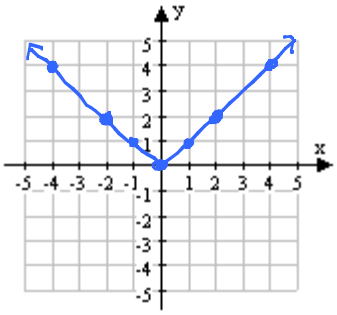
Sec 4.8 – Rational & Radical Relationships
Graphs of Absolute, Step, and Partial Functions Name:

Consider the following EQUATIONS, make a table, plot the points, and graph what you think the graph looks like.

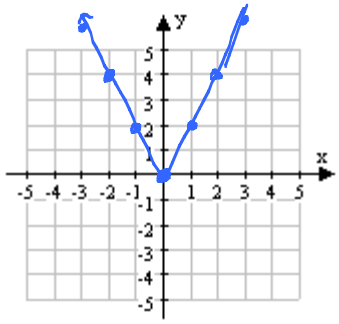
1. $f(x)=|x|$

x	y
−4	|-4| = 4
−2	|-2| = 2
−1	|-1| = 1
0	|0| = 0
1	|1| = 1
2	|2| = 2
4	|4| = 4



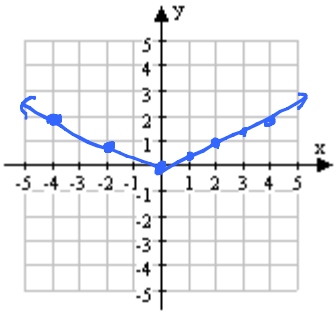
2. $f(x)=2|x|$

x	y
−3	2|-3| = 2(3) = 6
−2	2|-2| = 2(2) = 4
−1	2|-1| = 2(1) = 2
0	2|0| = 2(0) = 0
1	2|1| = 2(1) = 2
2	2|2| = 2(2) = 4
3	2|3| = 2(3) = 6



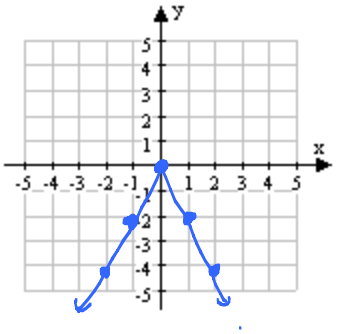
3. $f(x)=0.5|x|$

x	y
−4	0.5|-4| = 0.5(4) = 2
−2	0.5|-2| = .5(2) = 1
0	0.5|0| = .5(0) = 0
1	0.5|1| = .5(1) = .5
2	0.5|2| = .5(2) = 1
3	0.5|3| = .5(3) = 1.5
4	0.5|4| = .5(4) = 2



4. $f(x)=-2|x|$

x	y
−4	-2|-4| = -2(4) = -8
−1	-2|-1| = -2(1) = -2
0	-2|0| = -2(0) = 0
1	-2|1| = -2(1) = -2
2	-2|2| = -2(2) = -4
3	-2|3| = -2(3) = -6
4	-2|4| = -2(4) = -8

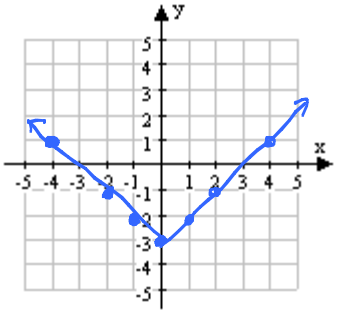


5. What happens to the graph as the number in front of $|x|$ gets Larger? Close to Zero? Negative?

AS THE COEFFICIENT BECAME LARGER THAN 1 THE GRAPH BECAME VERTICALLY STRETCHED.
AS THE COEFFICIENT APPROACHED 0 THE GRAPH BECAME VERTICALLY COMPRESSED.
WHEN THE COEFFICIENT WAS NEGATIVE THE GRAPH WAS REFLECTED OVER THE X-AXIS.

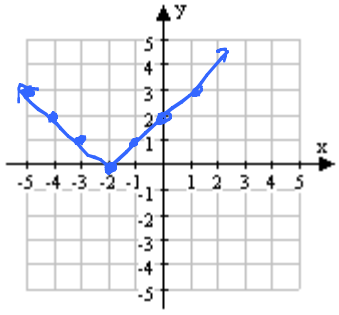
6. $f(x)=|x|-3$

x	y
−4	|-4|-3 = 4-3 = 1
−2	|-2|-3 = 2-3 = -1
−1	|-1|-3 = 1-3 = -2
0	|0|-3 = 0-3 = -3
1	|1|-3 = 1-3 = -2
2	|2|-3 = 2-3 = -1
4	|4|-3 = 4-3 = 1



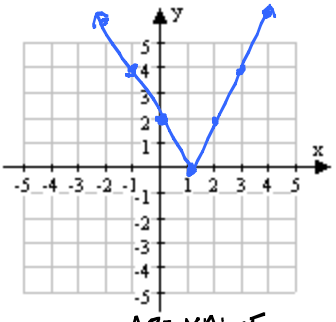
7. $f(x)=|x+2|$

x	y
−5	|-5+2| = |-3| = 3
−4	|-4+2| = |-2| = 2
−3	|-3+2| = |-1| = 1
−2	|-2+2| = |0| = 0
−1	|-1+2| = |1| = 1
0	|0+2| = |2| = 2
1	|1+2| = |3| = 3



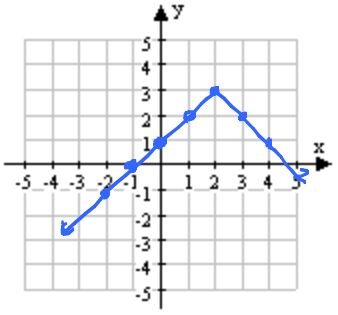
8. $f(x)=2|x-1|$

x	y
−2	2|-2-1| = 2|-3| = 6
−1	2|-1-1| = 2|-2| = 4
0	2|0-1| = 2|-1| = 2
1	2|1-1| = 2|0| = 0
2	2|2-1| = 2|1| = 2
3	2|3-1| = 2|2| = 4
4	2|4-1| = 2|3| = 6



9. $f(x)=-|x-2|+3$

x	y
−2	-|-2-2|+3 = -|-4|+3 = -1
−1	-|-1-2|+3 = -|-3|+3 = 0
0	-|0-2|+3 = -|-2|+3 = 1
1	-|1-2|+3 = -|-1|+3 = 2
2	-|2-2|+3 = -|0|+3 = 3
3	-|3-2|+3 = -|1|+3 = 2
4	-|4-2|+3 = -|2|+3 = 1



ABS VALUE

10. What happens to the graph as we add or subtract a number inside or outside the [illegible]?

ADDING OR SUBTRACTING A NUMBER TO THE OUTSIDE TRANSLATES THE GRAPH UP OR DOWN.
ADDING OR SUBTRACTING A NUMBER INSIDE THE ABSOLUTE VALUE TRANSLATES THE GRAPH LEFT OR RIGHT IN THE "OPPOSITE DIRECTION".

Consider the following EQUATIONS, make a table, plot the points, and graph what you think the graph looks like.

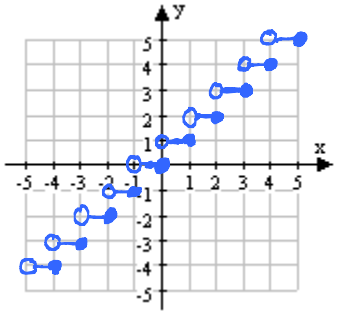
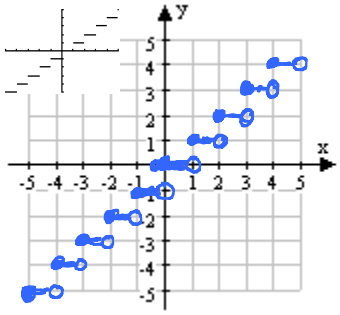
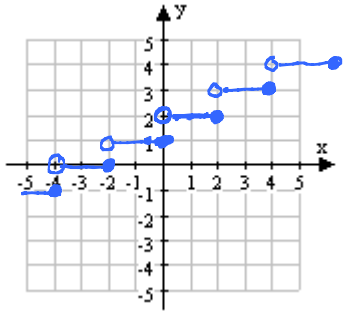
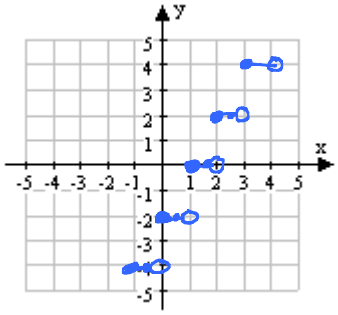
11. $f(x)=\lceil x \rceil$ 12. $f(x)=\lfloor x \rfloor$ or $f(x)=[\![x]\!]$ 13. $f(x)=\lceil 0.5x \rceil+1$ 14. $f(x)=2[\![x-1]\!]$

x	y
– 0.5	$\lceil -0.5 \rceil = 0$
0	$\lceil 0 \rceil = 0$
0.5	$\lceil 0.5 \rceil = 1$
1	$\lceil 1 \rceil = 1$
1.2	$\lceil 1.2 \rceil = 2$
2	$\lceil 2 \rceil = 2$
2.4	$\lceil 2.4 \rceil = 3$

x	y
– 0.5	$\lfloor -0.5 \rfloor = -1$
0	$\lfloor 0 \rfloor = 0$
0.5	$\lfloor 0.5 \rfloor = 0$
1	$\lfloor 1 \rfloor = 1$
1.2	$\lfloor 1.2 \rfloor = 1$
2	$\lfloor 2 \rfloor = 2$
2.4	$\lfloor 2.4 \rfloor = 2$

x	y
– 0.5	$\lceil 0.5(-.5) \rceil + 1 = 0+1 = 1$
0	$\lceil 0.5(0) \rceil + 1 = 0+1 = 1$
0.5	$\lceil 0.5(.5) \rceil + 1 = 1+1 = 2$
1	$\lceil 0.5(1) \rceil + 1 = 1+1 = 2$
1.2	$\lceil 0.5(1.2) \rceil + 1 = 1+1 = 2$
2	$\lceil 0.5(2) \rceil + 1 = 1+1 = 2$
2.4	$\lceil 0.5(2.4) \rceil + 1 = 2+1 = 3$

x	y
– 0.5	$2[\![-.5-1]\!] = 2(-2) = -4$
0	$2[\![0-1]\!] = 2(-1) = -2$
0.5	$2[\![.5-1]\!] = 2(-1) = -2$
1	$2[\![1-1]\!] = 2[\![0]\!] = 0$
1.2	$2[\![1.2-1]\!] = 2(0) = 0$
2	$2[\![2-1]\!] = 2[\![1]\!] = 2$
2.4	$2[\![2.4-1]\!] = 2(1) = 2$

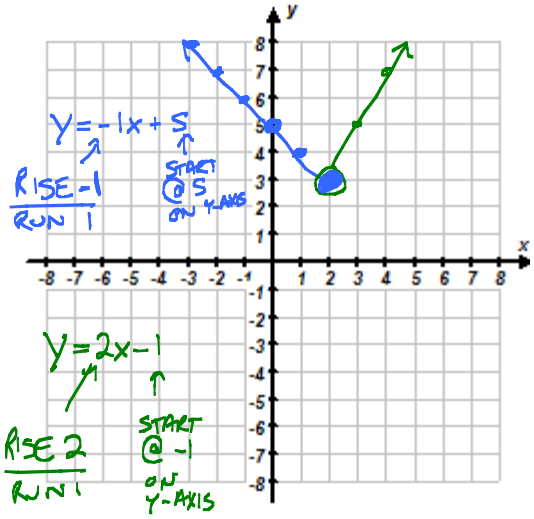





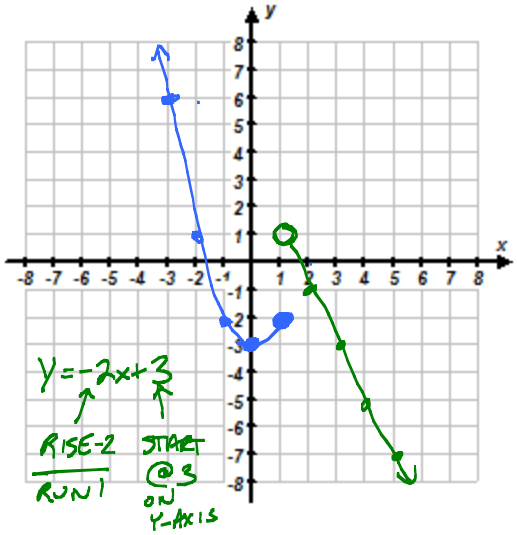
15. Graph the following partial functions (piece-wise).

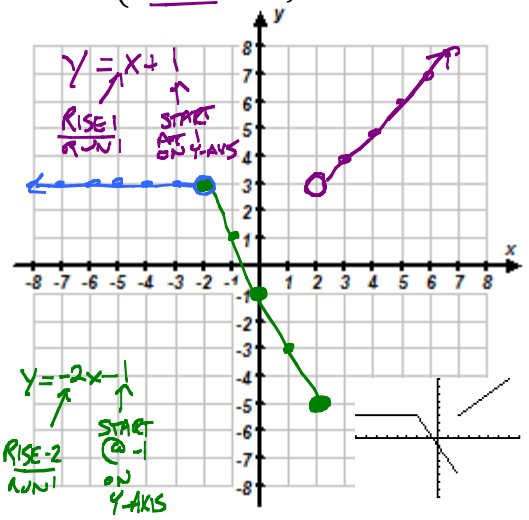
a. $f(x) = \begin{cases} -x+5 & \text{if } x \le 2 \\ 2x-1 & \text{if } x > 2 \end{cases}$

b. $f(x) = \begin{cases} x^2-3 & \text{if } x \le 1 \\ -2x+3 & \text{if } x > 1 \end{cases}$

c. $f(x) = \begin{cases} 3 & \text{if } x < -2 \\ -2x-1 & \text{if } -2 \le x \le 2 \\ x+1 & \text{if } x > 2 \end{cases}$







16. Given the following function evaluate the following.

$$g(x) = \begin{cases} x^2-2x & \text{if } x \le -1 \\ 3x+2 & \text{if } x > -1 \end{cases}$$

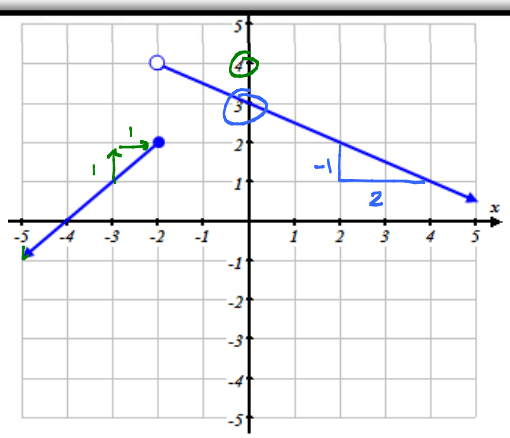
a. $g(-4) = (-4)^2 - 2(-4) = 16+8 = 24$

b. $g(-1) = (-1)^2 - 2(-1) = 1+2 = 3$

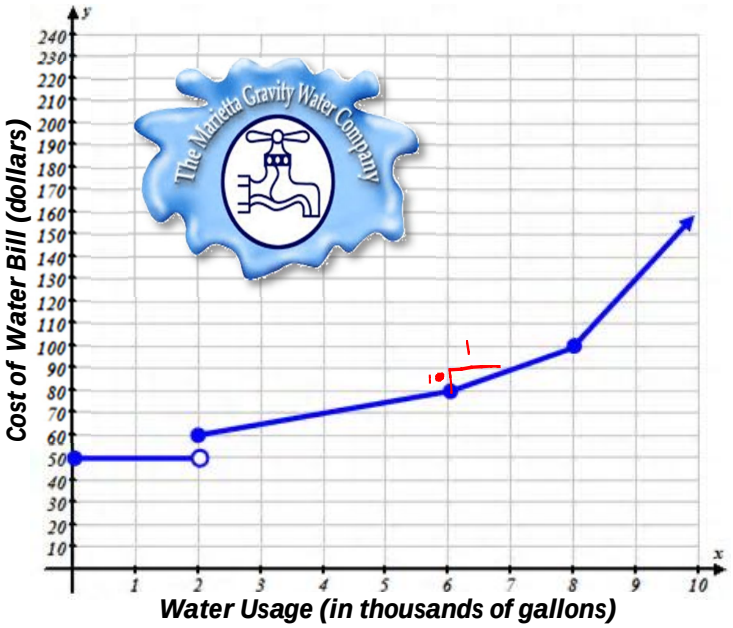
c. $g(3) = 3(3)+2 = 9+2 = 11$

17. Describe the following graph using a partial function

$$h(x) = \begin{cases} 1x+4 & x \le -2 \\ -\frac{1}{2}x+3 & x > -2 \end{cases}$$



17. A city water company charges homeowners based on how much water they use in thousands of gallons. The company progressively charges at a higher rate the more water that is used.



a. Based on the graph at the right how much does the city charged when a home owner uses the following number of gallons of water:

1700 gallons of water costs $50.

1.7

2000 gallons of water costs $60.

2.0

7000 gallons of water costs $90.

7.0

b. Finish filling in the following piece-wise equation below that describes the chart based on the graph:

$$y = \begin{cases} 50 & \text{if } 0 \le x < 2 \\ 5x + 50 & \text{if } 2 \le x < 6 \\ 10x + 20 & \text{if } 6 \le x < 8 \\ 30x - 140 & \text{if } x \ge 8 \end{cases}$$