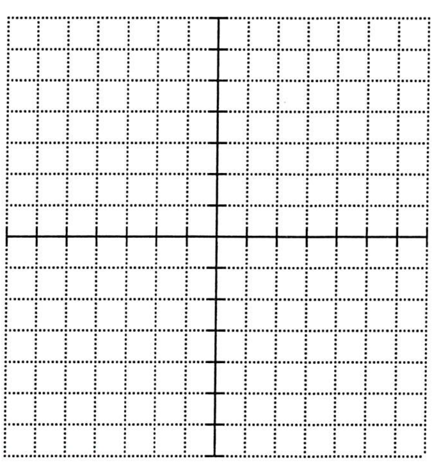
Complete the table below based on the observations that you have seen in the previous examples.

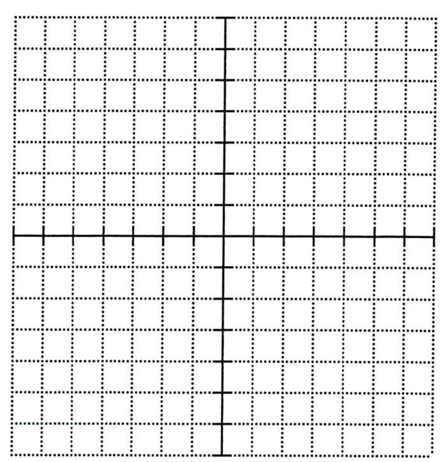
Equation with Transformations	Describe the shift(s) and/or reflections that the graph of $f(x)$ undergoes	Describe what would be done to the x and/or y coordinates to the graph of $f(x)$
$y = f(x) + c$		
$y = f(x) - c$		
$y = f(x + c)$		
$y = f(x - c)$		
$y = -f(x)$		
$y = f(-x)$		
$y = \lvert f(x) \rvert$		
$y = a \cdot f(x)$		

In Algebra II, you learned how to graph several other functions. Graph the basic functions mentioned below.

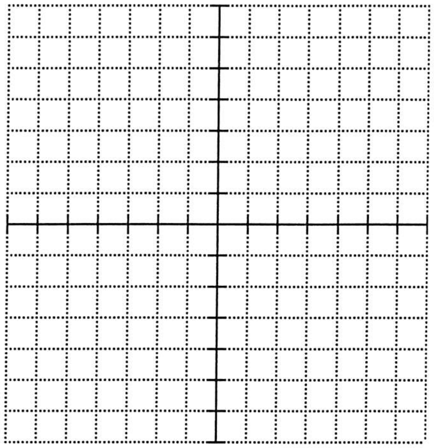
I. Basic Quadratic Function: $f(x) = x^2$



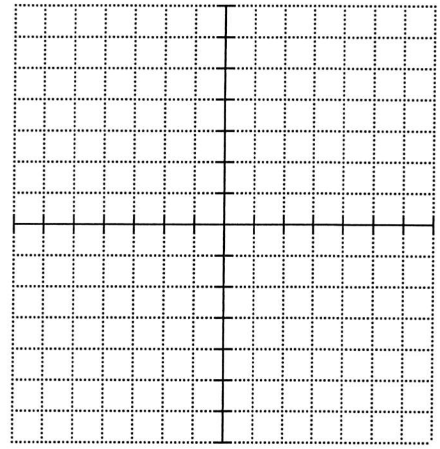
II. Basic Absolute Value Function: $f(x) = \lvert x \rvert$



III. Basic Cubed Root Function: $f(x) = \sqrt[3]{x}$

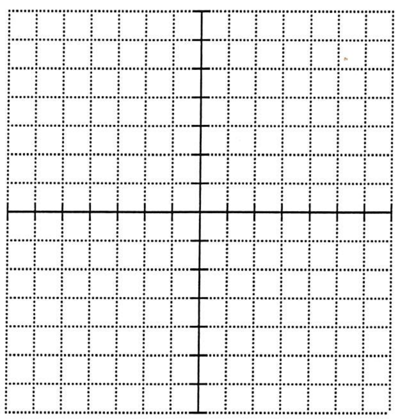


IV. Basic Cubic Function: $f(x) = x^3$

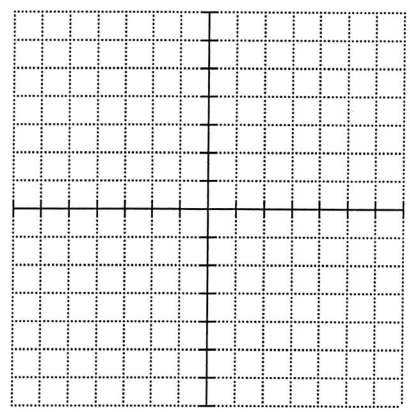


Describe how the graphs of each of the following functions will be different from the basic function. Then, graph the given functions

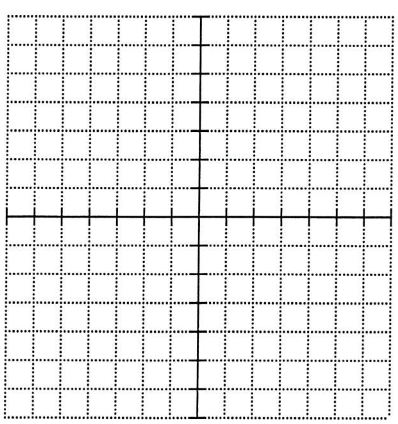
$g(x) = (x + 2)^2 - 3$



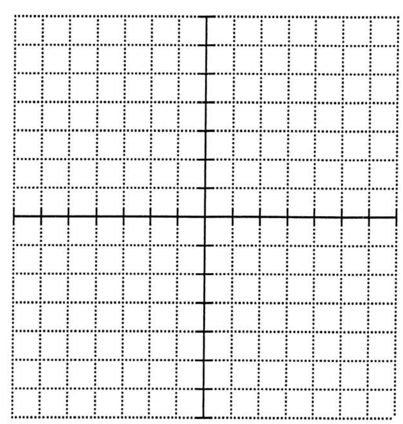
$h(x) = -|x+1| + 4$



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



$p(x) = (-x+4)^3 + 1$



The table below shows ordered pairs on the graph of a function, $f(x)$, that consists of line segments connecting the points in the table. Use the table to create a table of values for each function below that is a transformation of the graph of $f(x)$.

x	–3	–1	1	3	5
$f(x)$	5	1	–4	1	2

1. $g(x) = -f(x) + 2$

State the shifts and/or reflections that $f(x)$ undergoes to obtain the graph of $g(x)$, stating what changes are made to which coordinates of $f(x)$ to obtain the coordinates of point for $g(x)$.

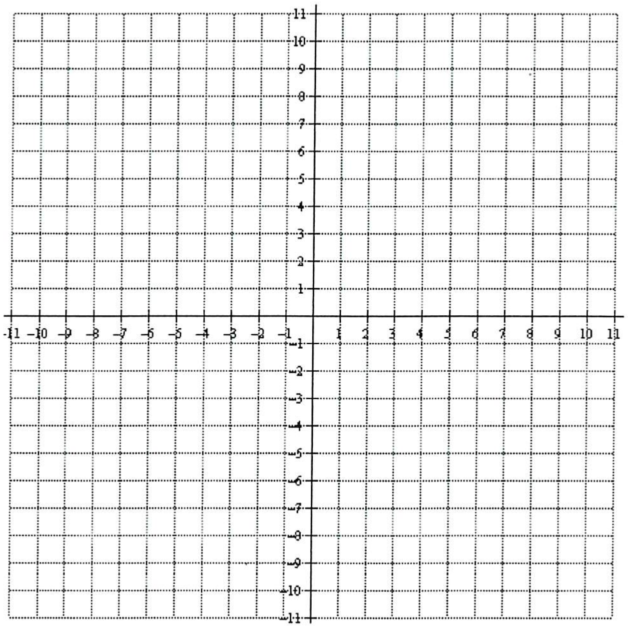
Coordinates on $f(x)$	x coordinate on $g(x)$	y coordinate on $g(x)$	Ordered Pairs on $g(x)$
(–3, 5)			
(–1, 1)			
(1, –4)			
(3, 1)			
(5, 2)			

2. $h(x) = 3f(x + 2) - 3$

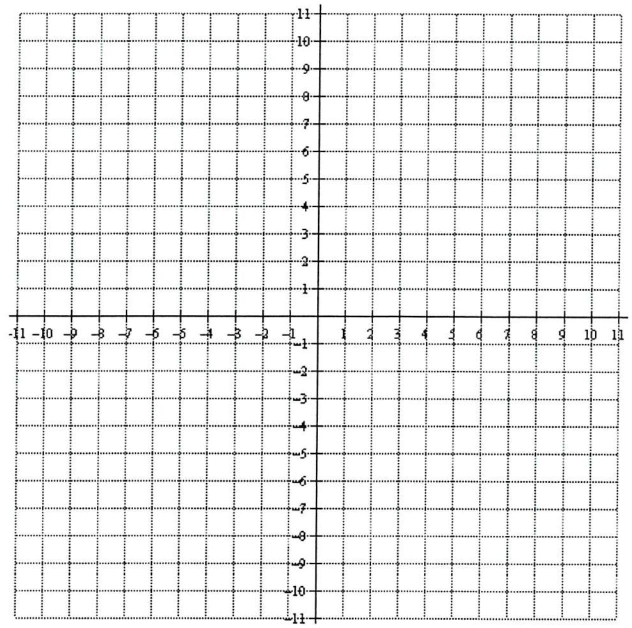
State the shifts and/or reflections that $f(x)$ undergoes to obtain the graph of $h(x)$, stating what changes are made to which coordinates of $f(x)$ to obtain the coordinates of point for $h(x)$.

Coordinates on $f(x)$	x coordinate on $h(x)$	y coordinate on $h(x)$	Ordered Pairs on $h(x)$
(–3, 5)			
(–1, 1)			
(1, –4)			
(3, 1)			
(5, 2)			

3. $g(x)=\begin{cases}\sqrt{-x}+3, & -4\le x<0\\ 2, & x=0\\ \sqrt{x}+3, & x>0\end{cases}$



4. $p(x)=\begin{cases}\sqrt{-x-2}+2, & x<-2\\ -2x-2, & -2<x<1\\ -\sqrt{x-1}-4, & x>1\end{cases}$



3. $q(x) = f(-x + 3) - 2$

State the shifts and/or reflections that $f(x)$ undergoes to obtain the graph of $q(x)$, stating what changes are made to which coordinates of $f(x)$ to obtain the coordinates of point for $q(x)$.

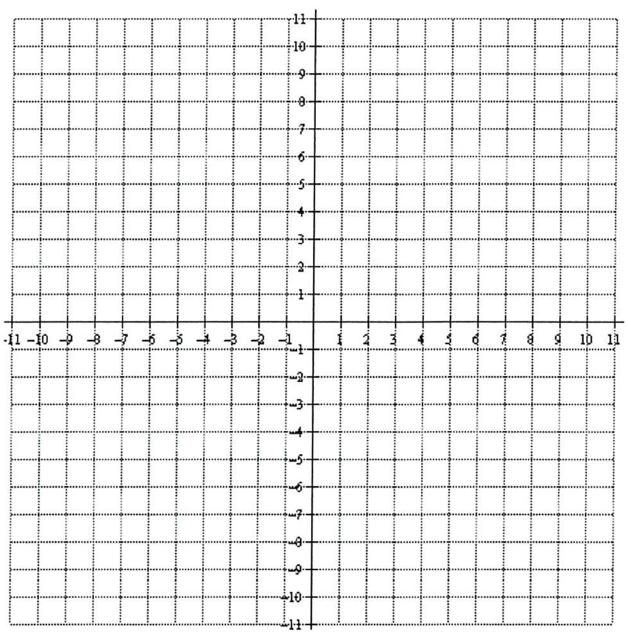
Coordinates on $f(x)$	x coordinate on $q(x)$	y coordinate on $q(x)$	Ordered Pairs on $q(x)$
(–3, 5)			
(–1, 1)			
(1, –4)			
(3, 1)			
(5, 2)			

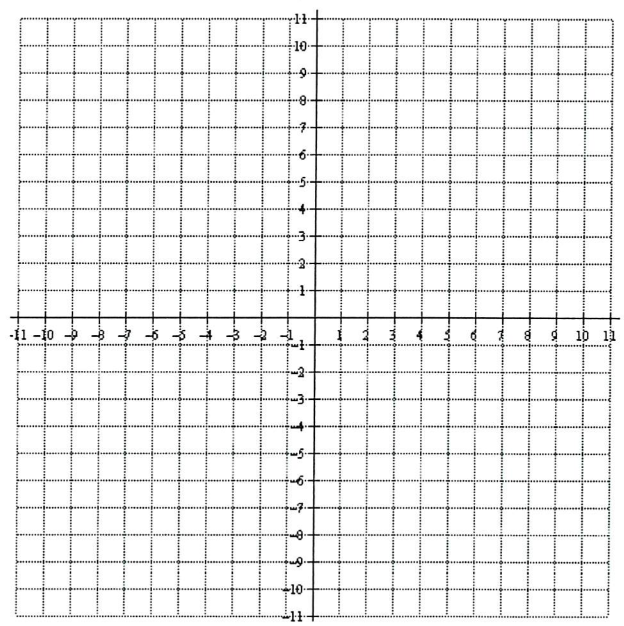
Graphs of Piece-wise Defined Functions:

Graph the following piecewise defined functions on the provided grids.

1. $g(x) = \begin{cases} (x-2)^2 - 3, & -1 < x \le 4 \\ \frac{2}{3}x + 2, & x > 4 \end{cases}$

2. $h(x) = \begin{cases} |x+2| + 1, & x < -1 \\ 3, & x = -1 \\ -\frac{1}{2}x + 5, & x > -1 \end{cases}$





The table below shows ordered pairs on the graph of a function, $f(x)$, that consists of line segments connecting the points in the table. Use the table to create a table of values for each function below that is a transformation of the graph of $f(x)$.

x	–3	–1	1	3	5
$f(x)$	5	1	–4	1	2

1. $g(x) = -f(x) + 2$

State the shifts and/or reflections that $f(x)$ undergoes to obtain the graph of $g(x)$, stating what changes are made to which coordinates of $f(x)$ to obtain the coordinates of point for $g(x)$.

① Reflection over x-axis
② Shift up 2

$(x, -y+2)$

Coordinates on $f(x)$	x coordinate on $g(x)$	y coordinate on $g(x)$	Ordered Pairs on $g(x)$
(–3, 5)	−3	−5+2=−3	(−3,−3)
(–1, 1)	−1	−1+2=1	(−1,1)
(1, –4)	1	4+2=6	(1,6)
(3, 1)	3	−1+2=1	(3,1)
(5, 2)	5	−2+2=0	(5,0)

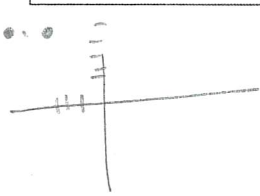
2. $h(x) = 3f(x + 2) - 3$

State the shifts and/or reflections that $f(x)$ undergoes to obtain the graph of $h(x)$, stating what changes are made to which coordinates of $f(x)$ to obtain the coordinates of point for $h(x)$.

① Vertical dilation by a factor of 3
② $x+2=0$ $x=-2$
Shift left 2
③ Shift down 3

$(x-2, 3y-3)$

Coordinates on $f(x)$	x coordinate on $h(x)$	y coordinate on $h(x)$	Ordered Pairs on $h(x)$
(–3, 5)	−3−2=−5	3(5)−3=12	(−5,12)
(–1, 1)	−1−2=−3	3(1)−3=0	(−3,0)
(1, –4)	1−2=−1	3(−4)−3=−15	(−1,−15)
(3, 1)	3−2=1	3(1)−3=0	(1,0)
(5, 2)	5−2=3	3(2)−3=3	(3,3)



3. $q(x) = f(-x + 3) - 2$

State the shifts and/or reflections that $f(x)$ undergoes to obtain the graph of $q(x)$, stating what changes are made to which coordinates of $f(x)$ to obtain the coordinates of point for $q(x)$.

① Reflects over y-axis
② $-x+3=0$ Shifts right 3
$-x=-3$
$x=3$
③ Shifts down 2

$(-x+3, y-2)$

Coordinates on $f(x)$	x coordinate on $q(x)$	y coordinate on $q(x)$	Ordered Pairs on $q(x)$
(–3, 5)	$3+3=6$	$5-2=3$	(6, 3)
(–1, 1)	$1+3=4$	$1-2=-1$	(4, –1)
(1, –4)	$-1+3=2$	$-4-2=-6$	(2, –6)
(3, 1)	$-3+3=0$	$1-2=-1$	(0, –1)
(5, 2)	$-5+3=-2$	$2-2=0$	(–2, 0)

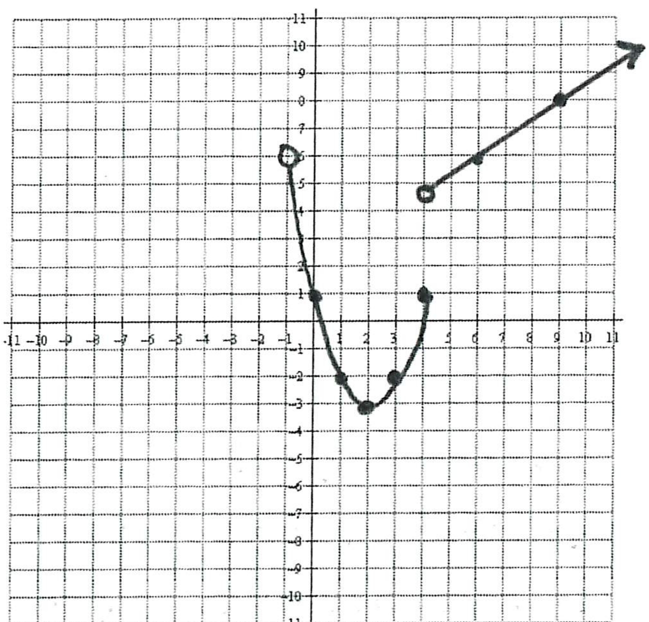
Graphs of Piece-wise Defined Functions:

Graph the following piecewise defined functions on the provided grids.

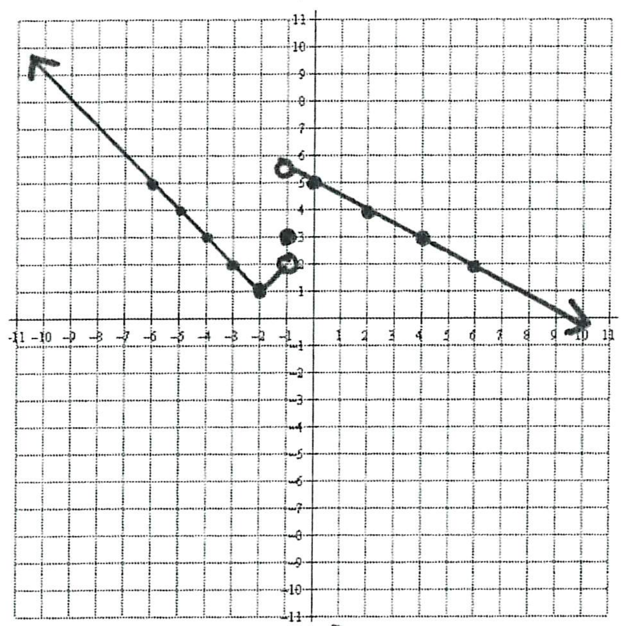
1. $g(x) = \begin{cases} (x-2)^2 - 3, & -1 < x \le 4 \\ \frac{2}{3}x + 2, & x > 4 \end{cases}$

2. $h(x) = \begin{cases} |x+2| + 1, & x < -1 \\ 3, & x = -1 \\ -\frac{1}{2}x + 5, & x > -1 \end{cases}$

Point (–1, 3)



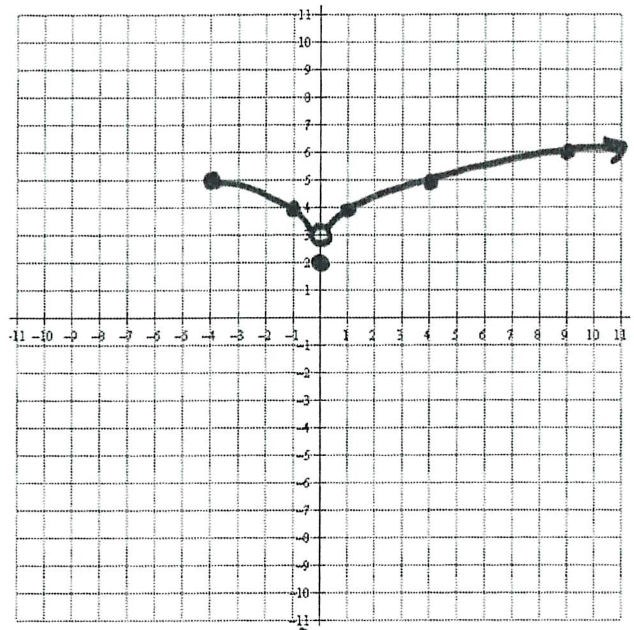
D: $(-1, \infty)$
R: $[-3, \infty)$



D: $(-\infty, \infty)$
R: $(-\infty, \infty)$

$-x-2=0$
$-x=2 \quad x=-2$

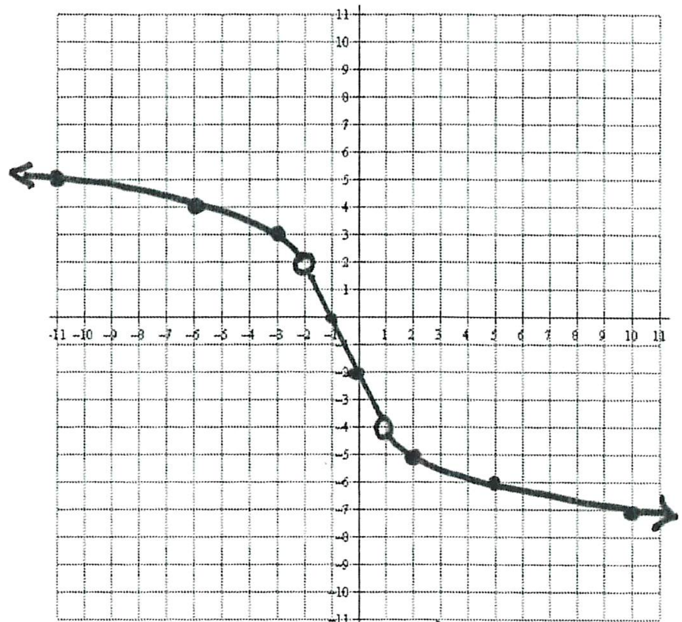
3. $g(x)=\begin{cases}\sqrt{-x}+3, & -4\le x<0\\ 2, & x=0\\ \sqrt{x}+3, & x>0\end{cases}$ ← Point (0,2)



D: [-4, ∞)

R: y = 2 and (3, ∞)

4. $p(x)=\begin{cases}\sqrt{-x-2}+2, & x<-2\\ -2x-2, & -2<x<1\\ -\sqrt{x-1}-4, & x>1\end{cases}$



D: (-∞, -2) ∪ (-2, 1) ∪ (1, ∞)

R: (-∞, -4) ∪ (-4, 2) ∪ (2, ∞)