Day 1: Graphing Absolute Value

Warm-Up:

1) Write down all the transformations of the graph of $y = x^2$.

a. $y = (x + h)^2$ moves the graph of $y = x^2$ _______________

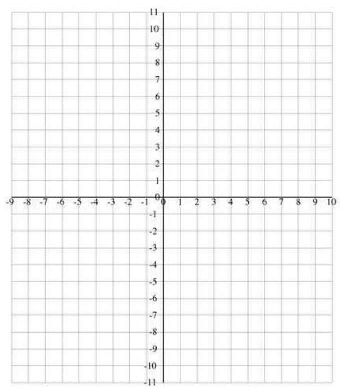
b. $y = (x - h)^2$ moves the graph of $y = x^2$ _______________

c. $y = (x)^2 + k$ moves the graph of $y = x^2$ _______________

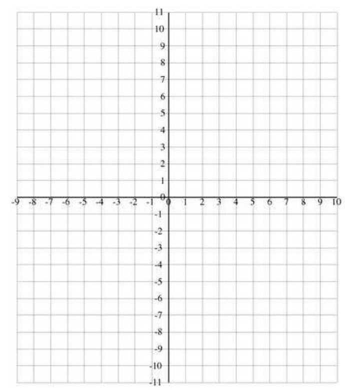
d. $y = (x)^2 - k$ moves the graph of $y = x^2$ _______________

Graph each function. Be as accurate as you can. Remember to graph at least 5 points. Then indicate the transformations from the parent graph.

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



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



4. Given $f(x) = 5x - 10$, evaluate $f(8)=$

5. Given $f(x) = x^2 + 5$, evaluate $f(x - 3)=$

Graphing Absolute Value Functions

A function of the form $f(x) = | mx + b | + c$, where $m \neq 0$ is an **absolute value function**.

$$|x| = \begin{cases} \_\_\_\_\_\_\_, & \text{if } x<0 \\ \_\_\_\_\_\_\_, & \text{if } x=0 \\ \_\_\_\_\_\_\_, & \text{if } x>0 \end{cases}$$

Let's play in our calculator with graphing absolute value functions.

Calculator Instructions (picture directions on the Day 1 Power Point)

1. Go to **Y_1 =**

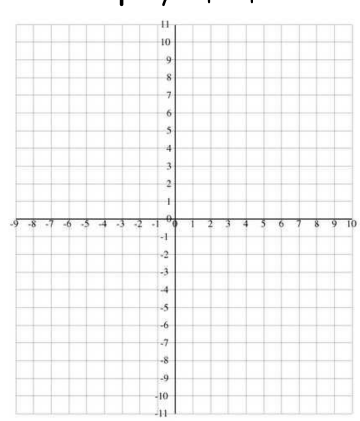
2. Then hit **MATH**

3. Scroll left to **NUM**

4. Hit Enter on **1: abs(**

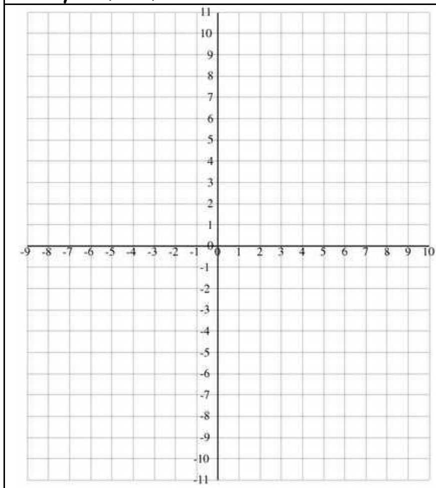
5. Type in equation. Example y = | x | should look like **abs(x)**.
   Hit the graph key and adjust the window as needed.

Graph y = | x |

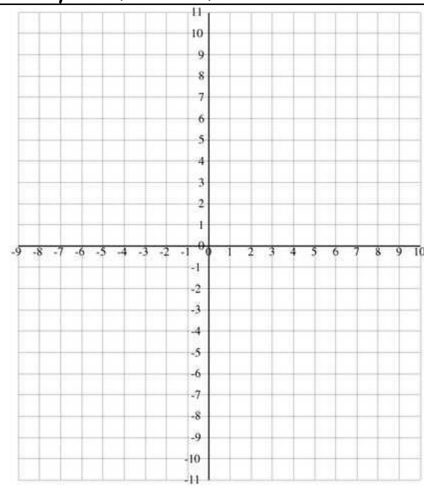


Graph the following in your calculator, use the list function to plot points and sketch the graph.

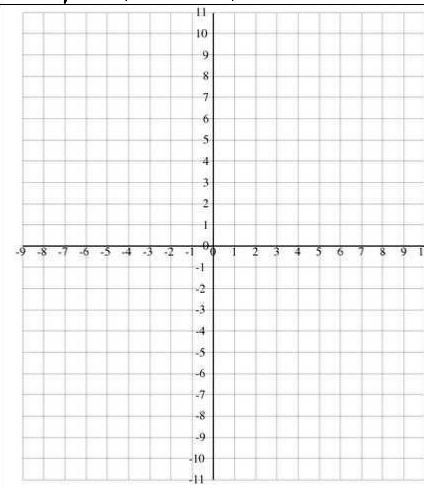
1. y = | x |



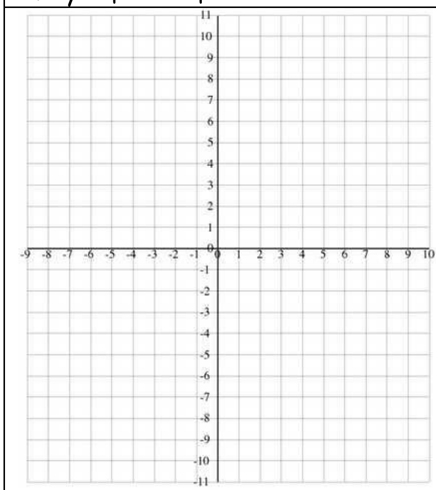
2. y = 2| x + 4 |



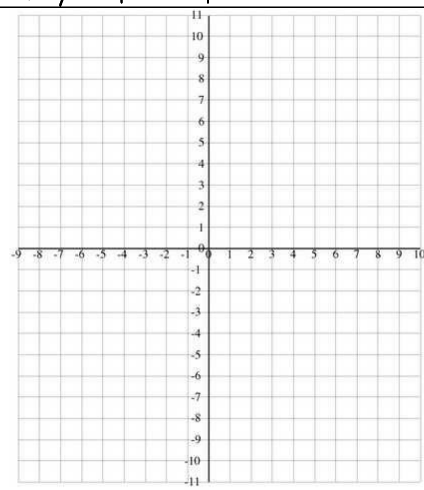
3. y = 2| x + 1.5 |



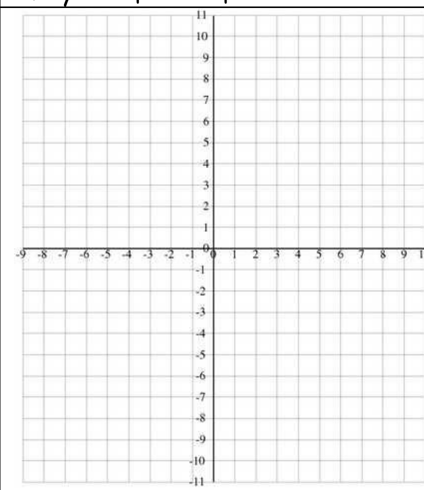
4. y = | x - 2 |



5. y = 2| x - 3 |



6. y = -3| x + 2 |



7. What is a zero of a function? Where are the zeros on each of the above graphs?

8. Where is the vertex of each graph?

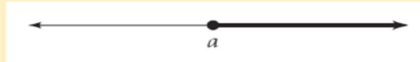
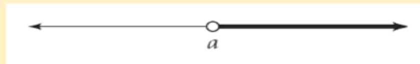
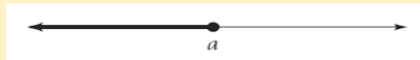
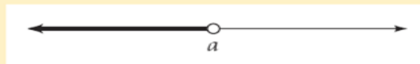
1. y = | x |	_______________	4. y = | x - 2 |	_______________
2. y = 2| x + 4 |	_______________	5. y = 2| x - 3 |	_______________
3. y = 2|x + 1.5 |	_______________	6. y = -3| x + 2 |	_______________

9. Using the pattern, what is the vertex of y = a| x - h |?

10. How does "a" affect the graph?

Expressing Domain and Range with Interval Notation

Infinite Intervals

Interval Notation	Set Notation	Graph	Type
$[a, \infty)$	$\{ x \mid x \geq a \}$		Closed
(a, ∞)	$\{ x \mid x > a \}$		Open
$(-\infty, a]$	$\{ x \mid x \leq a \}$		Closed
$(-\infty, a)$	$\{ x \mid x < a \}$		Open

Express the values of x in interval notation.

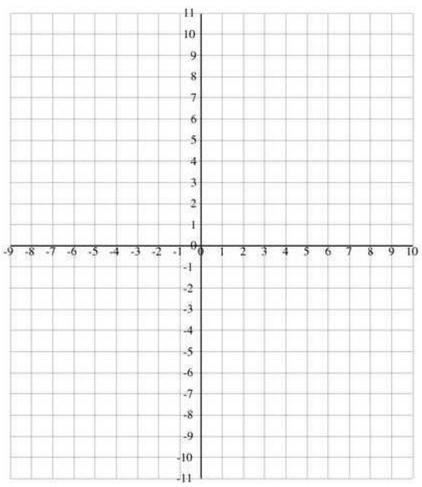
1) $x \geq 5$ ______________________________

2) x is all real numbers __________________

3) $-1 < x \leq 8$ __________________________

4) $x \leq -3 \text{ or } x > 6$ ______________________

Example: Graph y = 3| x + 4 | without your calculator.



Step 1: Identify the vertex.

Step 2: Make a table of values (be sure that the x value from step 1 and values around that x-value are included:

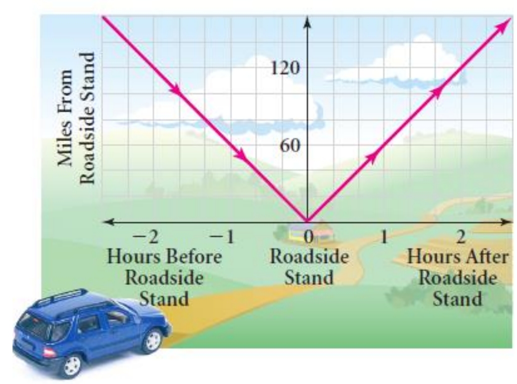
x	-8	-6	-4	-2	0	2
y						

Step 3: Graph the function using the table

Domain: ________________ Range: ________________

Example: The graph at the right models a car traveling at a constant speed.

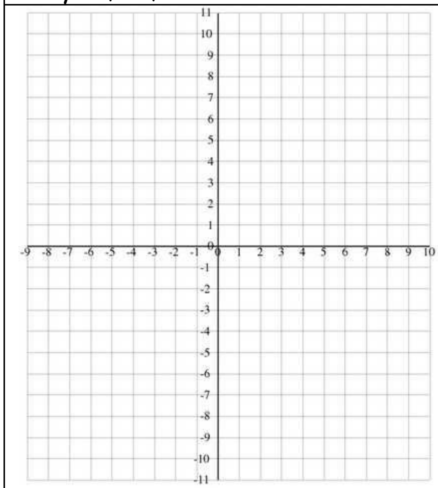
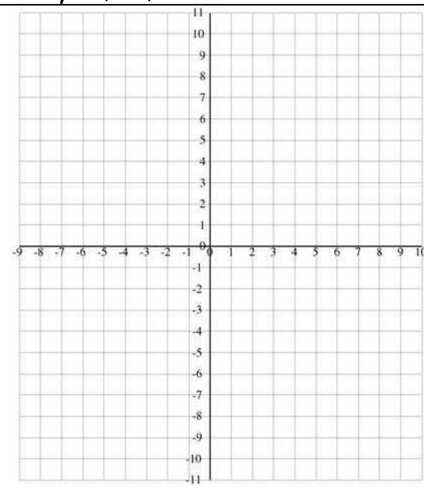
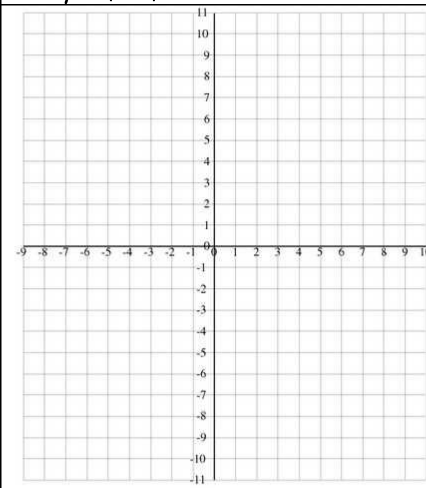
a. Describe the relation shown in the graph.



b. Which equation best represents the relation?

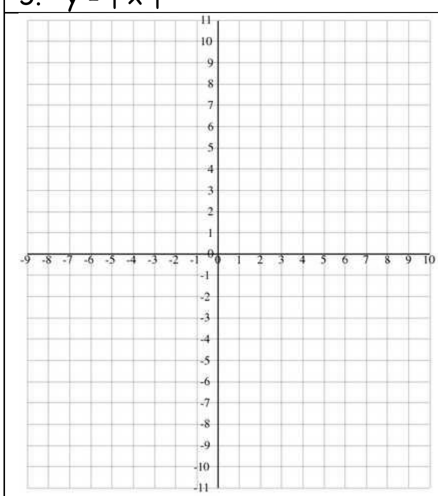
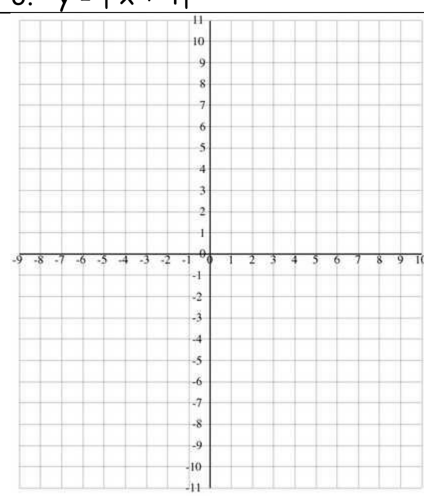
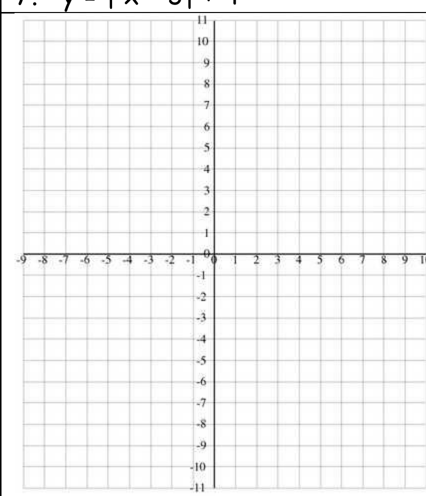
a. y = |60x|
b. y = |x + 60|
c. y = |60 - x|
d. y = |x| + 60

Graph the following in your calculator, use the list function to plot points and sketch the graph. Then determine the domain and range in interval notation!!

1. y = | x |	2. y = | x | + 4	3. y = | x | - 3
		
Domain:________________ Range:_________________	Domain:________________ Range:_________________	Domain:________________ Range:_________________

4. Compare the graphs of the 3 functions. What does the "k" do in the graph y = a\| x - h \| + k?

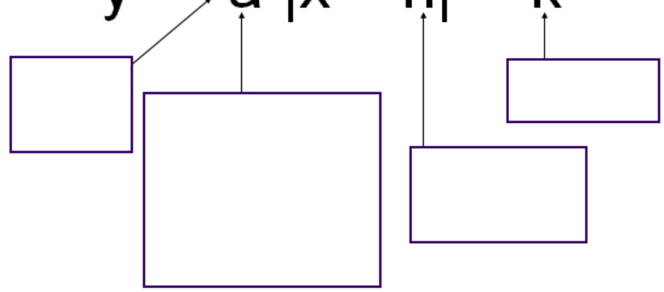
Graph the following in your calculator, use the list function to plot points and sketch the graph. Then determine the domain and range in interval notation!!

5. y = | x |	6. y = | x + 4|	7. y = | x - 3| + 4
		
Domain:________________ Range:_________________	Domain:________________ Range:_________________	Domain:________________ Range:_________________

8. Compare the graphs of the 3 functions. What does the "h" do in the graph y = a\| x - h \| + k

Transformations

$$y = -a\,|x - h| + k$$



Remember that (h, k) is your vertex

Identify the transformations from the parent. Also determine the domain and range for each function.

1. $y = 3\,|x + 2| - 3$

   Domain:______________________ Range:________________________

2. $y = |x - 1| + 2$

   Domain:______________________ Range:________________________

3. $y = 2\,|x + 3| - 1$

   Domain:______________________ Range:________________________

4. $y = -1/3|x - 2| + 1$

   Domain:______________________ Range:________________________

What can we do if an equation is not in vertex form? $y = |3x + 6| - 4$

What would the slope be?

We'll use the slope as our GCF. Factor it out, then we can have vertex form! ☺

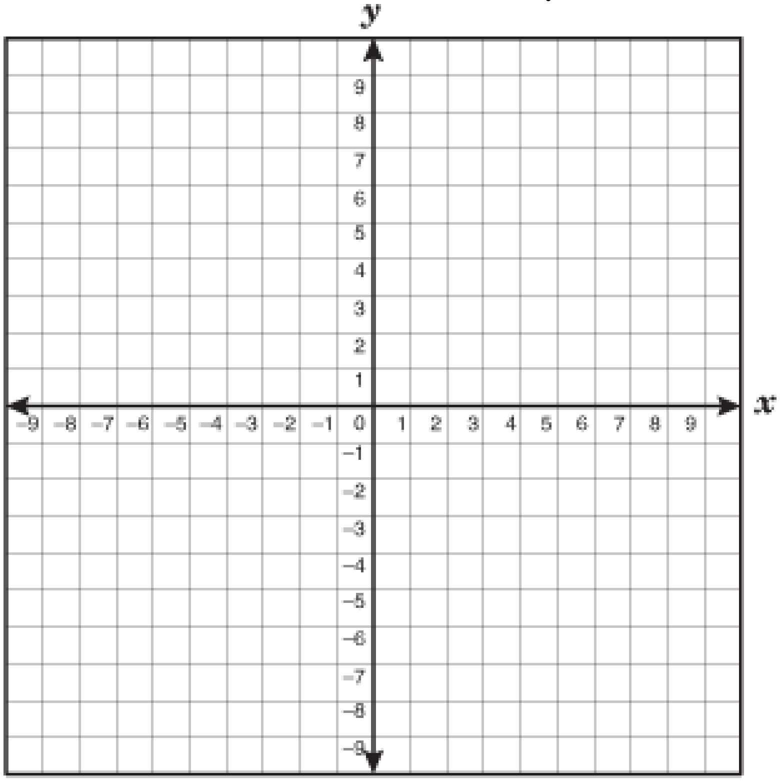
What is our vertex?

How is it transformed from the parent?

What is the domain?

What is the range?

Practice: Absolute Value Graphs & Transformations NO Calculators! ☺



Function:	Colored Pencil:
1) $f(x) = \|x\|$	**Regular Pencil!**
2) $f(x) = \|2x + 4\|$	
3) $f(x) = \|\frac{1}{2}x - 2\|$	
4) $f(x) = \|x\| + 5$	
5) $f(x) = \|x\| - 3$	
6) $f(x) = 3\|x\|$	
7) $f(x) = \frac{1}{2}\|x\|$	
8) $f(x) = -\|x\|$	

Description of Transformation and Domain & Range in interval notation.

1. Parent Function!	**Domain:**	**Range:**
2.	**Domain:**	**Range:**
3.	**Domain:**	**Range:**
4.	**Domain:**	**Range:**
5.	**Domain:**	**Range:**
6.	**Domain:**	**Range:**
7.	**Domain:**	**Range:**
8.	**Domain:**	**Range:**

Day 2: Graphing Square and Cube Roots

Warm-Up: 1.) Write down all the transformations of the graph of $y = x^2$.

a. $y = (x+h)^2$ moves the graph of $y = x^2$ _______________

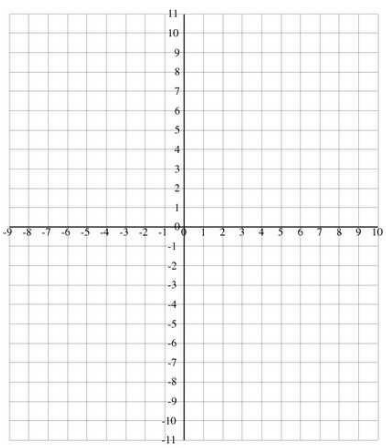
b. $y = (x-h)^2$ moves the graph of $y = x^2$ _______________

c. $y = (x)^2 + k$ moves the graph of $y = x^2$ _______________

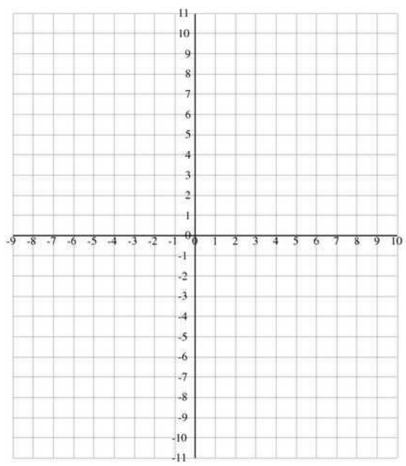
d. $y = (x)^2 - k$ moves the graph of $y = x^2$ _______________

Graph each function then describe the transformations from the parent graph.

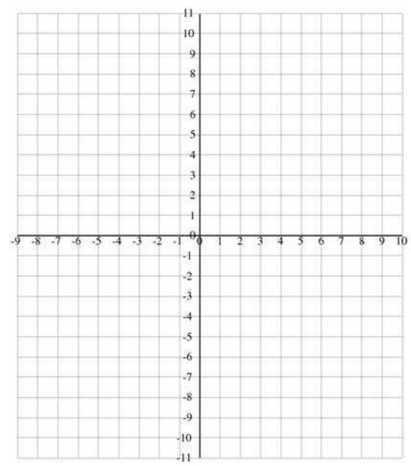
2) $f(x) = |3x + 9| - 2$



3) $y = -|x| + 6$



4) $f(x) = x^2 - 3$



5.) Given $f(x) = x^2$

Evaluate $f(x) + f(x+2)$

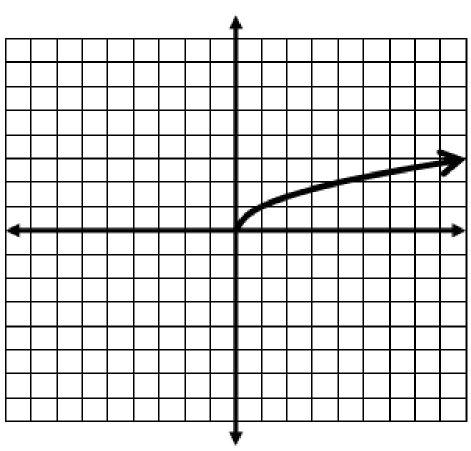
6.) Given $g(x) = x^2 + 2$

Evaluate $g(x+3) - g(x)$

Graphs of Square Roots

Graphing the square root function:

$f(x) = \sqrt{x}$



Characteristics of the graph

Vertex

End Behavior

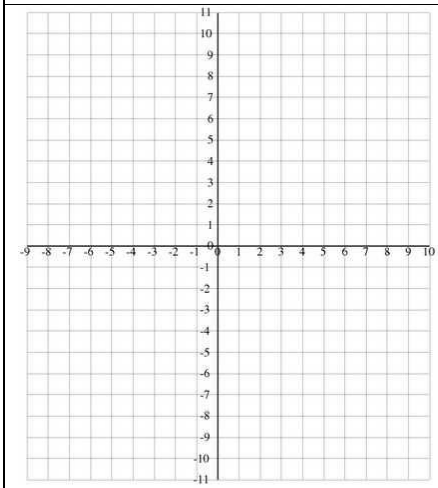
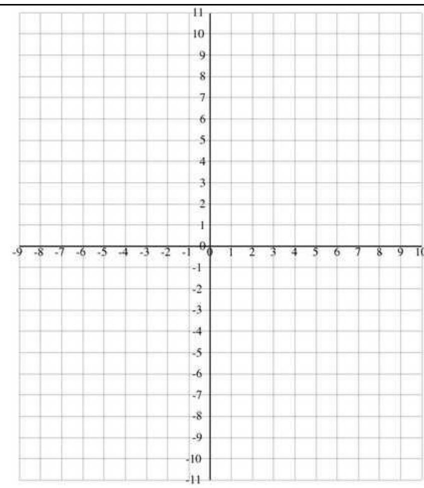
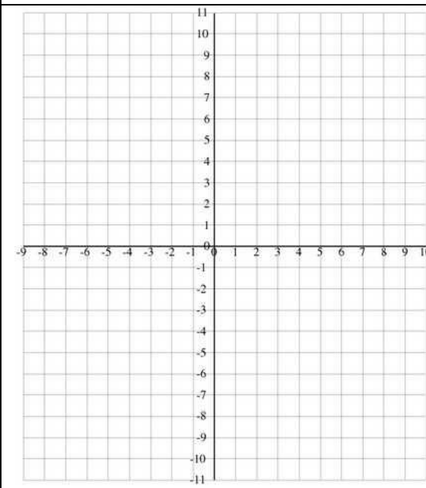
Domain

Range

Symmetry

Pattern

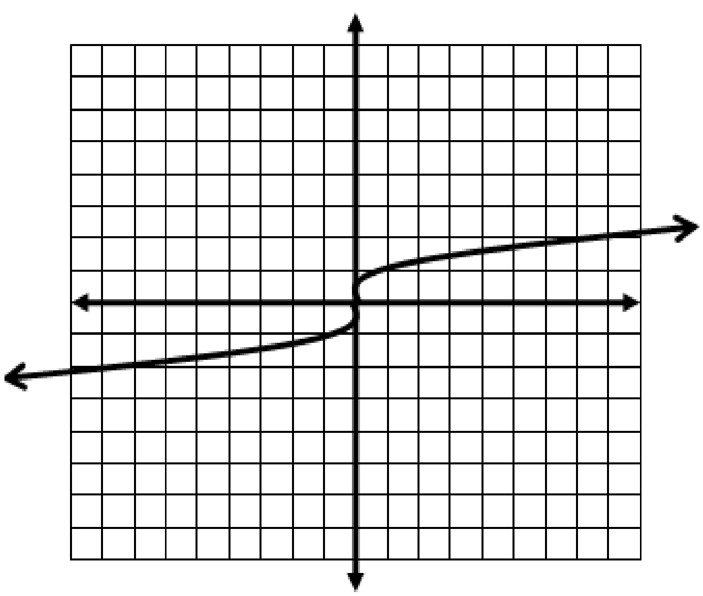
Graph the following in your calculator, use the list function to plot points and sketch the graph. Note the domain and range in interval notation.

1. $y=\sqrt{x}$	2. $y=\sqrt{x+2}$	3. $y=\sqrt{x}+2$
		
Domain:_______________ Range:________________	Domain:_______________ Range:________________	Domain:_______________ Range:________________

4. What happens when the 2 is under the radical? What happens when it is not? Have we seen this before?

Graphs of Cube Roots

The result: $f(x) = \sqrt[3]{x}$



Characteristics of the graph

Vertex

End Behavior

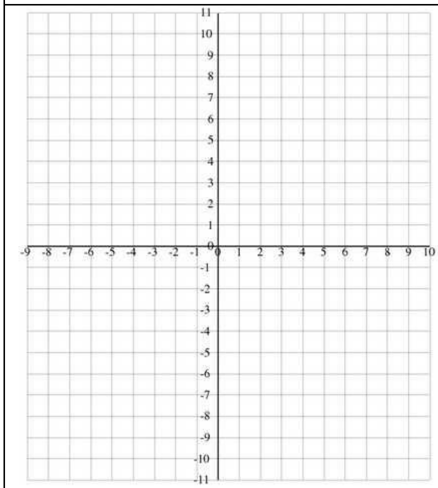
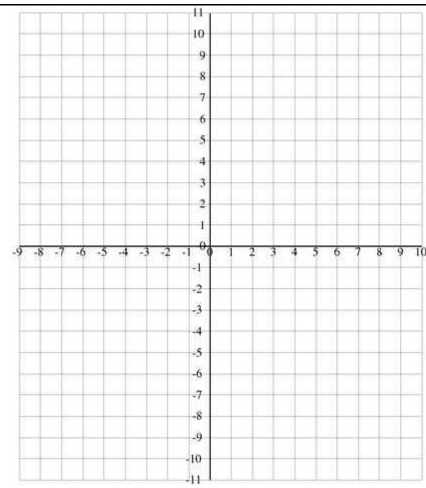
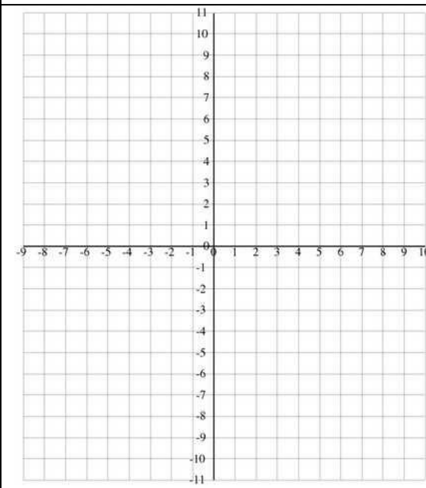
Domain

Range

Symmetry

Pattern

Graph the following in your calculator, use the list function to plot points and sketch the graph. Note the domain and range in interval notation.

5. $y=\sqrt[3]{x}$	6. $y=\sqrt[3]{x+2}$	7. $y=\sqrt[3]{x}$ + 2
		
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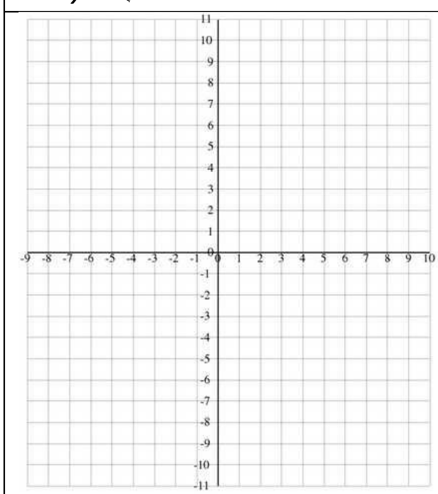
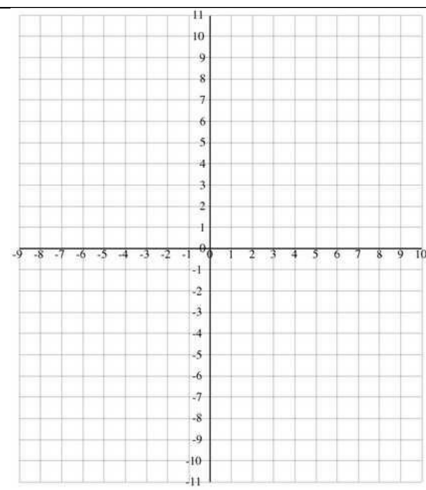
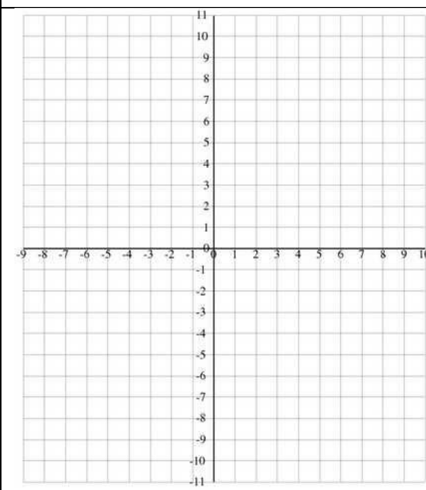
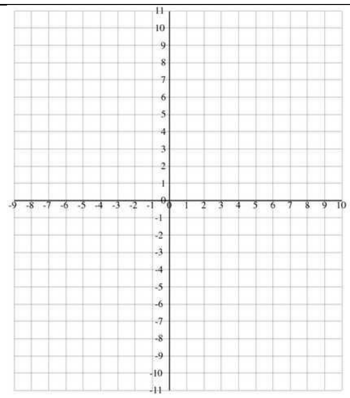
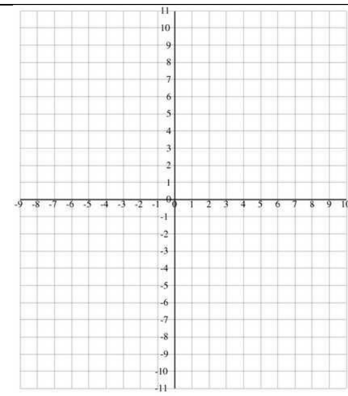
Based on your knowledge of transformations and the shape of $y=\sqrt{x}$ and $y=\sqrt[3]{x}$, graph the following by hand. Note the domain and range in interval notation.

8. $y=\sqrt{x+2}-4$	9. $y=\sqrt[3]{x-4}+6$	10. $y=-2\cdot\sqrt[3]{x+1}+3$
		
Domain:________________ Range:_________________	Domain:________________ Range:_________________	Domain:________________ Range:_________________

Rewrite $y=\sqrt{4x+16}$ to make it easy to graph using a translation (hint…get it in the form $y=a\sqrt{x-h}$).

11. $y=\sqrt{4x+16}$	12. $y=\sqrt[3]{8x+32}-5$
	

Extra Practice:

1) Given $f(x) = 3x - 2x^2$
Evaluate $f(2x + 2) - f(x)$

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

Day 3: Graphing Inverse Variation

Warm-Up:

1) Fill in the following table using the function $y=\dfrac{4}{x-3}-1.5$

x	y
-5	-2
-3	
-1	
1	
3	
5	
7	

2) Given $f(x)=\sqrt{9x-36}+16$
   a. Find the vertex form of f(x)

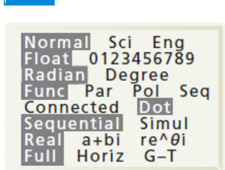
   Then, find
   b. Its vertex
   c. How it is translated from the parent graph
   d. Its domain
   e. Its range

Graphing Inverse Variation

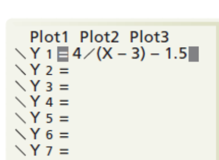
You can use your graphing calculator to graph rational functions. It is sometimes preferable to use the Dot plotting mode rather than the connected plotting mode. The Connected mode can join branches of a graph that should be separated. Try both modes to get the best graph.

Graph $y = \frac{4}{x-3} - 1.5$.

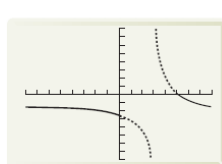
Step 1 Press the MODE key. Scroll down to highlight the word Dot. Then press ENTER.



Step 2 Enter the function. Use parentheses to enter the denominator accurately.



Step 3 Graph the function.



What's happening at x = 3?

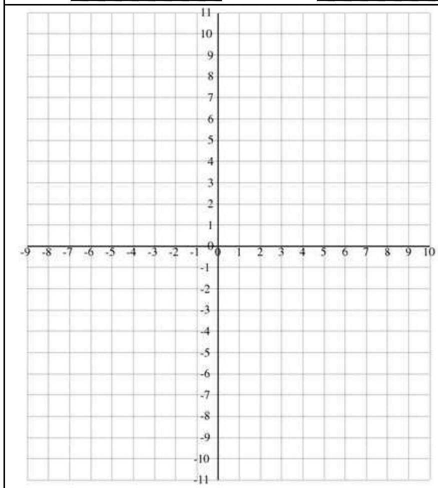
at y = -1.5?

Why?

Use your calculator to graph the following. Graph at least 3 points for each branch. Write the equations for the vertical and horizontal asymptotes. Discuss any patterns with your neighbors.

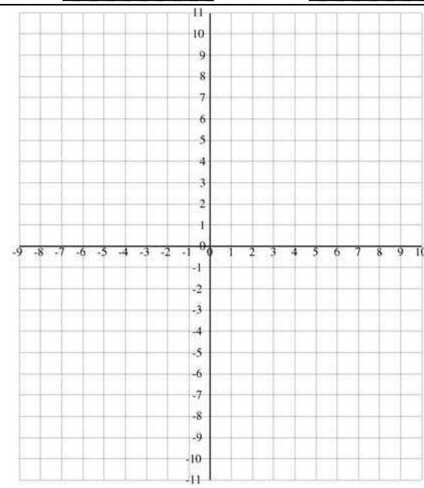
1. $y = \frac{2}{x}$

VA: __________ HA: __________



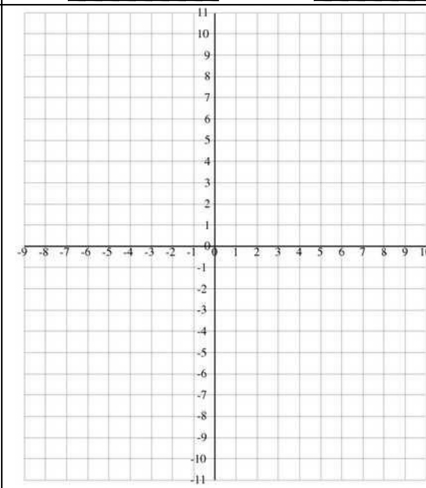
2. $y = \frac{2}{x} + 2$

VA: __________ HA: __________



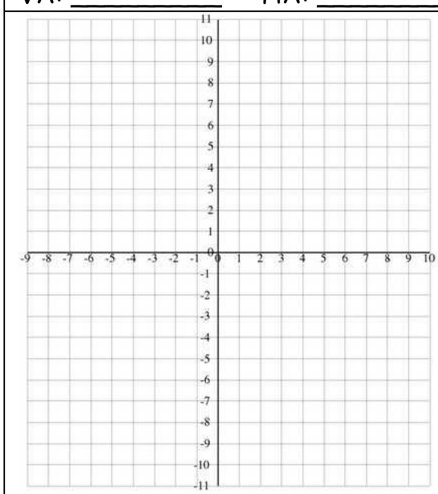
3. $y = \frac{2}{(x+3)} + 2$

VA: __________ HA: __________



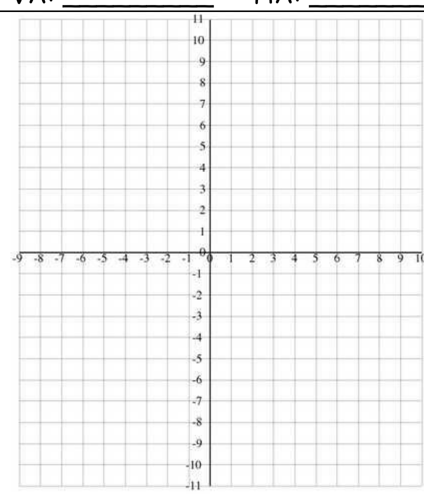
4. $y = \frac{2}{(x+5)}$

VA: __________ HA: __________



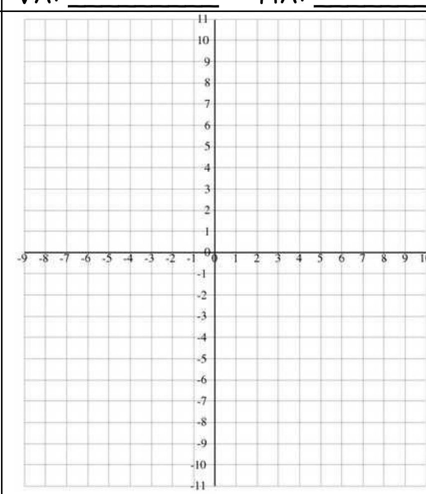
5. $y = -\frac{2}{x}$

VA: __________ HA: __________



6. $y = -\frac{2}{(x-1)}$

VA: __________ HA: __________



The asymptotes of these graphs can help us to write the domain and range. Let's discuss #3, then #4 together.

3) Domain: ________________________ Range: ___________________________

4) Domain: ________________________ Range: ___________________________

You Try ~

2) Domain: ________________________ Range: ___________________________

6) Domain: ________________________ Range: ___________________________

What is an "inverse variation?"

- A relationship that can be written in the form __________, where *k* is a ______________ ________________ and $x \neq 0$
- Inverse variation implies that one quantity will _____________________________ while the other quantity will _________________________ (the inverse, or opposite, of increase).

Example:
Suppose that putting on the prom at the certain high school costs $4000.

- How much should you charge per ticket if 100 people will come? 200 people? 400 people?
- What equation could represent this scenario if we let y represent the cost of a ticket and x be number of tickets sold?

You Try ~
Suppose that hosting a family reunion costs $1000.

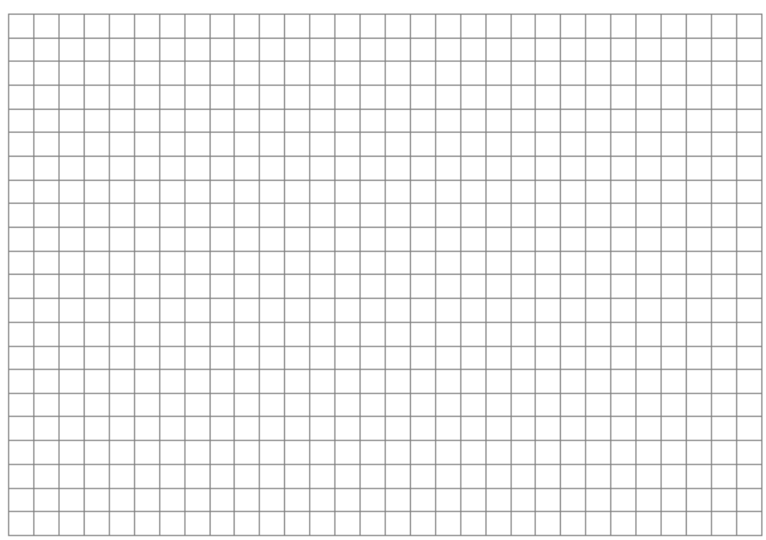
- How much should you charge per ticket if 100 people will come? 200 people? 500 people?
- What equation could represent this scenario if we let y represent the cost of a ticket to the reunion and x represent number of tickets sold?
- What is the value of k, the constant?

How do you graph these by hand? Let's look at $y = \frac{6}{x}$.

First, make a table of values that includes positive and negative values of *x*.

x	12	6	3	2	1	1/2	0	-1/2	-1	-2	-3	-6	-12
y													

Graph the points and connect them with a smooth curve.
The graph has two parts.
Each part is called a branch.



The _____________ is a horizontal asymptote.

The _____________ is a vertical asymptote.

The Domain of the function is all real numbers except for 0. So, ________________.

The Range of the function is all real numbers except for 0. So, _______________.

You Try: Graph $y = \frac{12}{x}$ without a calculator.

x	12	6	3	2	1	1/2	0	-1/2	-1	-2	-3	-6	-12
y													

Compare this graph to the previous graph.

What are the asymptotes?

What is the Domain?

What is the Range?

You Try: Graph $y = \frac{6}{(x+3)} + 2$.

x	9	3	0	-1	-2	-2.5	-3	-3.5	-4	-5	-6	-9	-15
y													

Compare this graph to the previous graphs.

Where is the horizontal asymptote?

Where is the vertical asymptote?

What is the Domain?

What is the Range?

Properties: Translations of Inverse Variations

The graph of $y = \frac{k}{x-b} + c$ is a translation of $y = \frac{k}{x}$ by b units ______________________________ and c units ________________________. The vertical asymptote is ___________. The horizontal asymptote is ___________.

****Note: pay attention to the signs with these formulas. Think about transformations!**

Shifting graphs...Write an equation for the translation of $y = \frac{6}{x}$ that has asymptotes at:

a. x = 4 and y = -3

b. x = -4 and y = 3

c. x = 0 and y = 2

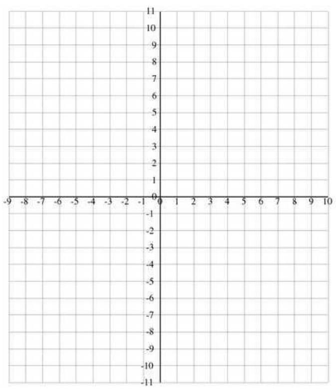
Day 4 and 5: Graphing Piece-Wise Functions

DAY 4 Warm-Up:

1. Why does the graph of the inverse variation have a vertical asymptote?

2. Graph. Find the asymptotes. Then, write the domain and range using interval notation.

a. $y = \frac{-9}{x-4} + 2$



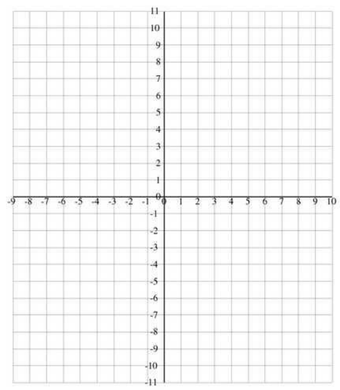
VA:______

HA:______

Domain: _________

Range: __________

b. $f(x) = \frac{3}{x+2}$



VA:______

HA:______

Domain: _________

Range: __________

3. In #2, where is the graph discontinuous? Why? (do for a & b)

4. Given $f(x) = 1 - 4x^2$ and $g(x) = 1 - 2x$
   a. Find $f(1 - 2x)$. Give your answer in standard form.

   b. Evaluate $f(x)/g(x)$. (What value is excluded from the domain?)

DAY 5 Warm-Up:

Given $f(x) = x^2 - 5x - 2$, evaluate:

1) $f(-3)$ 2) $f(x - 4)$ 3) $f(x - 3) - 4f(x)$

Day 4/5 Notes: Graphing Piece-Wise Functions

Definition

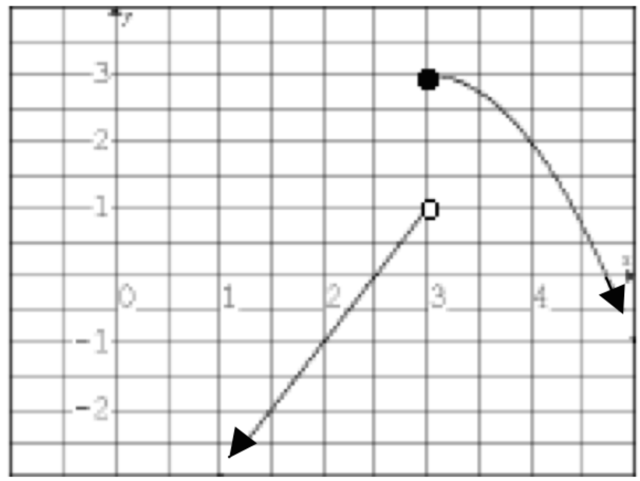
The domain is the set of ______________________. The output of a function is called the ____________.

Up to now, we've been looking at functions represented by a single equation. In real life, however, functions are represented by a combination of equations, each corresponding to a part of the domain. These are called **Piecewise Functions.**

Example:

$$\text{Let } f(x) = \begin{cases} 2x - 5 & \text{for } x < 3 \\ -(x-3)^2 + 3 & \text{for } x \geq 3 \end{cases}$$

Note: We will refer to the x-value where the function changes as the "transition point."



Example 1:

$$Y = \begin{cases} x + 2 & ; x < 1 \\ (x-1)^2 & ; x \geq 1 \end{cases}$$

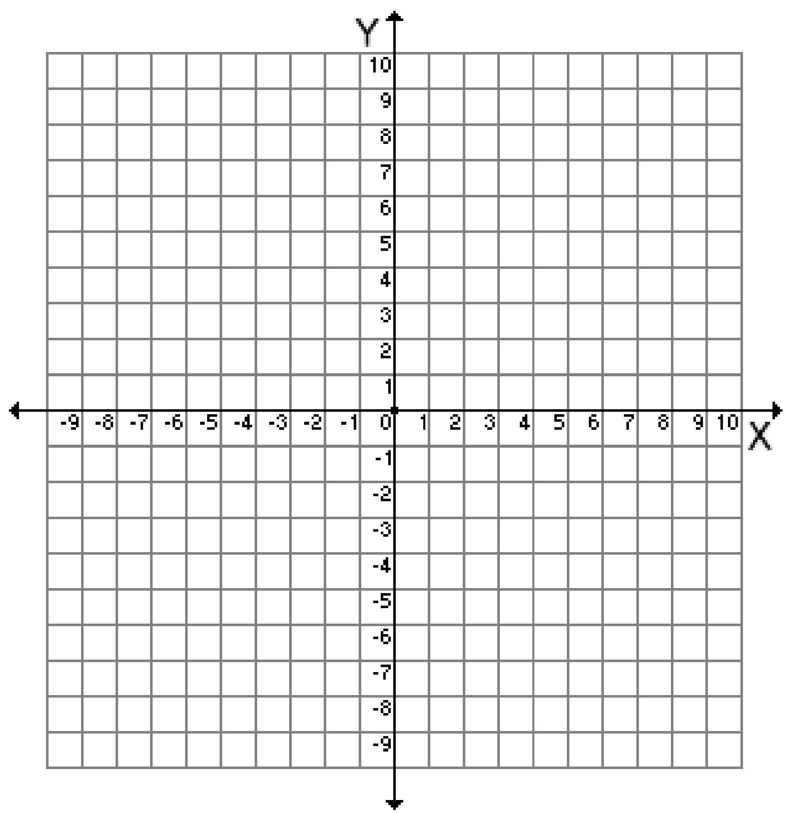
f(-2) =

f(3) =

f(1) =

Domain: _______________

Range: _______________



Example 2: You Try!

$$y = \begin{cases} -3 & ; x \leq -1 \\ -x^2 + 4 & ; x > -1 \end{cases}$$

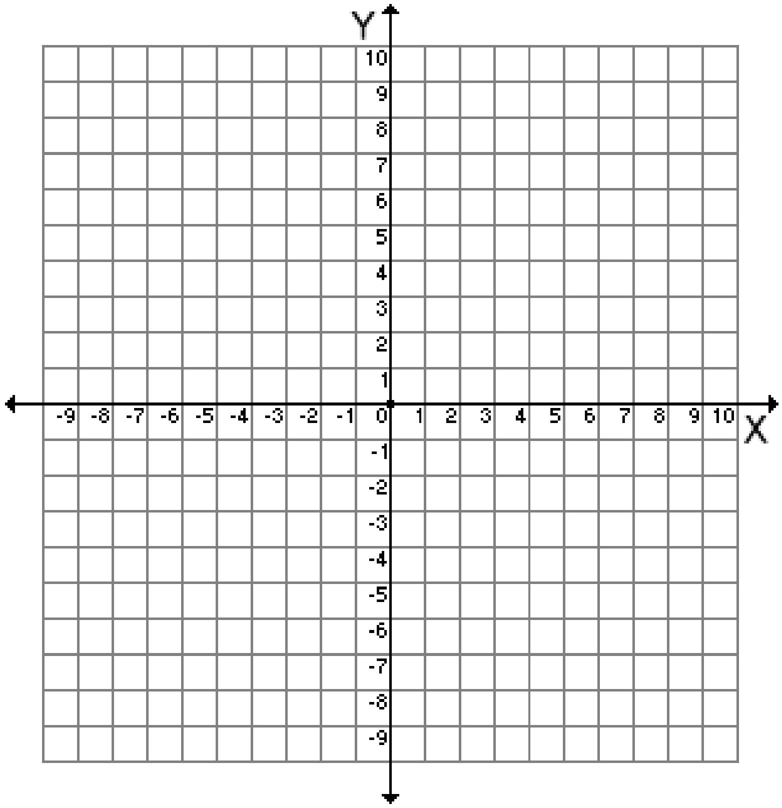
f(-2) =

f(3) =

f(1) =

Domain: ________________

Range: _________________



Example 3:

$$y = \begin{cases} |x+3| & ; x \leq -3 \\ 4 & ; -3 < x \leq 2 \\ 5 - x & ; x > 2 \end{cases}$$

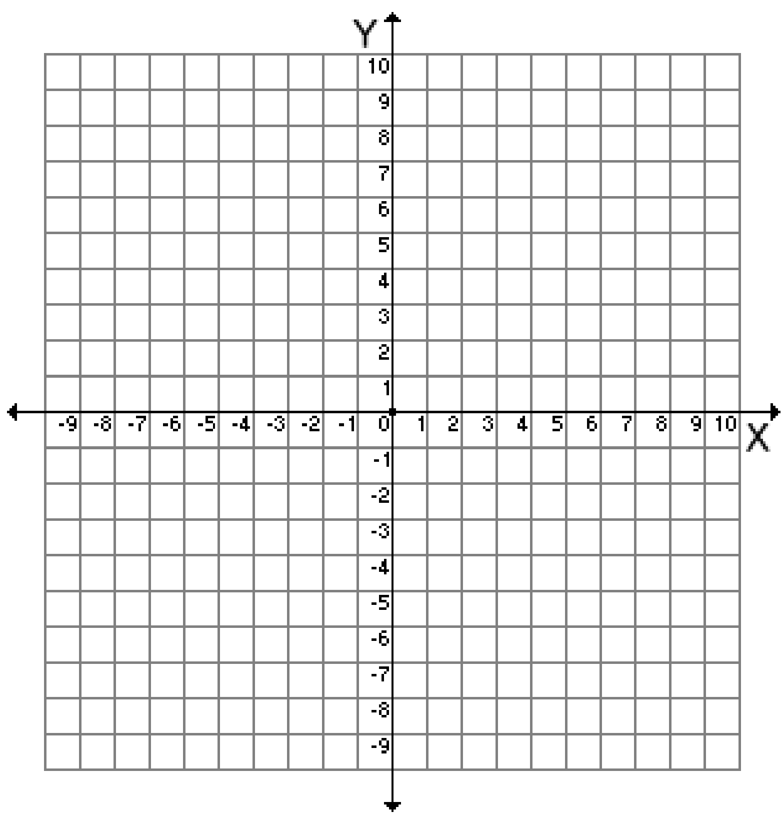
f(-2) =

f(3) =

f(1) =

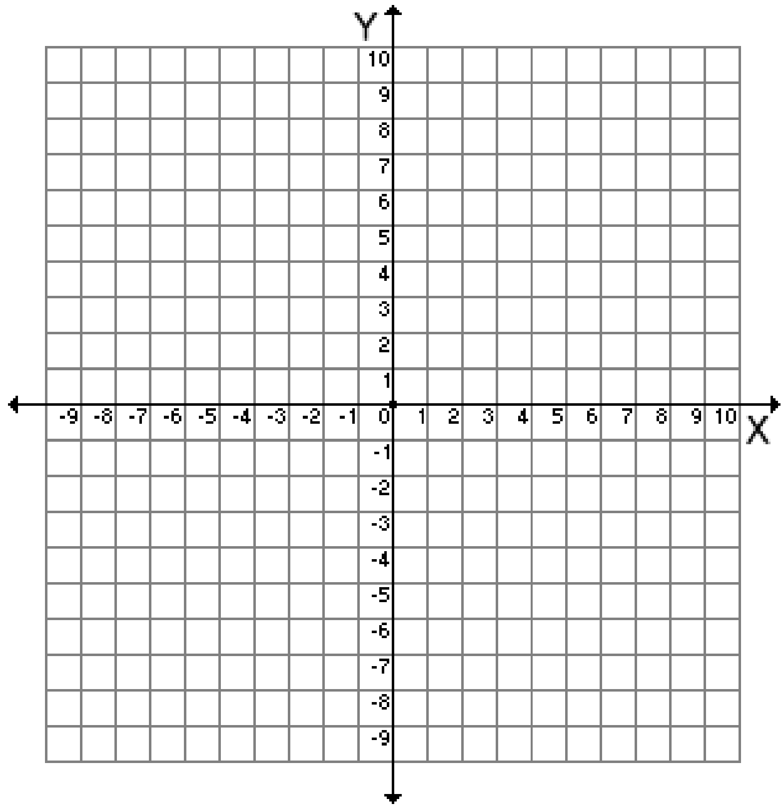
Domain: ______________

Range: ______________



Example 4: You Try!

$$y = \begin{cases} 3 & ; x < -1 \\ (x+1)^2 - 2 & ; -1 \le x \le 1 \\ x - 4 & ; x > 1 \end{cases}$$



f(-2) =

f(3) =

f(1) =

Domain: ____________

Range: ____________

USING TECHNOLOGY TO GRAPH PIECEWISE FUNCTIONS

Given: $f(x)=\begin{cases} x^2+2 & \text{if } x \le 1 \\ -2x+7 & \text{if } x>1 \end{cases}$

Carefully define each piece in the following way:

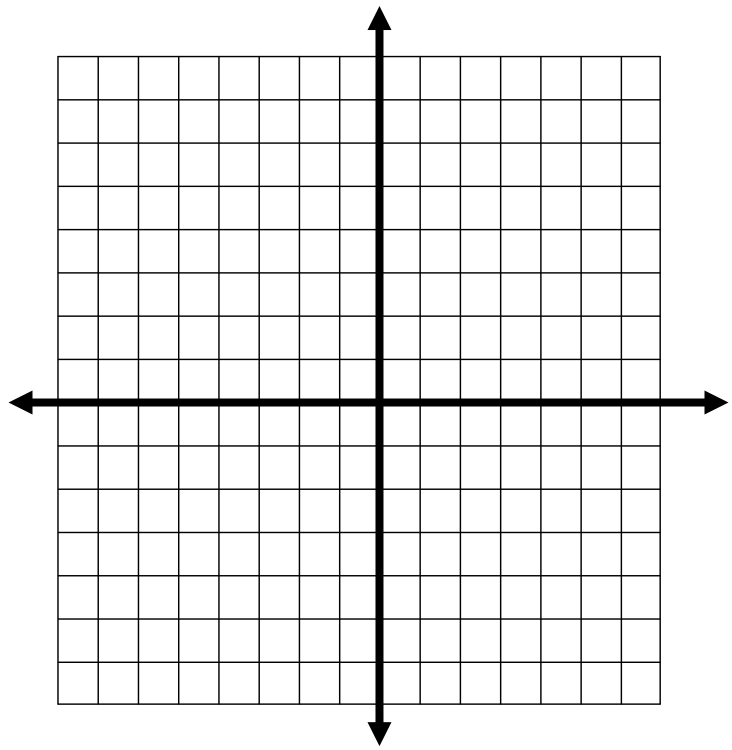
Enter in Y1: Y1 = (X^2 + 2) (X ≤ 1) + (-2X + 7) (X > 1)

To get the best view of this function, set your window carefully based on your previous sketch or on the table above. You can use the table to check x=1 (where should the open and closed circle be?) Verify that what you graphed by hand is the same as the graph on the calculator screen.

Practice time:

Part I. Carefully graph each of the following. Identify whether or not he graph is a function. Then, evaluate the graph at any specified domain value. You may use your calculators to help you graph, but you must sketch it carefully on the grid (be sure to use open and closed circles properly)!

1. $f(x)=\begin{cases} x+5 & x<-2 \\ x^2+2x+3 & x\geq -2 \end{cases}$



Function? Yes or No

$f(3)=$

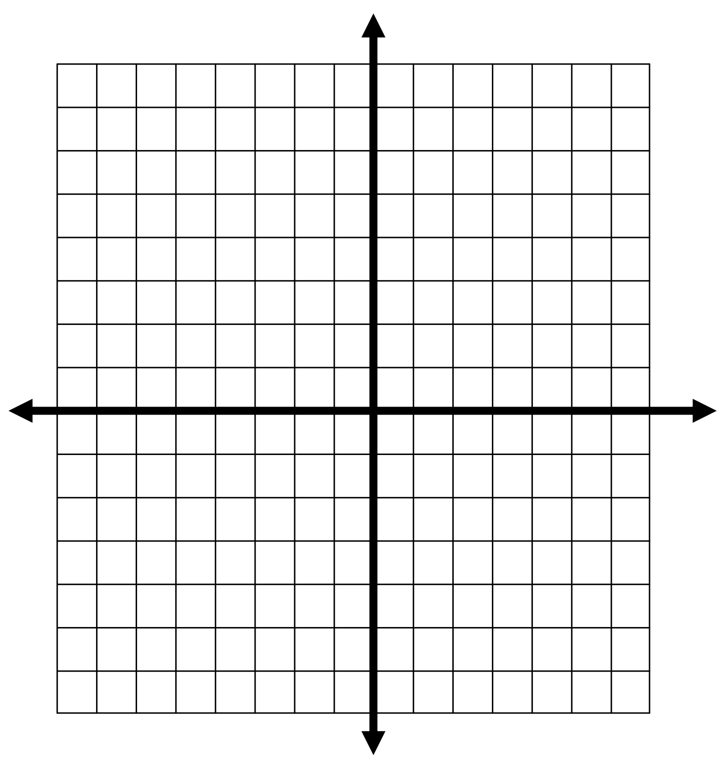
$f(-4)=$

$f(-2)=$

Domain: ______________

Range: ______________

2. $f(x)=\begin{cases} 2x+1 & x\geq 1 \\ x^2+3 & x<1 \end{cases}$



Function? Yes or No

$f(-2)=$

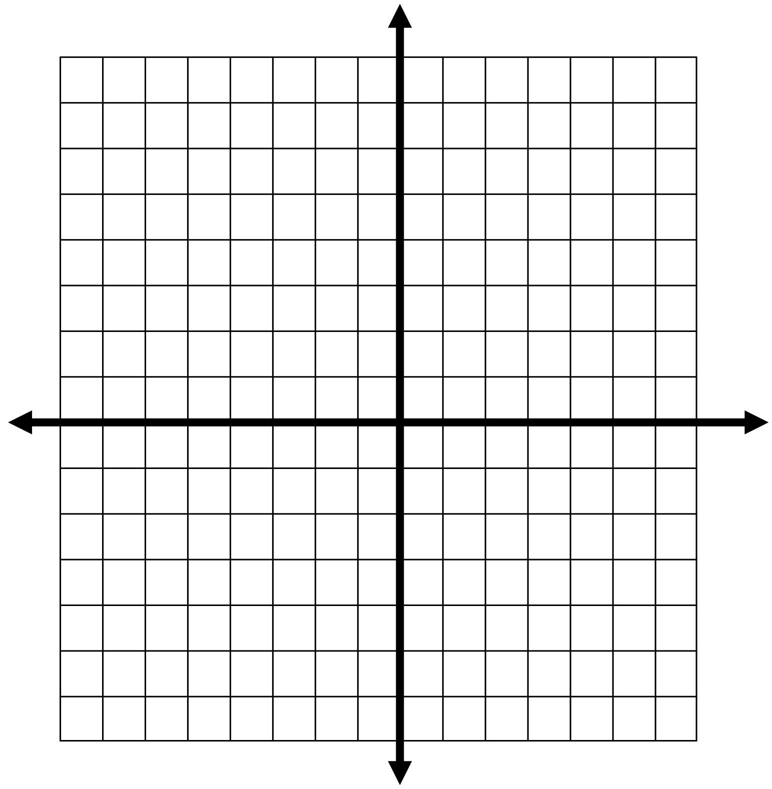
$f(6)=$

$f(1)=$

Domain: ______________

Range: ______________

3. $f(x)=\begin{cases}-2x+1 & x\le 2\\ 5x-4 & x>2\end{cases}$



Function? Yes or No

$f(-4)=$

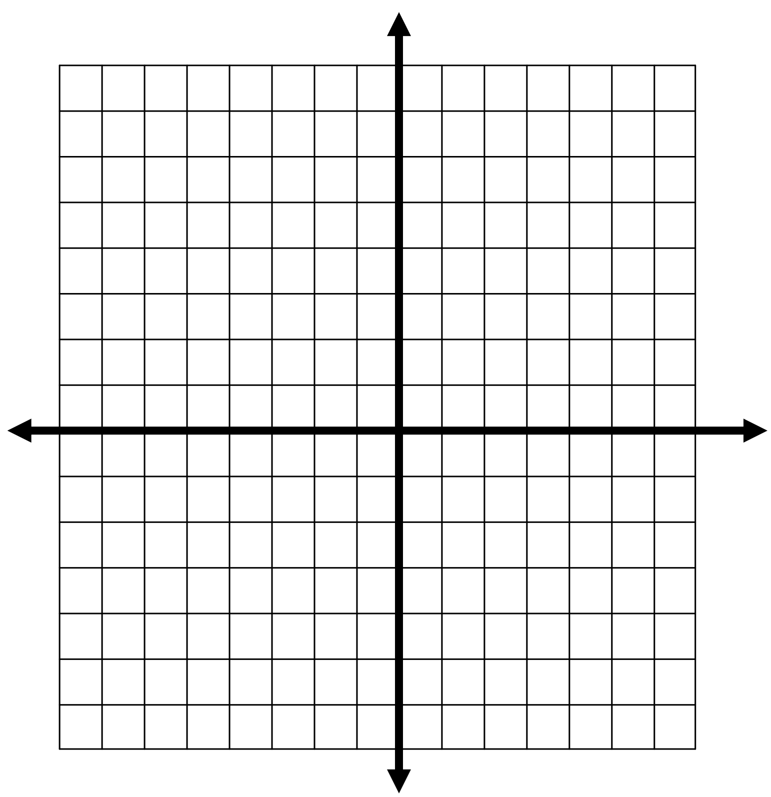
$f(8)=$

$f(2)=$

Domain: ______________

Range: ______________

4. $f(x)=\begin{cases}x^2-1 & x\le 0\\ 2x-1 & 0<x\le 5\\ 3 & x>5\end{cases}$



Function? Yes or No

$f(-2)=$

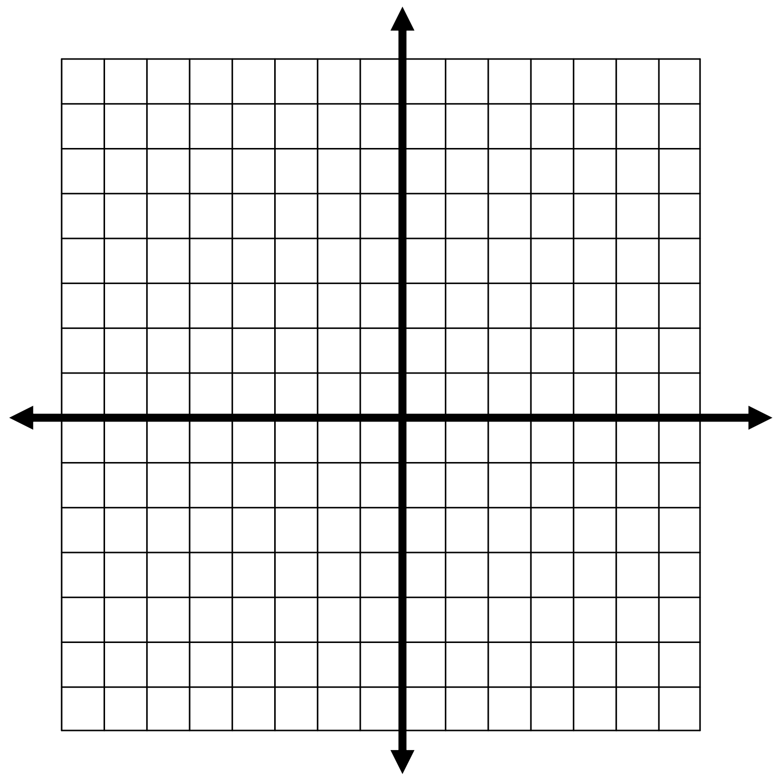
$f(0)=$

$f(5)=$

Domain: ______________

Range: ______________

5. $f(x) = \begin{cases} x^2 & x \leq 0 \\ -x^2 + 4 & x > 0 \end{cases}$



Function? Yes or No

$f(-4) =$

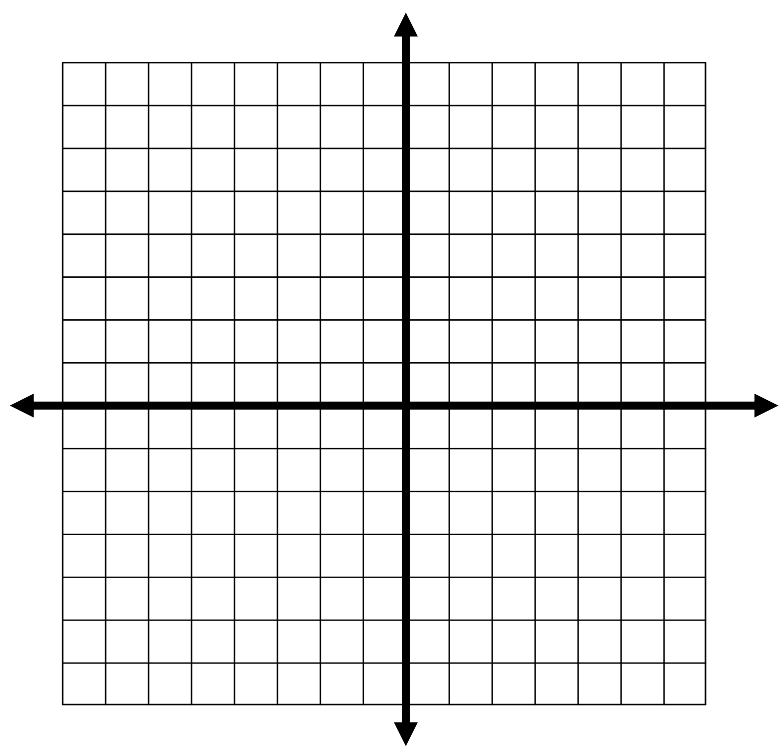
$f(0) =$

$f(3) =$

Domain: ______________

Range: ______________

6. $f(x) = \begin{cases} 5 & x \leq -3 \\ -2x - 3 & x > -3 \end{cases}$



Function? Yes or No

$f(-4) =$

$f(0) =$

$f(3) =$

Domain: ______________

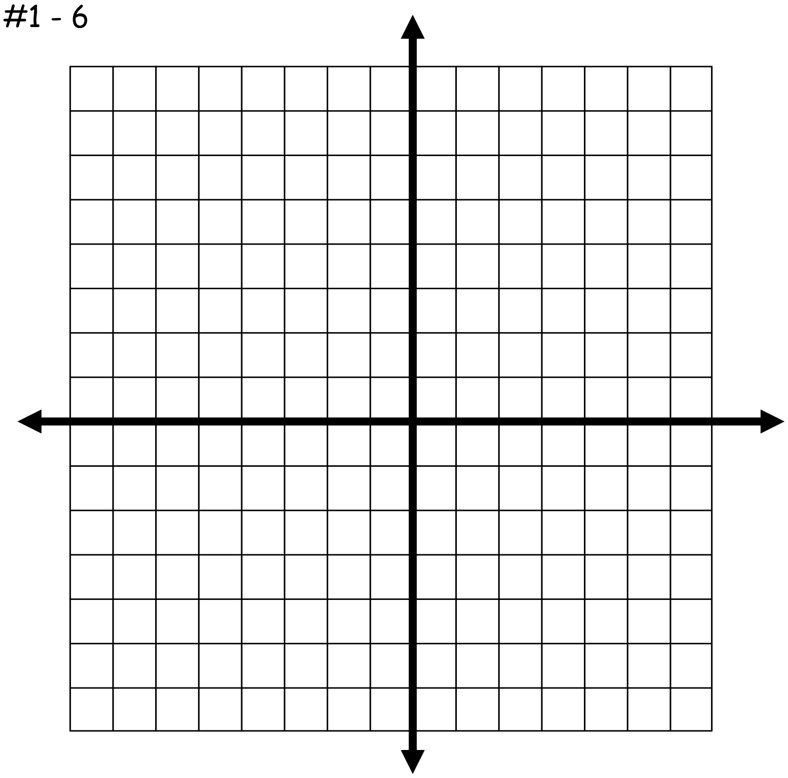
Range: ______________

Day 7: Graphing Piece-Wise Functions cont'd

Warm-Up: Use the following function to answer #1 - 6

$$f(x) = \begin{cases} -2x - 3, & x \leq -4 \\ x^2 - 4, & -4 < x < 3 \\ \frac{1}{2}x + 1, & x \geq 3 \end{cases}$$

1. f(2) =
2. f(-4) =
3. f(8)=
4. Domain: ______________
5. Range: ______________
6. Graph the function



Given g(x) = x^2 – 4x + 5, evaluate:

7) g(2x – 3)

8) g(x – 3) – 2g(x)

Piece-Wise Functions ~ APPLICATIONS Problems

1. When a diabetic takes long-acting insulin, the insulin reaches its peak effect on the blood sugar level in about three hours. This effect remains fairly constant for 5 hours, then declines, and is very low until the next injection. In a typical patient, the level of insulin might be modeled by the following function.

$$f(t) = \begin{cases} 40t + 100 & \text{if } 0 \leq t \leq 3 \\ 220 & \text{if } 3 < t \leq 8 \\ -80t + 860 & \text{if } 8 < t \leq 10 \\ 60 & \text{if } 10 < t \leq 24 \end{cases}$$

Here, f (t) represents the blood sugar level at time t hours after the time of the injection. If a patient takes insulin at 6 am, find the blood sugar level at each of the following times.

a. 7 am b. 11 am c. 3 pm d. 5 pm

2. Lisa makes \$4/hr baby-sitting before midnight and \$6/hr after midnight. She begins her job at 7 PM.

a. Complete the table below for the total amount of money Lisa makes.

Time	8PM	9PM	10PM	11:30PM	12:00AM	12:30AM	1:00AM	1:30AM	2:00AM
Hours worked									
Money Earned									

b. If we want to fill out the entries after midnight in the table above, we need to realize that the function is piecewise; that is, Lisa is paid at two different rates, one for the time she baby-sits before midnight, and another for the time she babysits after midnight.

Since the rate changes at $t = 5$, we need two different rules: one for $t \leq 5$ and one for $t > 5$.

___________, for $0 \leq x \leq 5$

_____________, for $5 < x$

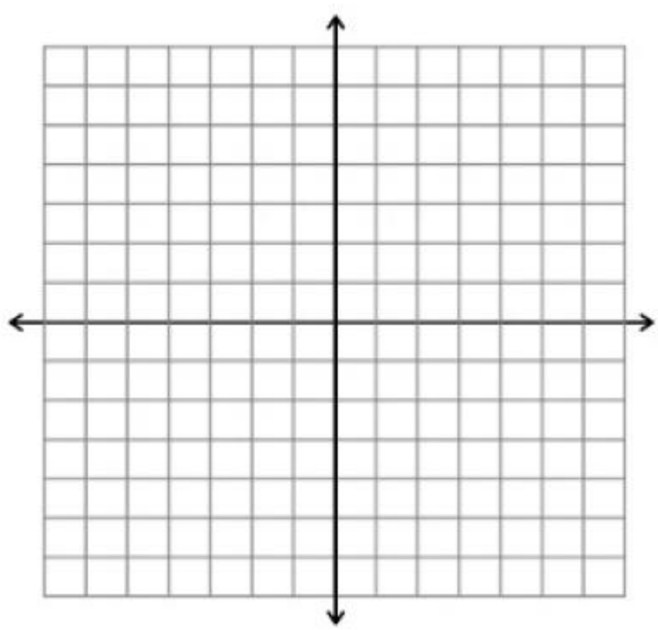
F(t) = ______________________________

3. I really want to write the letter M on my graph paper using y=mx+b form…

From x = -6 to x = -4, use the equation y = 2x + 12
From x = -4 to x = -3, use the equation y = -3x – 8
From x = -3 to x = -2, use the equation y = 3x+10
From x = -2 to x = 0, use the equation y = -2x

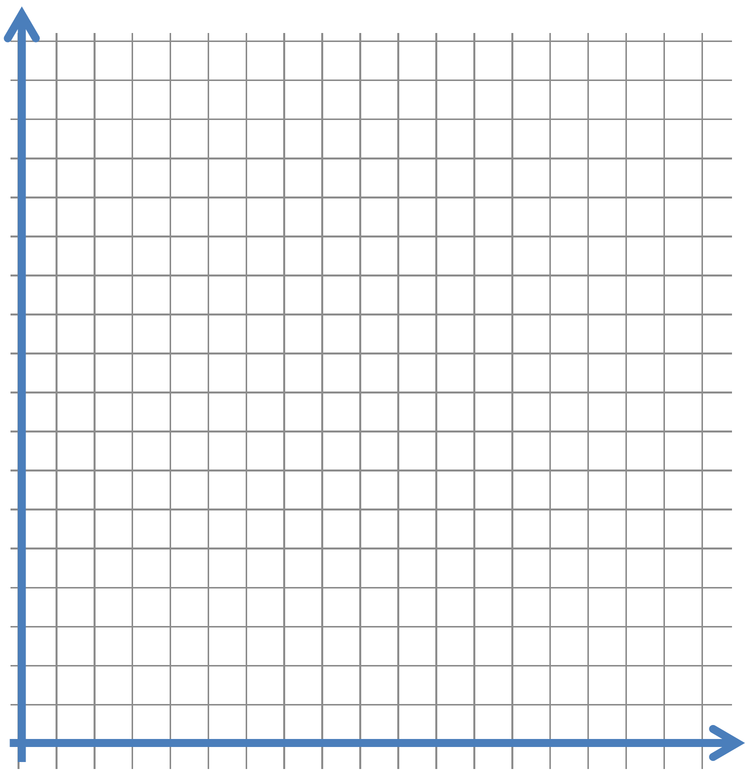
In mathematics, we write this set of directions as a piece-wise function:

$$f(x) = \begin{cases} 2x+12, \text{ if } -6 \leq x < -4 \\ -3x-8, \text{ if } -4 \leq x < -3 \\ 3x+10, \text{ if } -3 \leq x < -2 \\ -2x, \text{ if } -2 \leq x < 0 \end{cases}$$



4. A wholesaler charges \$3.00 per pound for an order of less than 20 pounds of candy and \$2.50 per pound for 20 or more pounds. Write a piecewise function for this situation. Then graph the function.

$f(x) = \left\{ \right.$



What is the total charge for an order of 15 pounds of candy?

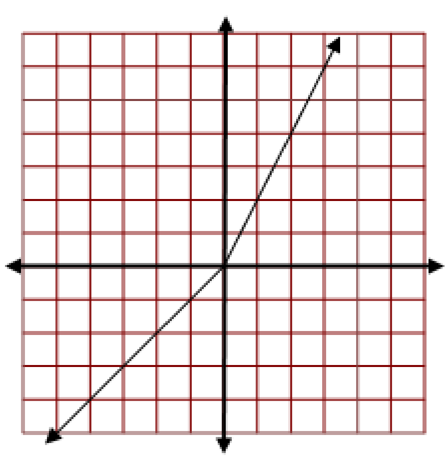
For 20 pounds?

For 30 pounds?

WRITING PIECEWISE EQUATIONS

Write equations for the piecewise functions whose graphs are shown below. Assume that the units are 1 for every tick mark. State the domain and range.

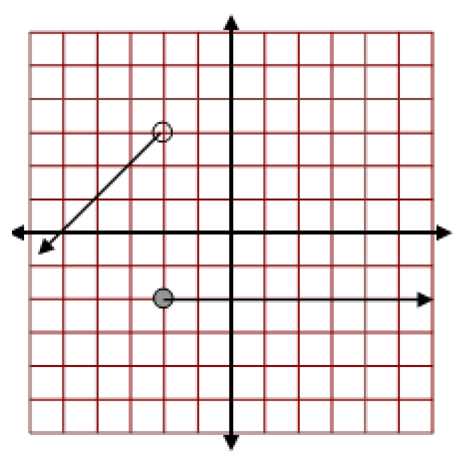
1.



$f(x) = \left\{ \right.$

Domain: ____________ Range: ____________

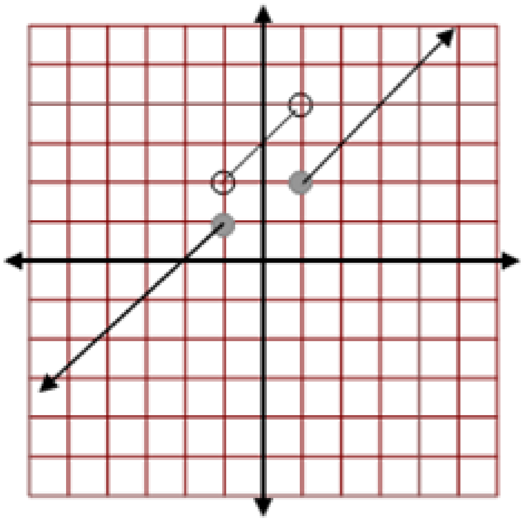
2.



$f(x) = \left\{ \right.$

Domain: ___________ Range: _____________

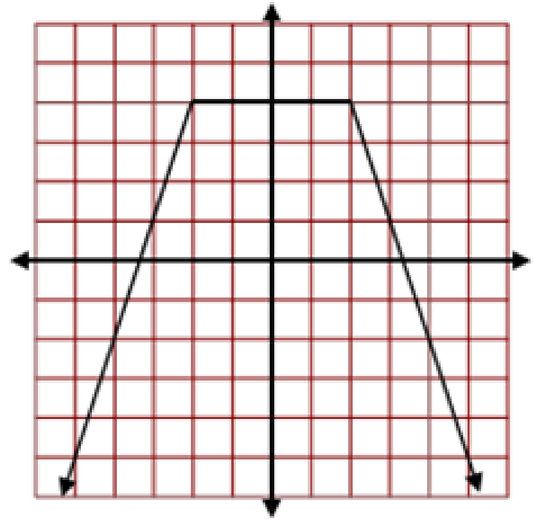
3.



$f(x) = \{$

Domain: ______________ Range: ______________

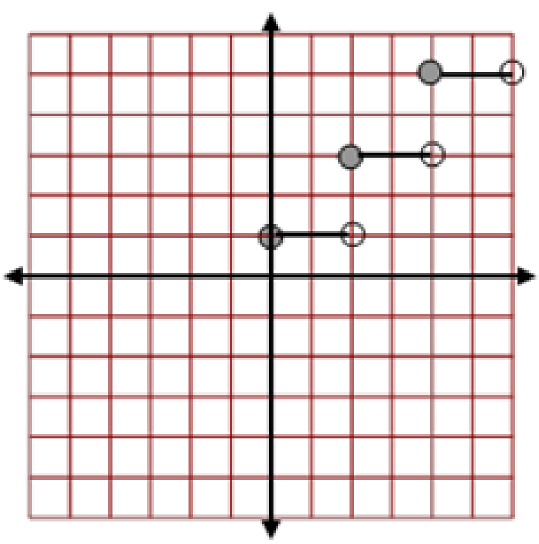
4.



$f(x) = \{$

Domain: ____________ Range:____________

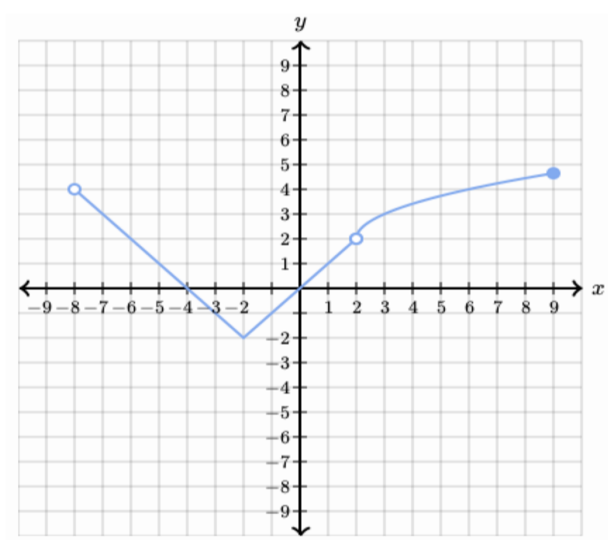
5.



$f(x) = \{$

Domain: ______________ Range: ______________

6.



$f(x) = \{$

Domain: ____________ Range: ____________

Another Piece-Wise Function Application Problem: We also see piece-wise functions in our tax structure:

*For income at or below $15,000, no tax is charged.

*Above $15,000 and at or below $40,000, the rate is 15% for all monies earned over $15,000.

*Above $40,000, the rate increases to 25% on all monies earned over $40,000 (where did the $6000 come from?), until income is $250,000.

*Above that level, the rate is 40%. (Where did the $37,500 come from?)

$$f(x)=\begin{cases} 0, \text{ if } 0\le x\le 15{,}000 \\ 0.15(x-15{,}000), \text{ if } 15{,}000<x\le 40{,}000 \\ 6000 + 0.25(x - 40{,}000), \text{ if } 40000<x\le 250{,}000 \\ 37{,}500+0.40(x-250{,}000), \text{ if } 250{,}000\le x \end{cases}$$

How much would I owe in taxes if I made

a. $12,000 b. $17,000 c. $47,000 d. $470,000

Day 8: Modeling Advanced Functions

Warm-Up: Remember to show your work in the space provided ☺

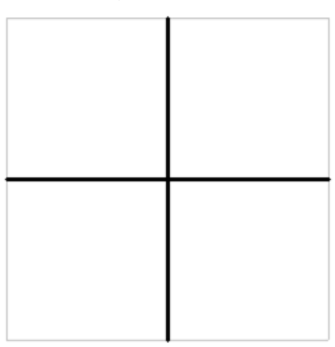
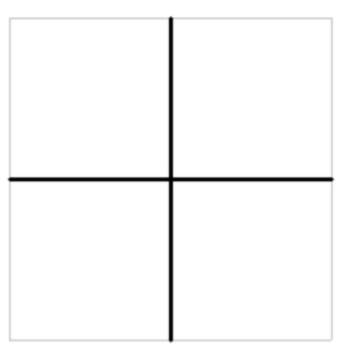
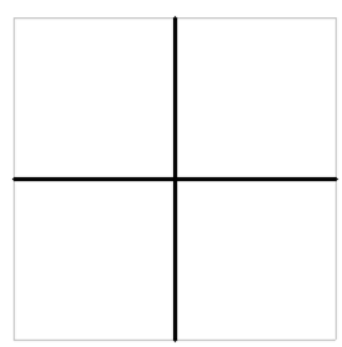
1) $(a^7)(a^4)$ = __________
2) $(2p^3)(5p)$= _________________
3) $(x^4y^5)^2$= _________________
4) $(2x^3y^4)^2$= _________________

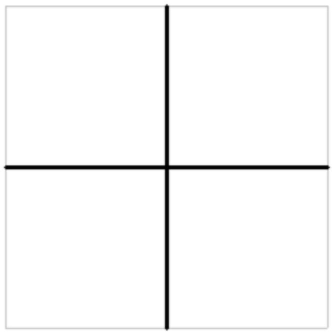
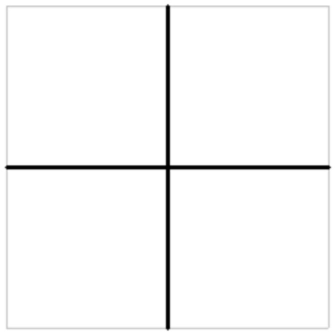
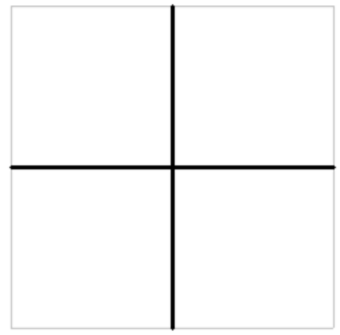
Notes: Modeling Power Functions

Power function $y=k\cdot x^p$

What effect will the k have? ____

Special Power functions: Let's draw a reminder of their basic shapes!! ☺

Parabola	Cubic Function	Hyperbola
$y=x^2$ 	$y=x^3$ 	$y=x^{-1}$ 

	Square Root Function	Cube Root Function
$y = x^{-2}$ 	$y = x^{1/2}$ 	$y = x^{1/3}$ 

Most power functions are similar to one of these six. What functions have symmetry? What kind?

x^p with positive even powers of p are similar to x^2

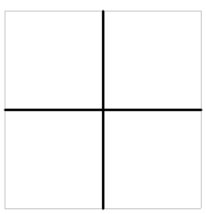
x^p with negative even powers of p are similar to x^{-2}

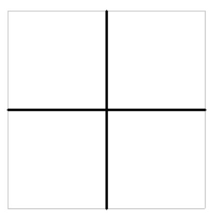
x^p with positive odd powers of p are similar to x^3

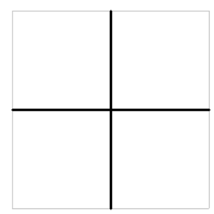
x^p with negative odd powers of p are similar to x^{-1}

Remember that even functions are symmetric across the y-axis.

Examples:

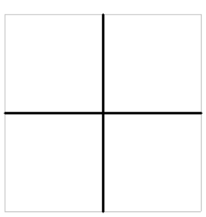


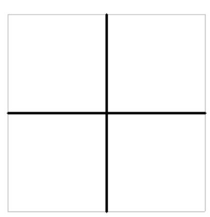


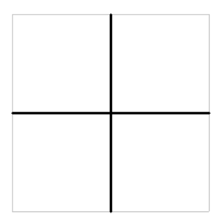


Remember that odd functions are symmetric about the origin.

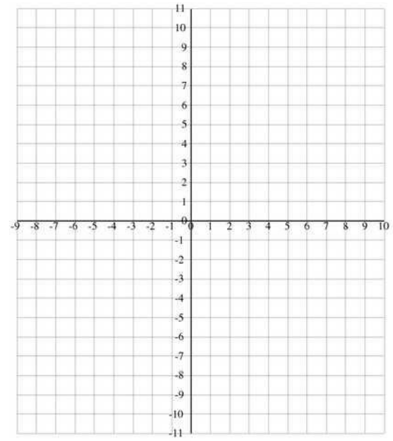
Examples:







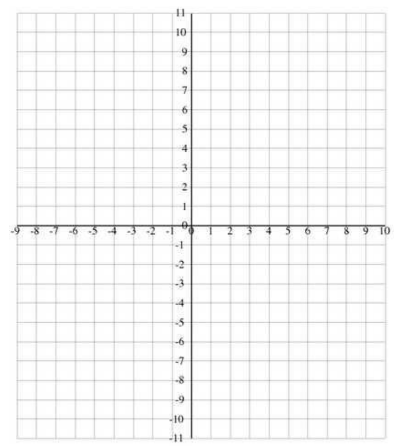
Be careful!! A function with an even degree (highest exponent) may or may not be an even function. A function with an odd degree may or may not be an odd function.



One type of power function is a **direct proportion**: $y = k \cdot x$ (alternatively: _____________), where k is a constant other than 0.

As x gets larger, y ___________________________, keeping k the same.

Examples: distance = rate x time, force = mass x acceleration
y = 4x (graph at the right)



Another type of power function is an **inverse proportion**: $y = \frac{k}{x}$ (alternatively: _____________), where k is a constant other than 0.

As x gets larger, y ________________________, keeping k the same.

Examples: the time taken for a journey is inversely proportional to the speed of travel; the time needed to dig a hole is (approximately) inversely proportional to the number of people digging.
y = 4/x (graph at the right)

Say that we are told that f(1) = 7 and f(3) = 56

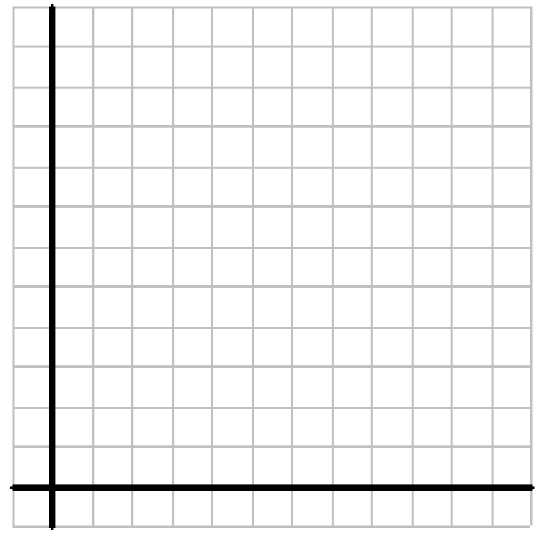
We can find f(x) given the data is linear: y = mx + b

We can find f(x) when the data is exponential: $y = a(b)^x$

Now we consider finding $f(x) = kx^p$ (we'll use our calculators for now!)…

Application – Power Regression, Interpreting and Predicting values!

Rate (miles/hr)	1	3	6	9	12	18	24
Time (hr)		8	4		2		1



1. Graph the points. Be sure to label axes with values AND words!!

NOTE: the pattern on the graph does NOT appear ___________

It looks like part of a _____________.

-> Clue that we probably have

____________ _______________.

2. Find a power function that models the data.

Stat → Edit → Input data into L1 and L2. Enter the values for which you have a **complete** ordered pair. (We'll fill in the blanks in the table later! ☺)

Stat → ________ → A: PwrReg To help with predictions, remember:

- You MUST store your equations in Y1. To get Y1, do ______, ______, _________, _______.
- For calculators with older operating system, do PwrReg, _____, _____, _____
- For calculators with newer operating system, on the PwrReg screen, by StoreEq, do _____

3. Determine whether the function is direct or inverse variation. Explain.

4. Fill in the missing values in the table above.

5. Determine the rate of cycling if a person biked for 6 hours.