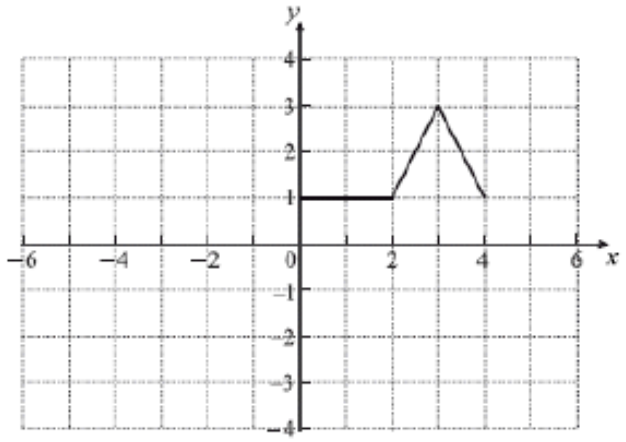
Reflecting Functions in the x and y Axes

The function $-f(x)$ is a reflection of $f(x)$ in the x-axis.

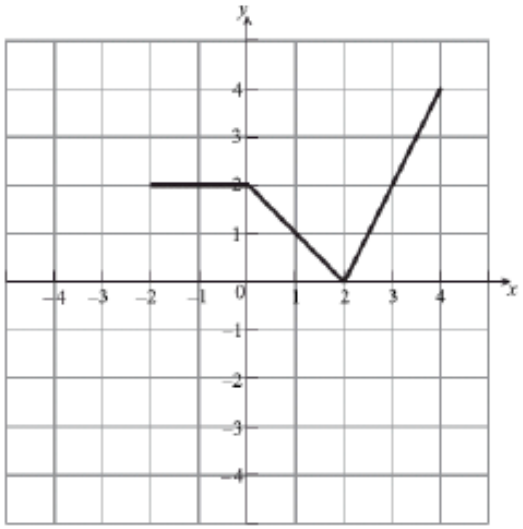
The function $f(-x)$ is a reflection of $f(x)$ in the y-axis.

Example 1:

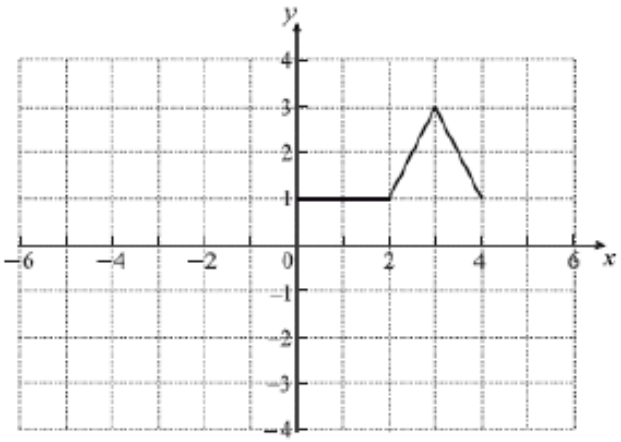
a) Given the graph of $f(x)$ below, sketch the graph of $f(-x)$.



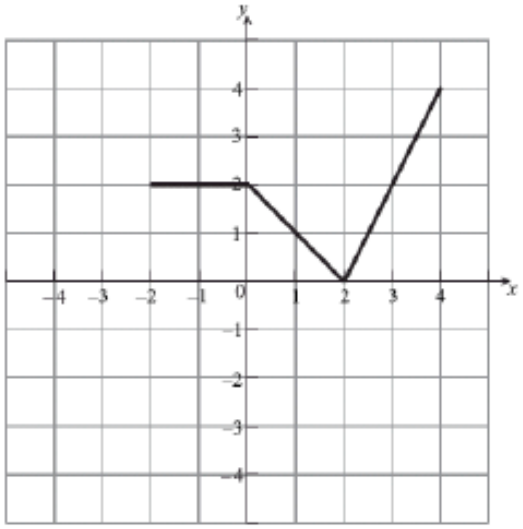
b) Given the graph of $g(x)$ below, sketch the graph of $-g(x)$.



c) Given the graph of $f(x)$ below, sketch the graph of $-f(x)$.



d) Given the graph of $g(x)$ below, sketch the graph of $g(-x)$.



Example 2:

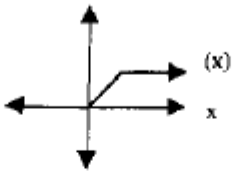
After a reflection in the y-axis, the quadratic function $g(x) = 4x^2 - 7x + 2$ would have the equation

(1) $y = -4x^2 + 7x + 2$ (3) $y = 4x^2 + 7x + 2$

(2) $y = -4x^2 + 7x - 2$ (4) $y = 4x^2 + 7x - 2$

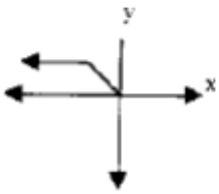
Example 3:

The graph below represents $f(x)$.

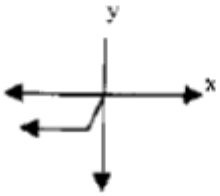


Which of the following is the graph of $-f(x)$?

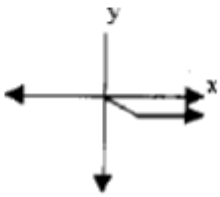
(1)



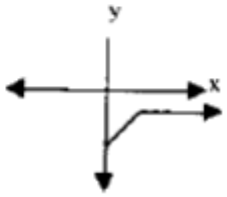
(2)



(3)

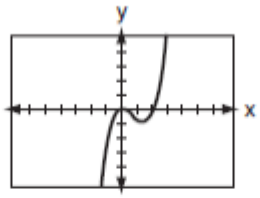


(4)



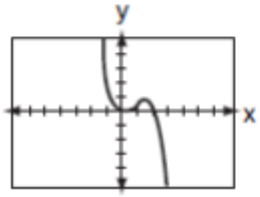
Example 4:

The accompanying graph represents the equation $y = f(x)$.

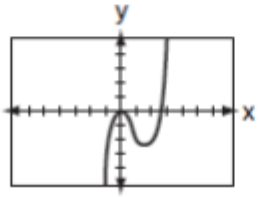


Which graph represents $g(x)$ if $g(x) = -f(x)$?

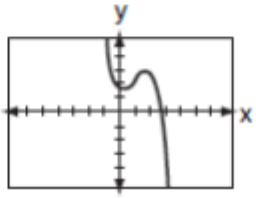
(1)



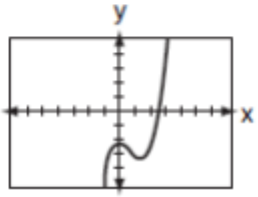
(2)



(3)



(4)



When doing a combination of translations and reflections, the following order should be used:

Example 5:

State the transformations in the order in which they occur.

Function	Transformation
$f(x) = -g(x-2)+3$	
$f(x) = g(-x)-5$	
$f(x) = g(-x+2)$	
$f(x) = -g(x-4)+1$	
$f(x) = -g(-x+1)-4$	

6) Which of the following equations represents the graph of $f(x) = x^2$ after a translation of 5 units to the right, reflection in the y-axis, and a translation of 3 units down.

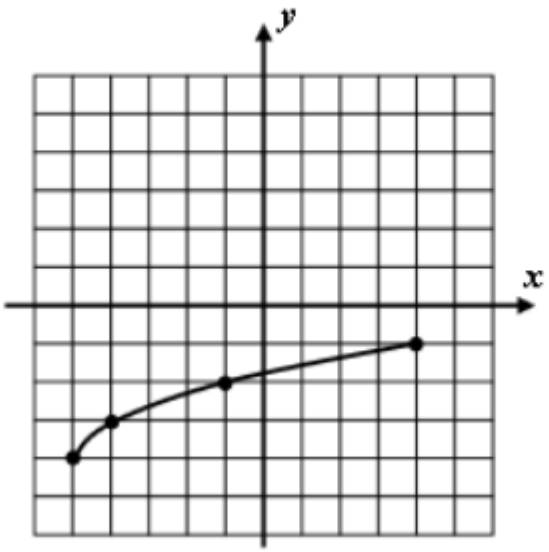
(a) $g(x) = -(x+5)^2 - 3$
(b) $g(x) = -(x-5)^2 - 3$
(c) $g(x) = (-x+5)^2 - 3$
(d) $g(x) = (-x-5)^2 - 3$

7) Which of the following equations represents the graph of $f(x) = \sqrt{x}$ after a translation of 21 units to the right and a reflection in the x-axis?

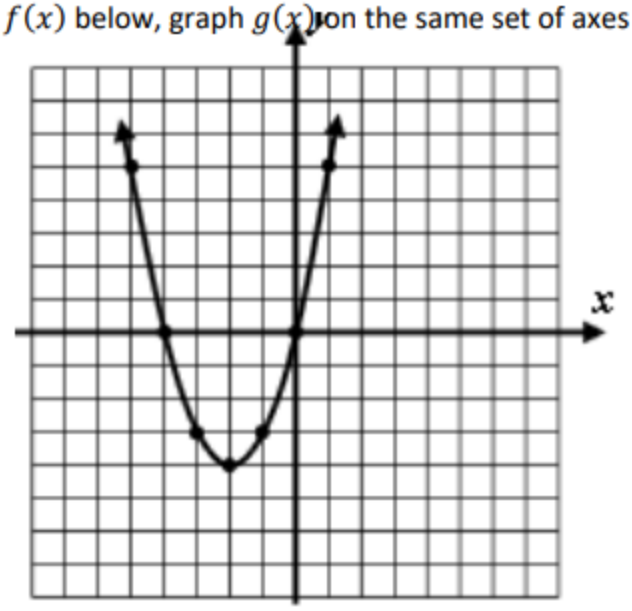
(a) $g(x) = -x^2 - 21$
(b) $g(x) = -(x-21)^2$
(c) $g(x) = (-x)^2 - 21$
(d) $g(x) = (-x-21)^2$

Graphing Multiple Transformations

8) Given the function $y = f(x)$ below, graph $g(x)$ on the same set of axes if $g(x) = f(-x - 3) + 2$.



9) Given the function $y = f(x)$ below, graph $g(x)$ on the same set of axes if $g(x) = -f(x - 2) + 3$

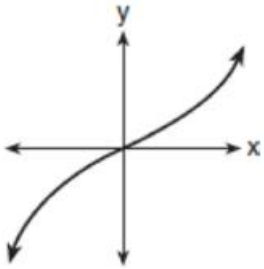


SUMMARY

	Function	Transformation
Translations	f(x) + c	Shift "c" up
	f(x) - c	Shift "c" down
	f(x + c)	Shift "c" left
	f(x - c)	Shift "c" right
Reflections	f(-x)	Reflection over y-axis
	-f(x)	Reflection over x-axis

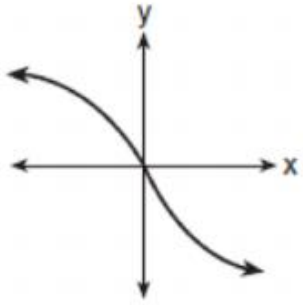
Exit Ticket

The graph below represents f(x).

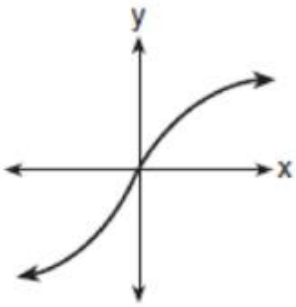


Which graph best represents f($-x$)?

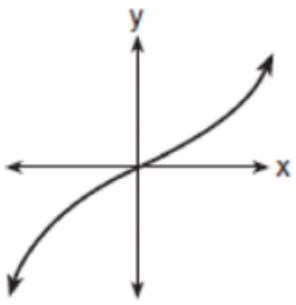
1)



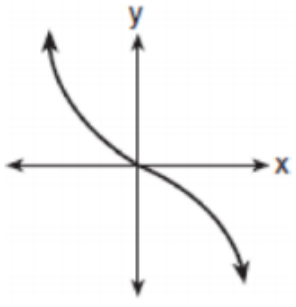
2)



3)



4)



Algebra 2: 6- 3 –REFLECTIONS OF FUNCTIONS - Homework

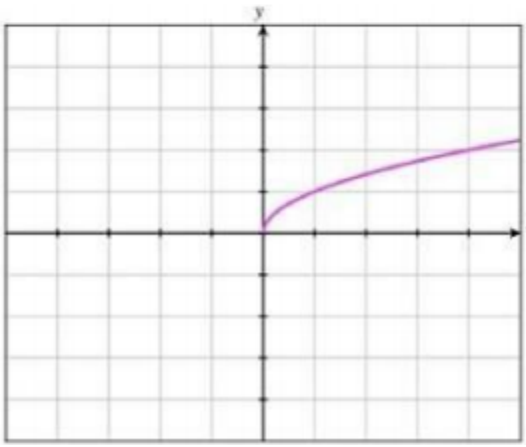
1) The graph of $f(x) = \sqrt{x}$ is shifted 4 units to the left and then 6 units upward. Which equation of $g(x)$ represents this transformation?

A) $g(x) = 6\sqrt{x+4}$
B) $g(x) = \sqrt{x-4}+6$
C) $g(x) = \sqrt{x+6}+4$
D) $g(x) = \sqrt{x+4}+6$

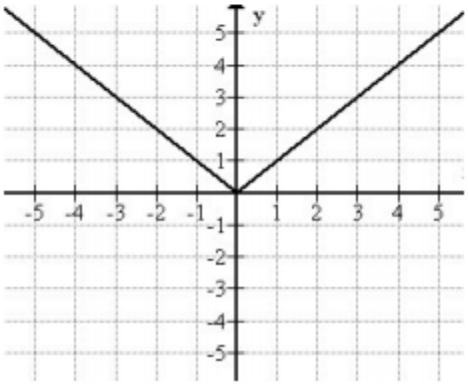
1) Which of the following describes how to transform the graph of $f(x) = x^2$ to the graph of $g(x) = -(x+6)^2$?

(1) Shift left 6 units and the reflect across the y-axis.
(2) Shift left 6 units and then reflect across the x-axis.
(3) Shift right 6 units and then reflect across the x-axis.
(4) Shift up 6 units and the reflect across the y-axis.

2) The graph of $f(x)$ is given below. State the order of the transformation occurring in $g(x) = f(-x-1)+3$ and sketch the graph of $g(x)$.



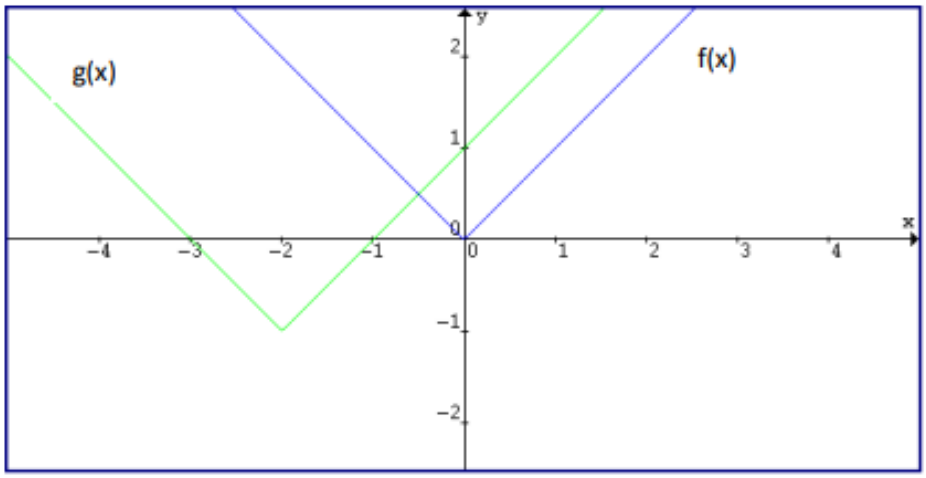
3) The graph of $f(x)$ is given below. State the order of the transformation occurring in $g(x) = -f(x+3)-2$ and sketch the graph of $g(x)$.



4) If $f(x) = -2x^2 + 5x - 3$ and $g(x)$ is a reflection of $f(x)$ across the y-axis, then an equation of g is which of the following?

(1) $g(x) = -2x^2 - 5x - 3$
(2) $g(x) = -2x^2 + 5x + 3$
(3) $g(x) = 2x^2 + 5x - 3$
(4) $g(x) = 2x^2 + 5x + 3$

5) The graphs of $f(x)$ and $g(x)$ are given below. Describe the transformation that is occurring to $f(x)$ to create the graph of $g(x)$.



6) State the order of the transformations that are occurring in each of the given equations.

Function	Translations
$f(x)=(-x+2)^2-1$	
$g(x)=-\lvert x-5\rvert+1$	
$h(x)=-\sqrt{-x+3}+2$	
$f(x)=-(x-4)^3$	

7) Solve the following system of equations:

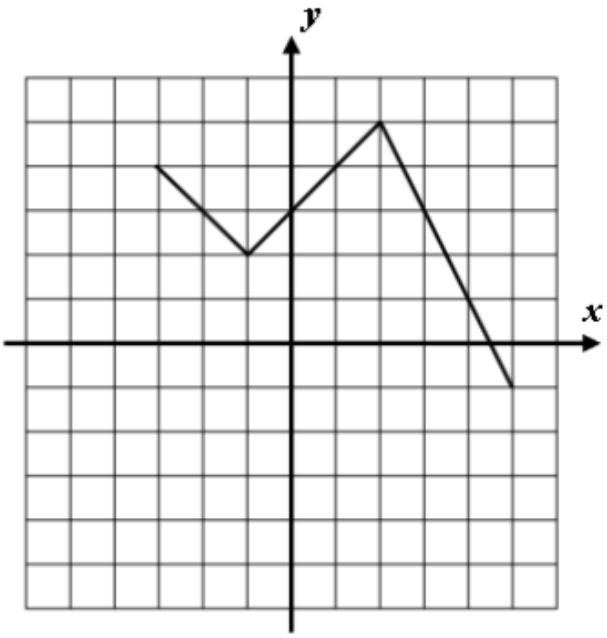
$$2x + y - z = -5$$
$$4x - 2y + z = 10$$
$$2x + 3y + 2z = 3$$

Algebra 2: 6 - 4 DILATIONS OF FUNCTIONS

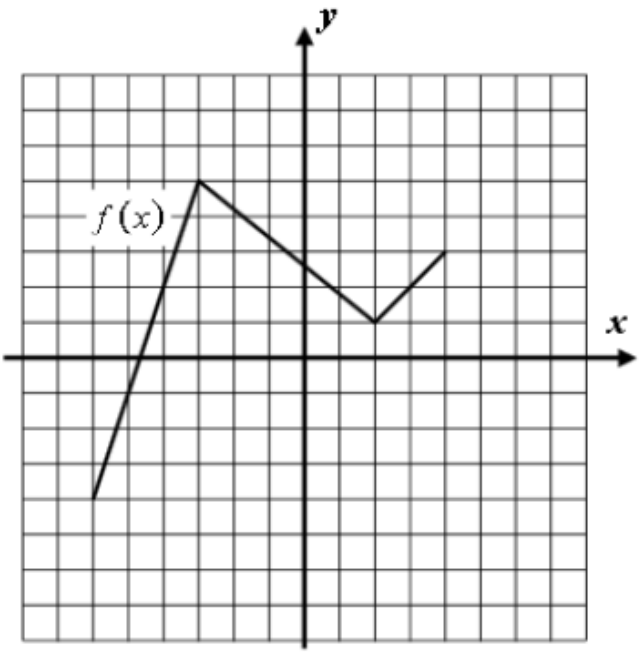
SWBAT: Dilate graphs of functions

Warm – Up

a) The graph of $f(x)$is given below. Sketch the graph of $g(x) = f(x+1) - 4$



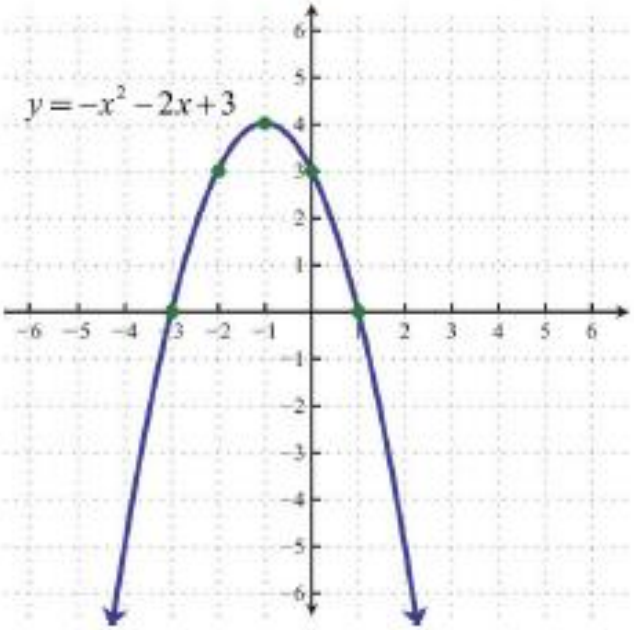
b) The graph of $f(x)$ is given below. Sketch the graph of $h(x) = -f(x) + 2$



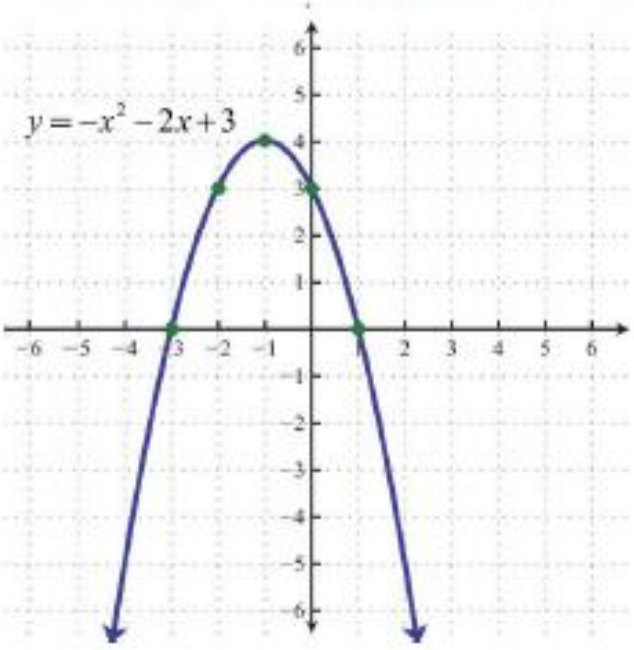
Vertical Scaling	Horizontal Scaling
• The function $h(x) = k \cdot f(x)$represents the vertical scaling of a function by a factor of k.	• The function $f(kx)$ represents a horizontal scaling of $f(x)$by a factor of $\frac{1}{k}$.
• To perform a vertical scaling you multiply the ____ values by _____.	• To perform a horizontal scaling you multiply the ____ values by _____.

Example 1:

a) Consider the graph below. Sketch the graph of $g(x) = \frac{1}{2}f(x)$

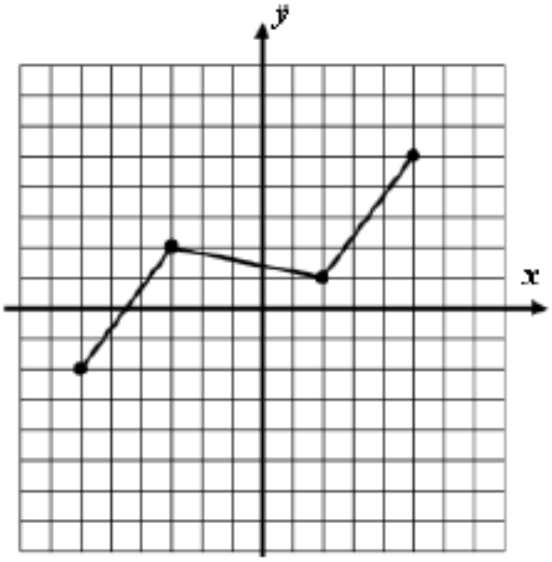


b) Consider the graph below. Sketch the graph of $g(x) = f\left(\frac{1}{2}x\right)$

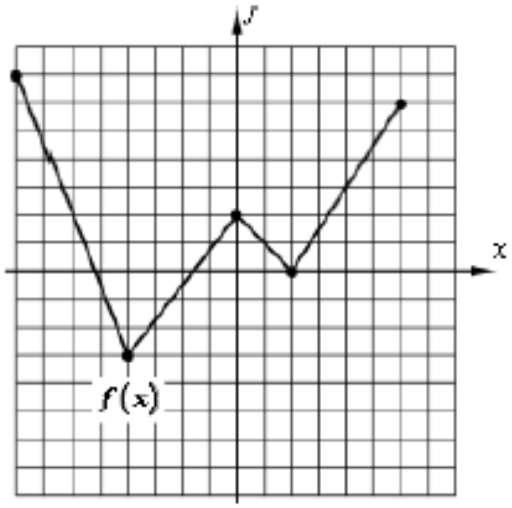


Example 2:

a) The graph of $g(x)$ is shown on the grid below. Sketch the graph of $2f(x)$.



b) The graph of $f(x)$is shown on the grid below. Sketch a graph of $f(2x)$ on the same set of axes.



Summary of Transformations

Function	Transformation
$f(x)+a$	
$f(x)-a$	
$f(x+a)$	
$f(x-a)$	
$-f(x)$	
$f(-x)$	
$k\cdot f(x)$ or $\frac{1}{k}\cdot f(x)$	
$f(k\cdot x)$ or $f(\frac{1}{k}\cdot x)$	

Performing multiple transformations:

If a function has multiple transformations, they are applied in the following order:

H

D

R

V

Let's try one!

State the order in which the transformations are occurring in $f(x)=(-x-2)^3-4$;

Now you try!

State the order in which the transformations are occurring in $-f(2x+1)-4$

Example 3:

Describe the transformation for each function.

Function	Tranformation
$y = \mathbf{2}\lvert x + 6\rvert$	
$y = \sqrt{-3x} - 2$	
$y = (x - 3)^2 + 7$	
$y = -\sqrt[3]{x + 7} - 10$	
$y = \frac{1}{2}x + 2$	

Example 4:

a) Write the equation of the function whose parent function is $f(x) = x^2$ and has been translated 3 units to the right, reflected over the x-axis, horizontally scaled by a factor of 2, and translated 4 units up.

b) Write the equation of the function whose parent function is $f(x) = \sqrt{x}$ and has been vertically scaled by a factor of 2, horizontally scaled by a factor of 5, and translated 10 units to the left.

c) Write an equation of the function whose parent function is $f(x) = |x|$ and has been vertically scaled by a factor of 7, reflected in the x-axis, reflected in the y-axis, translated 5 units to the right and translated 2 units up.

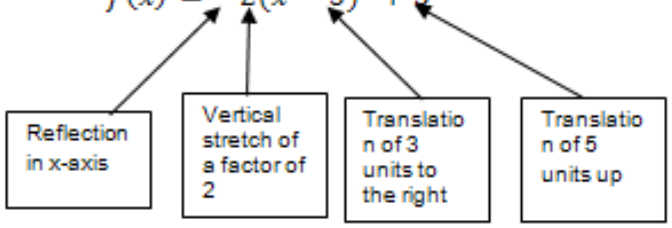
SUMMARY

Reflection in x-axis $y = -f(x)$	Reflection in the y-axis $y = f(-x)$
Translate up c units $y = f(x) + c$	Translate down c units $y = f(x) - c$
Translate left c units $y = f(x + c)$	Translate right c units $y = f(x - c)$
Stretch vertically $y = cf(x), c > 1$	Shrink vertically $y = cf(x), 0 < c < 1$
Shrink horizontally $y = f(cx), c > 1$	Stretch horizontally $y = f(cx), 0 < c < 1$

For multiples shifts, use the order of operations to determine what to do first

Example: Describe the transformations on $f(x) = x^2$ to get the graph of the equation

$$f(x) = -2(x - 3)^2 + 5$$



Transformations of Functions—Vertex Form of a Function

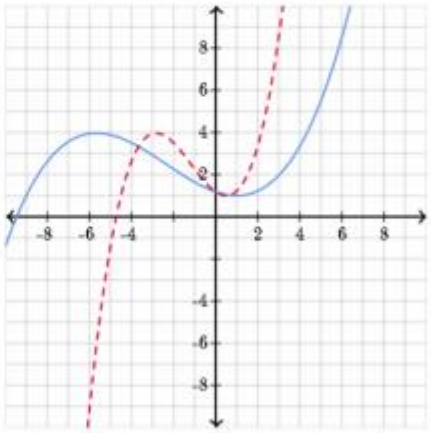
Quadratic Function: $f(x) = a(x - h)^2 + k$	Absolute Value Function: $f(x) = a\|x - h\|^2 + k$
Cubic Function: $f(x) = a(x - h)^3 + k$	Square Root Function: $f(x) = a\sqrt{x - h} + k$

The vertex is (h, k).

Exit Ticket

The solid line below is the graph of $g(x)$ which is a transformation of the graph of the dotted line, $f(x)$. Which equation below best represents the equation of $g(x)$ in terms of $f(x)$?

(1) $f(2x)$
(2) $2f(x)$
(3) $f(\frac{1}{2}x)$
(4) $\frac{1}{2}f(x)$



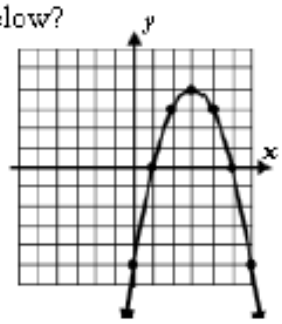
Algebra 2: 6 - 4 DILATIONS OF FUNCTIONS – Homework

1) The graph of $f(x) = 10 - x^2$ represents the graph of $f(x) = x^2$ after

(1) a vertical shift upwards of 10 units followed by a reflection in the x-axis.
(2) a reflection in the x-axis followed by a vertical shift of 10 units upwards.
(3) a leftward shift of 10 units followed by a reflection in the y-axis.
(4) a reflection across the x-axis followed by a rightward shift of 10 units.

2)

Which of the following equations represents the graph shown below?

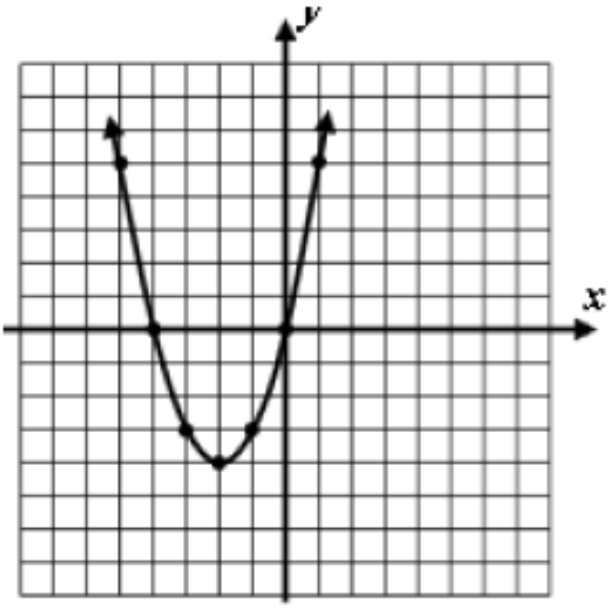


(1) $y = (x+3)^3 + 4$ (3) $y = -(x-3)^2 + 4$

(2) $y = -(x+3)^2 + 4$ (4) $y = (-x-3)^2 - 4$

_____

3) Consider the graph of f(x) below. Sketch the graph of $2f(x)$ on the same set of axes.



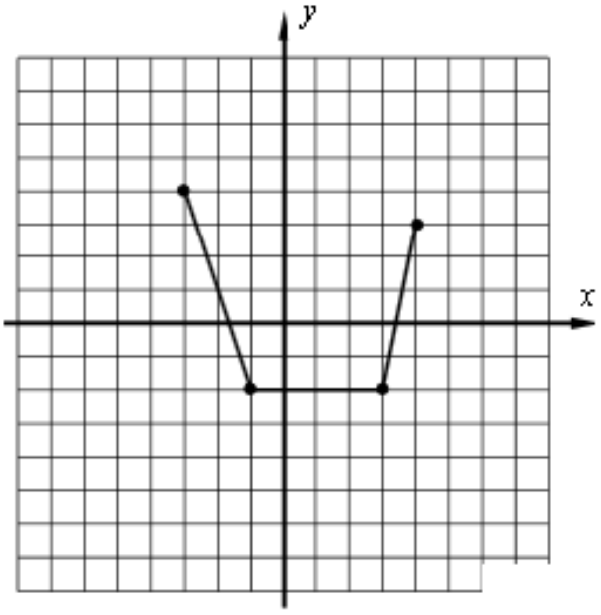
4) Write the equation of the function whose parent function is $f(x) = x^2$ and has been vertically stretched by a factor of 3, translated 10 units to the left, and reflected in the y-axis.

5) Write the equation of the function whose parent function is $f(x) = |x|$ and has been horizontally scaled by a factor of 5, translated 6 units to the right, reflected in the x-axis, and translated 2 units down.

6) Consider the function $f(x)$ graphed on the grid below.

a) Sketch the graph of $g(x) = f\left(\frac{1}{2}x\right)$ on the same set of axes.

b) How would you describe its graph compared to the graph of $f(x)$.



7) State the order of the transformations being performed in the given equations.

Function	Translations
$f(x) = -x^2 + 3$	
$g(x) = 2\lvert -x - 2\rvert - 1$	
$h(x) = -\sqrt{\frac{1}{2}x - 1} + 6$	

Review of Transformation of Functions

Part I: Short Answer

1) Explain how $y = |x+3| - 6$ is translated from $y = |x|$.

_____

2) Explain how $y = \sqrt[3]{x-5} + 3$ is translated from $y = \sqrt[3]{x}$.

_____

3) Explain how $y = f(x-4) - 2$ is translated from $y = f(x)$.

_____

4) Explain how $y = g(x+9)$ is translated from $y = g(x)$.

_____

5) Let the graph of $y = f(x)$ have the following points: $(4,-3), (-2,0), (-10,-15)$.
List the points on the graph of

a) $y = f(x-2)$ _____

b) $y = f(x) + 9$ _____

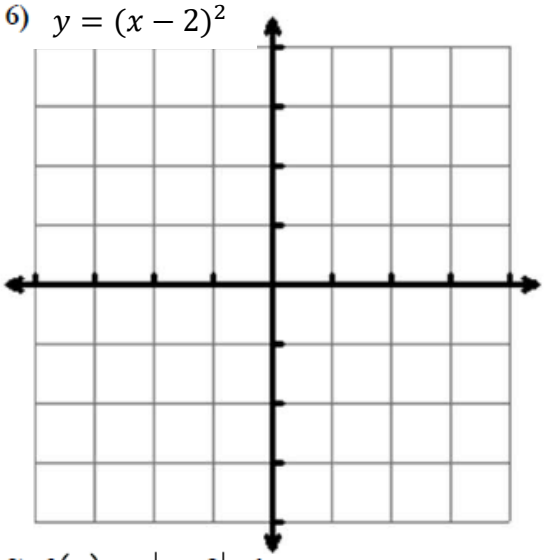
c) $= f(x+3) - 1$ _____

6) If the graph of $y = \sqrt{x}$ is translated up four units and left five units, write the new equation for this function.

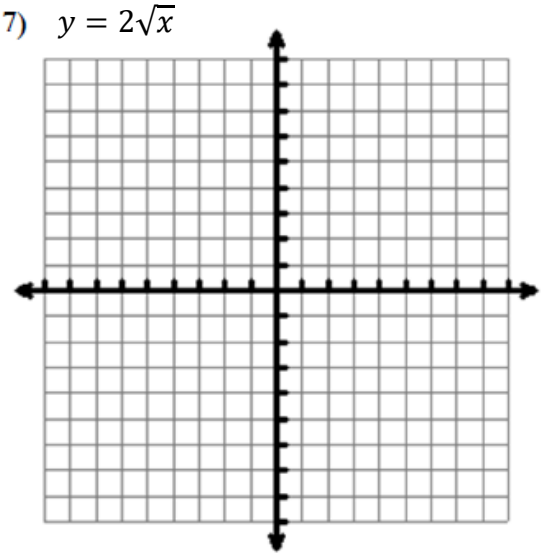
7) If the graph of $y = x^2$ is translated right seven units and down two units, write the new equation for this function.

Part II: Graphing - If the scale on the axes is not 1 unit, you will need to label the axes with numbers. You must show at least five exact points or five steps on each graph, if possible.

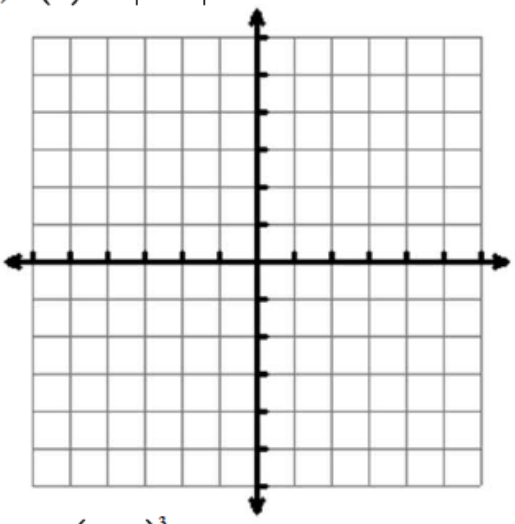
6) $y = (x-2)^2$



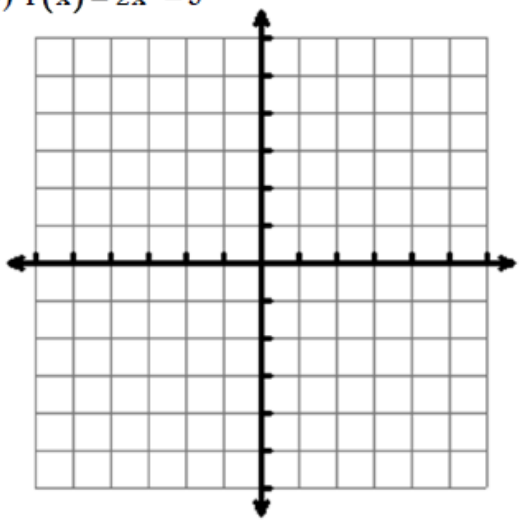
7) $y = 2\sqrt{x}$



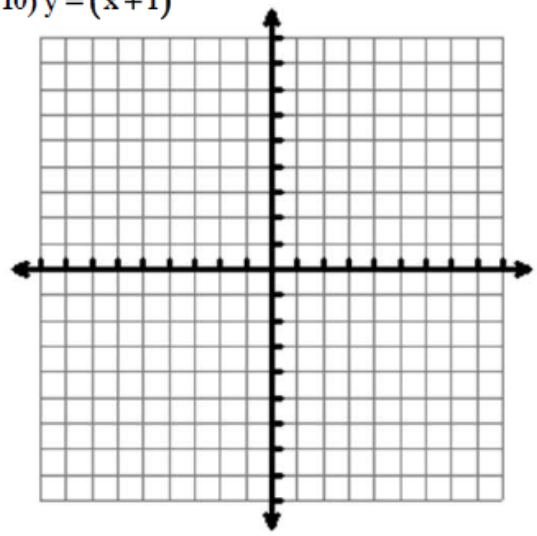
8) $f(x) = -|x+2|+1$



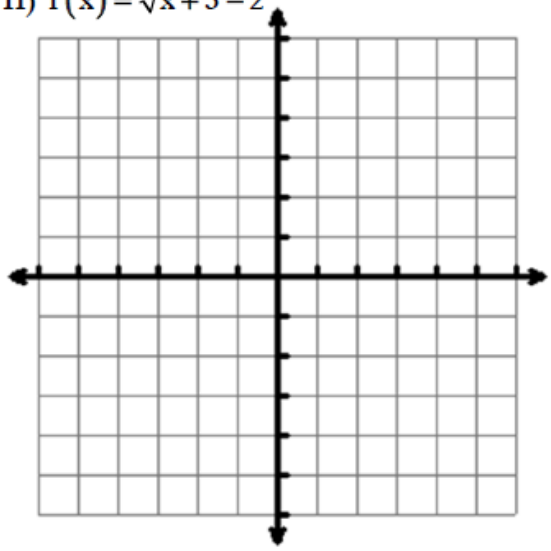
9) $f(x) = 2x^2 - 5$



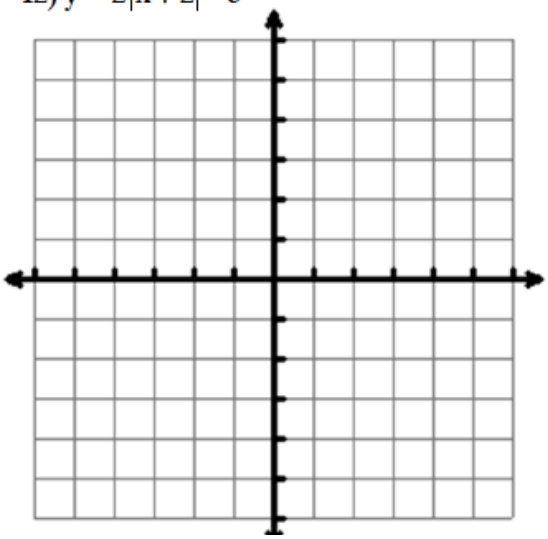
10) $y = (x+1)^3$



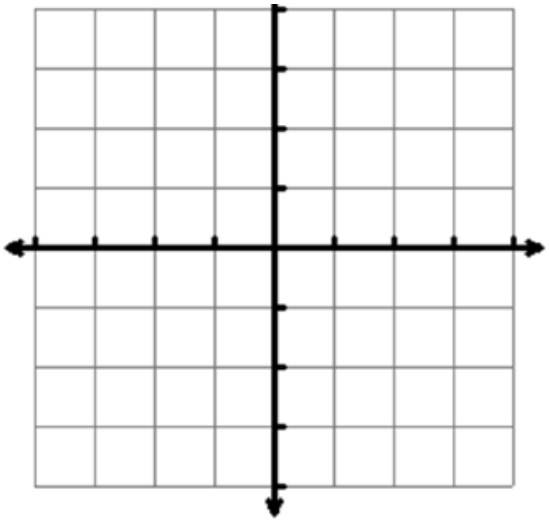
11) $f(x) = \sqrt{x+3} - 2$



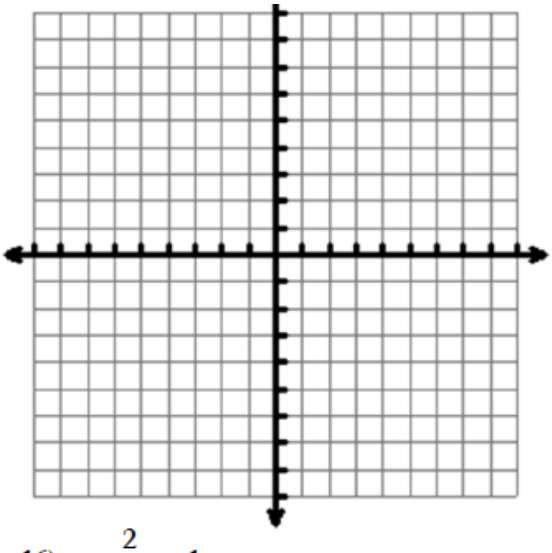
12) $y = 2|x+2|-5$



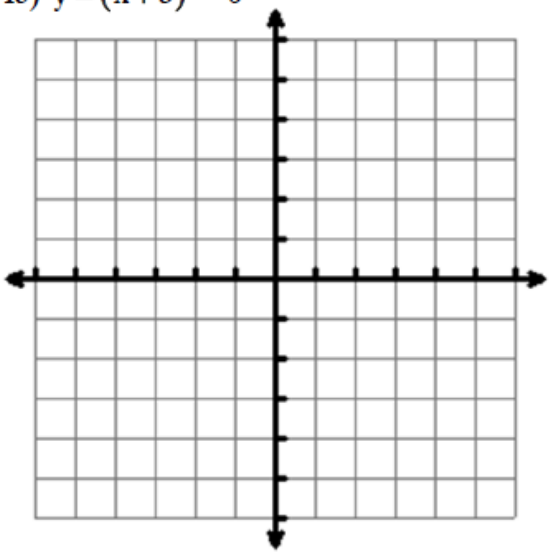
13) $y = |x+1|+1$



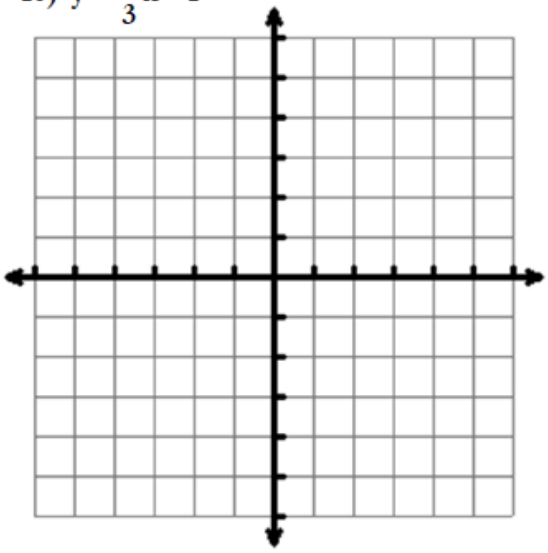
14) $y = \sqrt{x+3}-1$



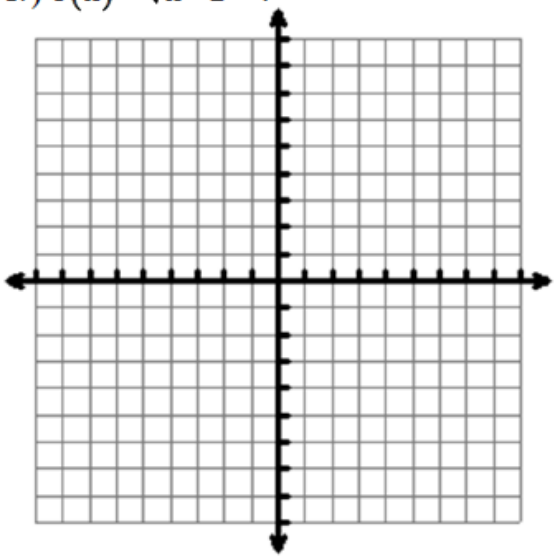
15) $y = (x+3)^2 - 6$



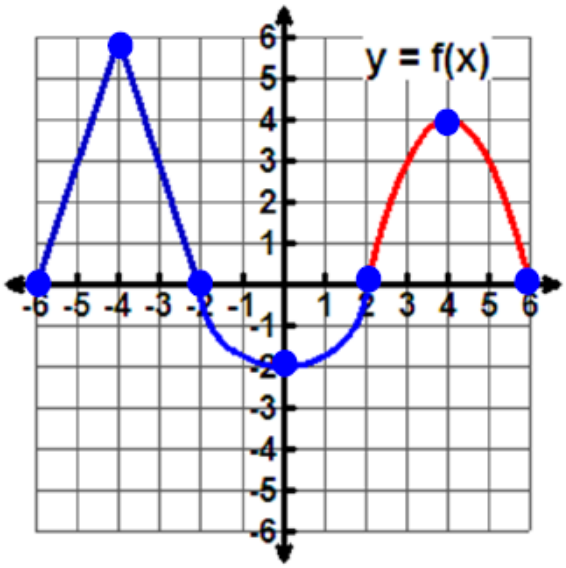
16) $y = \frac{2}{3}x - 1$



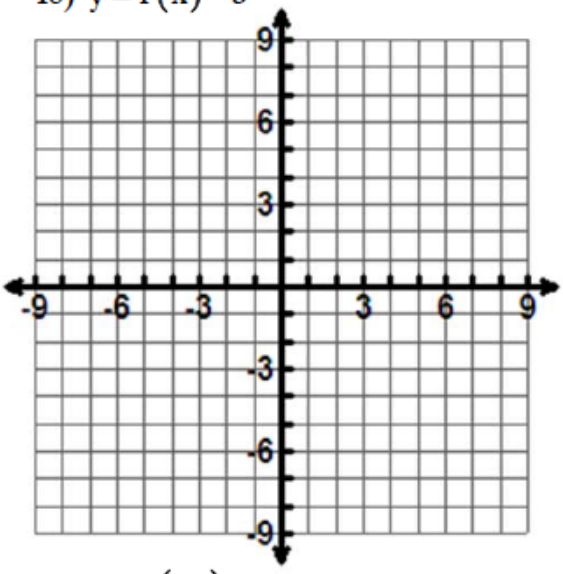
17) $f(x) = \sqrt{x-2}-4$



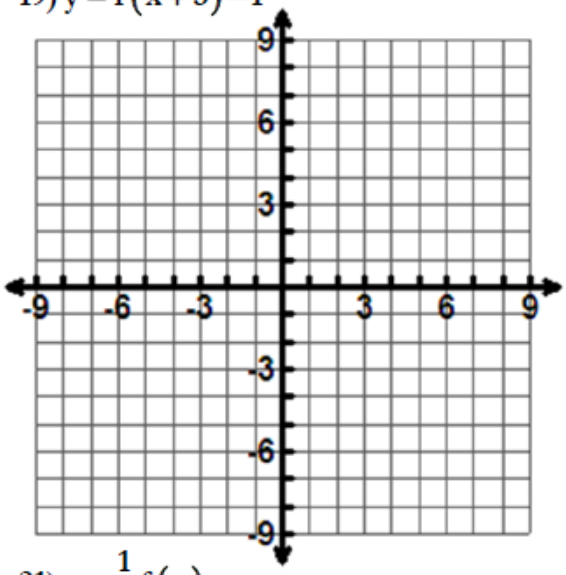
Part III: Use the graph of f(x) to sketch the graphs of the following.



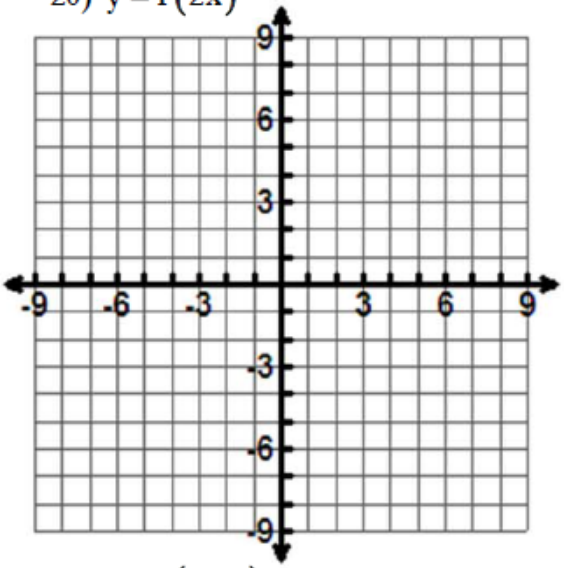
18) $y = f(x) - 3$



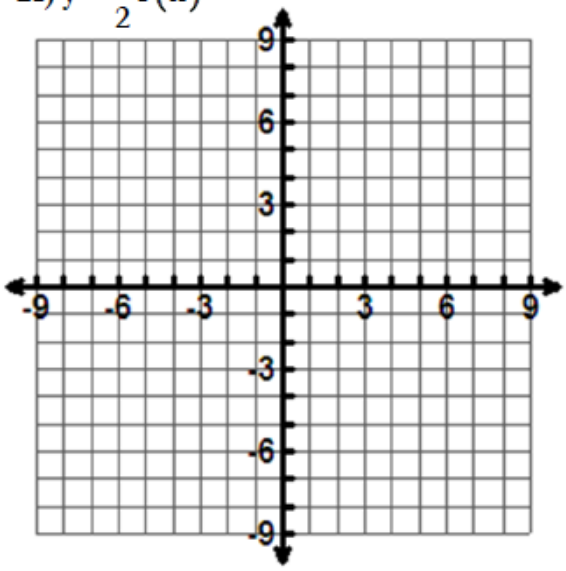
19) $y = f(x+3) - 1$



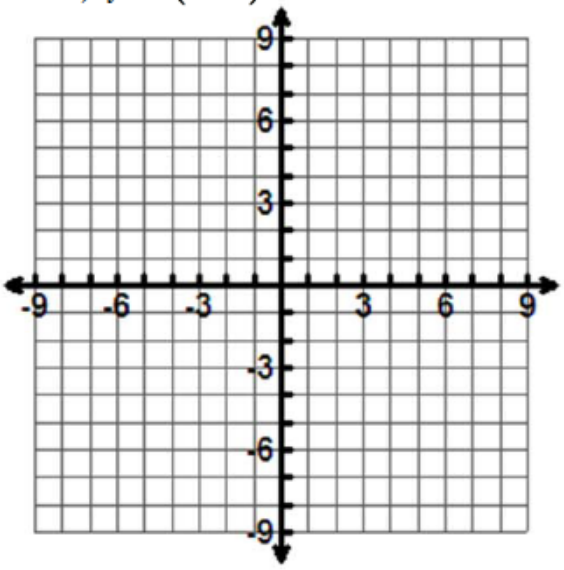
20) $y = f(2x)$



21) $y = \frac{1}{2} f(x)$



22) $y = f(x-1) + 2$



23.

State the parent function and the order in which the transformations are occurring in each function.

Function	Parent Function	Transformation
$f(x) = (2x + 1)^2 - 4$		
$g(x) = \frac{1}{4}\lvert -x \rvert + 2$		
$h(x) = -3\sqrt{x - 2} - 1$		
$f(x) = -2(x + 3)^2 - 1$		
$f(x) = \left\lvert \frac{1}{2}x - 1 \right\rvert + 3$		
$f(x) = \sqrt{-x - 2} - 5$		
$f(x) = -3(-x + 4)^3$		