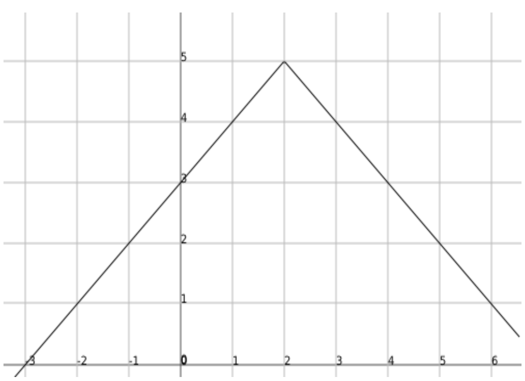
Day 1~ 2-1 Relations & Functions

Part 1: Use the following words to complete the sentences below:

Inputs	Dependent	Range	Domain	Independent	Relation	Outputs

1. A _______________ is a set of ordered pairs.
2. The ______________of a relation is the set of all _____________or x-coordinates of the ordered pairs.
3. The ______________of a relation is the set of all _____________or y-coordinates of the ordered pairs.
4. In an equation, the input variable is called the ____________________variable.
5. In an equation, the output variable is called the ___________________variable.

State the **domain** and the **range** for each relation.

1.


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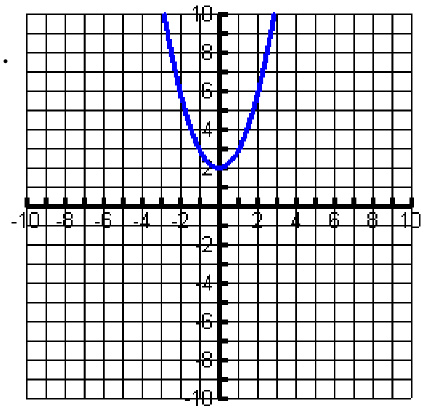
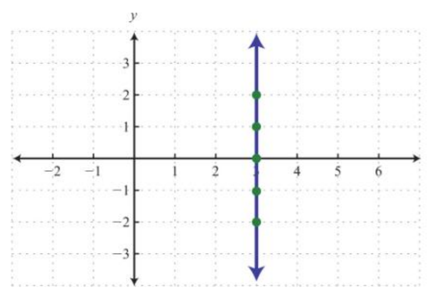


3.


3. At 2.4 calories burned per pound of weight each hour, the calories ***c*** burned in ***h*** hours by a 110 person walking briskly can be modeled by C = 110(2.4)h.

4. In Oak Park, houses will be from 1450 to 2100 square feet. The cost ***C*** of building at $125 per square foot can be modeled by C = 125f, where ***f*** is the number of square feet.

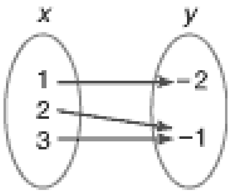
Part 2: Function versus not a function activity

1. A _______________is a relation in which each element of the domain is paired with exactly one element in the range.

2. The ______________________________is used to determine whether the relation has at least one element of the domain paired with more than one element of the range. If the vertical line passes through two or more points on the graph, then the relation is NOT a function.

Determine whether each relation is a function:

1. {(1,1), (2,1), (3,1), (4,1), (5,1)}
2. {(2,1), (2,2), (2,3), (2,4), (2,5)}
3. {(0,2), (0,3), (0,4), (0,5), (0,6)}
4.



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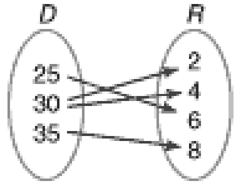

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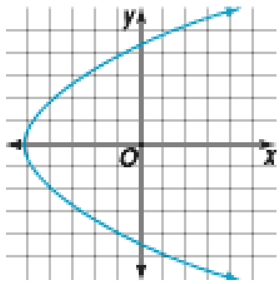
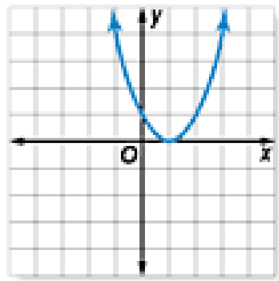


7.



Part 3: Function Notation

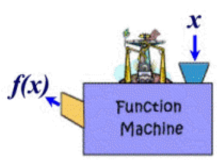
Traditionally, functions are referred to by the letter *f*, but *f* need not be the only letter used in function names. The following are but a few of the notations that may be used to name a function: $f(x)$, $g(x)$, $h(a)$, $A(t)$, ...

$f(x) = x^2$ $\quad g(x) = -2x + 4$ $\quad h(a) = a^2 + 5a + 4$ $\quad A(t) = 16t^2 - 4t - 1$

$y = x^2 + 7$ $\quad f(x) = x^2 + 7$

$$f = \{(x, y) \rightarrow y = x^2 + 7\}$$

Part 4: Evaluating Functions



To evaluate a function, simply replace the function's variable (substitute) with the indicated number or expression.

1. $f(x) = 2x + 5$ find $f(3)$.

2. $R(v) = v^3 + 3v^2 - 5v - 6$ find $R(-2)$

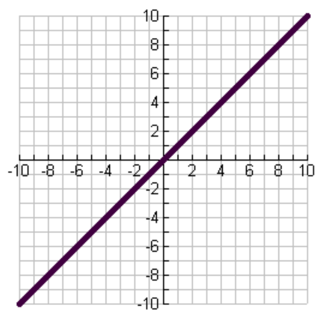
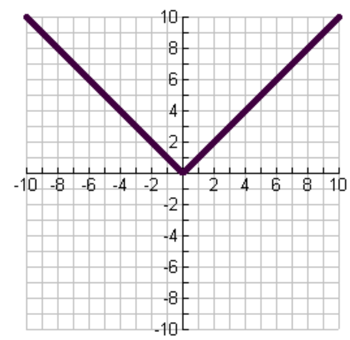
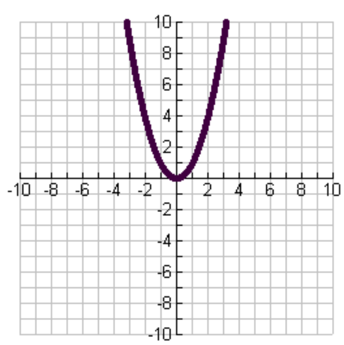
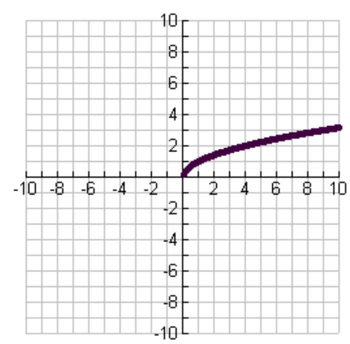
3. $h(x) = 2x^2 + 6x - 3$ find $h(4a)$

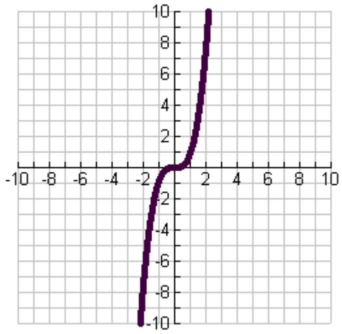
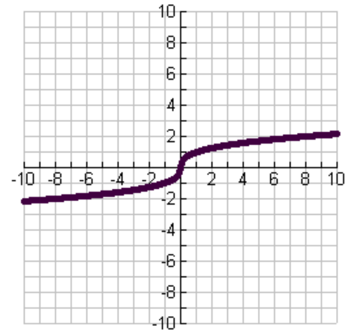
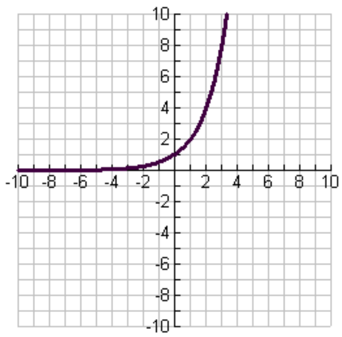
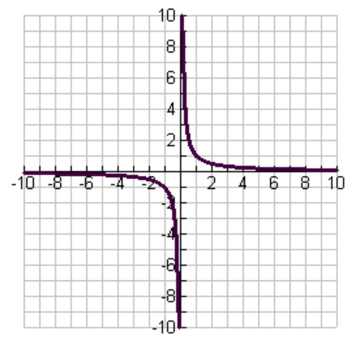
4. $f(x) = x^2 + 2x - 1$ find $f(3h + 2)$

Day 2~ Parent Functions

Vocabulary: Parent function | Vertical Stretch | Reflection | Transformation | Vertical Compression | Translation

- A ______________________________is the simplest form in a set of functions that form a family.
- Each function in the family is a ________________________of the parent function.
- One type of transformation is a __________________________.
- A _____________________flips the graph of a function across a line, such as the x- or y-axis.
- A ___________________________________multiplies all y-values of a function by the same factor greater than 1.
- A ___________________________________reduces all y-values of a function by the same factor between 0 and 1.

Linear f(x) = x	**Absolute Value f(x) = |x|**
 **Domain:** **Range:**	 **Domain:** **Range:**
Quadratic f(x) = x^2	**Square Root f(x) = $\sqrt{x}$**
 **Domain:** Range:	 **Domain:** Range:

Cubic $f(x) = x^3$	Cube Root $f(x) = \sqrt[3]{x}$
 Domain: Range:	 Domain: Range:
Exponential $f(x) = b^x$	**Rational $f(x) = \frac{1}{x}$**
 Domain: Range:	 Domain: Range:

Key Concept: Transformations of f(x)

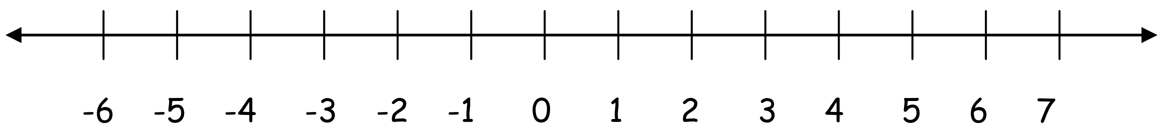
Vertical Translations	Horizontal Translations
• Translation up ***k*** units, k > 0 $y = f(x) + k$ • Translation down ***k*** units, k > 0 $y = f(x) - k$	• Translation right ***h*** units, h > 0 $y = f(x - h)$ • Translation left ***h*** units, h > 0 $y = f(x + h)$
Vertical Stretches and Compressions	**Reflections**
• Vertical stretch, a > 1 $y = af(x)$ • Vertical compression, 0 < a < 1 $y = af(x)$	• In the x-axis $y = -f(x)$ • In the y-axis $y = f(-x)$

PRACTICE: Graph each pair of functions on the same coordinate plane. Describe a transformation that changes f(x) to g(x).

1. $f(x) = x + 6$; $g(x) = x - 2$
2. $f(x) = -x - 5$; $g(x) = x - 4$
3. $f(x) = x - 7$; $g(x) = x + 4$
4. $f(x) = -x - 8$; $g(x) = -x + 5$

Day 3~ Absolute Value Equations (1.5)

________________is the distance a number is from zero on the number line and distance is_______________.



Ex: |-4| = 4 |6| = 6

Solving Absolute Value Equations

Absolute Value Equations usually have 2 answers. This is because to get rid of the absolute value bars we have to rewrite the equation as two separate linear equations.

Ex: $|x - 3| = 27$ Rewrite the equation as 2 different equations.

$x - 3 = 27$ and $x - 3 = -27$ *Think about which numbers have an absolute value of 27.*

The steps to solve an absolute value equation are:

1. Isolate the absolute value first.
2. Rewrite the equation as two separate linear equations.
3. Solve each equation individually to get the two answers.

Ex: $|2x + 3| = 15$ $2|x - 7| = 16$

Solve Multi-step Absolute Value Equations

Ex: $3|4x - 1| - 5 = 10$ $2|3x - 1| + 5 = 33$

Extraneous Solution: A solution of an equation derived from an original equation that is _____a solution of the original equation.

Check for extraneous solutions:

$|2x + 5| = 3x + 4$ $\qquad\qquad$ $|2x + 3| = 3x + 2$

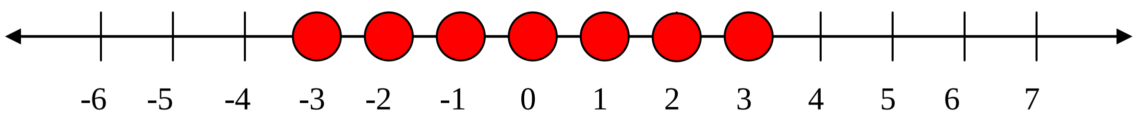
Day 3~ Absolute Value Inequalities

Ex: If $|x| \le 3$ that means that its distance from zero is less than 3 spaces.

What number(s) is exactly three spaces from zero? __________

What are other numbers that are less than 3 spaces away from zero? __________

Plot this on a number line:



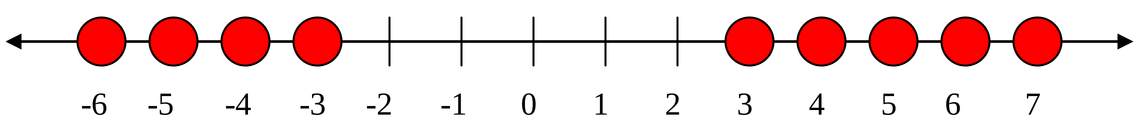
Where do all these numbers seem to lay? __________

Ex: If $|x| \ge 3$ that means that its distance from zero is more than 3 spaces.

What number(s) is exactly three spaces from zero? __________

What are other numbers that are more than 3 spaces away from zero? __________

Plot this on a number line:



Where do these points seem to lie?__________

We call these two situations compound inequalities. These two types are called ***and*** and ***or*** statements.

And: This is an in-between situation. Your answer would be written **# < *x* < #**

Or : This is the "going out" situation. Your answer would be written ***x* < # or *x* > #**

All absolute value inequalities make an **and** or an **or** statement. We know which by what the sign is.

Less Thand – Less than Absolute values make and statements

Greator – Greater than Absolute values make or statements.

Solve:

$|3x + 6| \geq 12$

$3|2x + 6| - 9 < 15$

You can use absolute value inequalities to specify allowable ranges in measurements. The difference between a desired measurement and its maximum and minimum allowable values is the ________________.

Ex. A manufacturing specification calls for a dimension d of 10 cm. However, there is an allowable tolerance of 0.1 cm. Write an absolute value inequality to describe this situation.

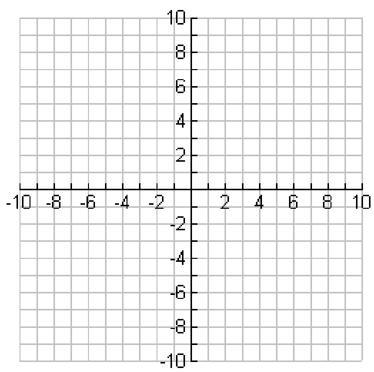
Ex. At the Brooks Graphic Company, the average starting salary for a new graphic designer is \$37,600, but the actual salary could differ from the average by as much as \$2590. Write an absolute value inequality to describe this situation.

Ex. Write an absolute value inequality for a length of 36 ft with a tolerance of 6 inches.

Day 3~ Absolute Value Graphs (2.5)

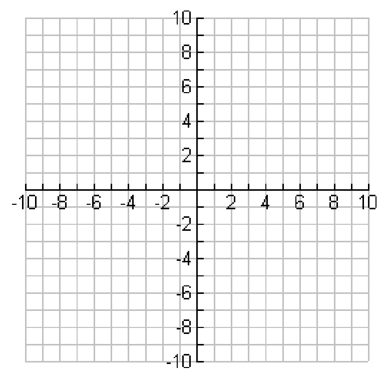
Graphing Absolute Functions on a calculator **(Hint: Use the absolute value key: Math, Number, 1)**

Ex. 1 $y = |x+3|$



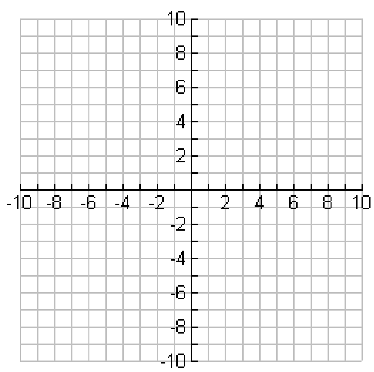
Vertex:________

Ex. 2 $y = |x| - 5$



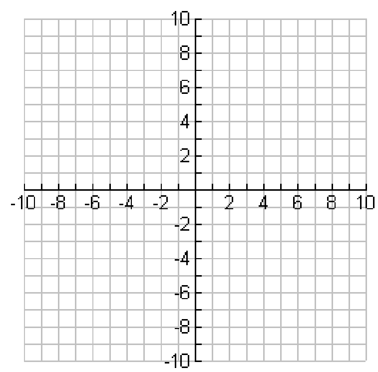
Vertex:_______

Ex. 3 $y = |x-2| - 6$



Vertex:________

Ex. 4 $y = -|x+4| + 3$

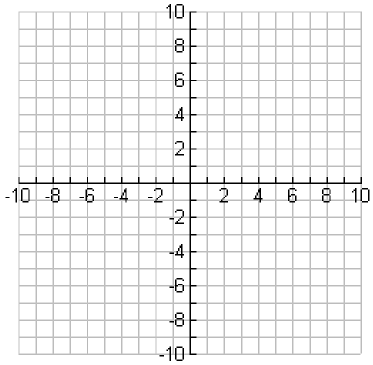


Vertex:_______

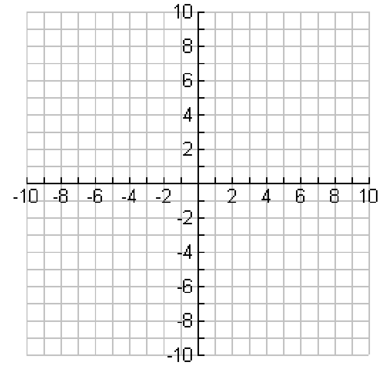
Practice:

Use your graphing calculator to graph the Absolute Value Functions below.

1. $y = -|x+4| - 6$



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

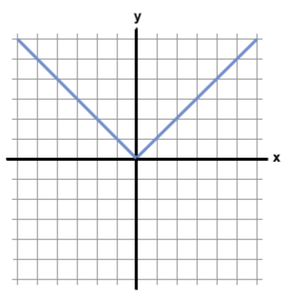


Day 3 ~ Section 2.6 Vertical & Horizontal Translations

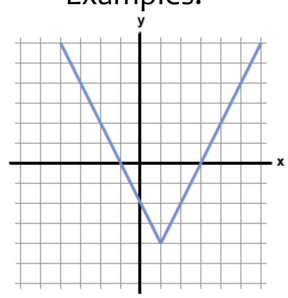
$$y = a|x-h| + k$$

Graphs of absolute value functions look like angles.

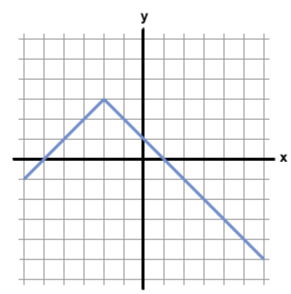
Examples:



$f(x) = |x|$



$f(x) = 2|x - 1| - 4$



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

A ____________ of a function is the point where the function reaches a maximum or minimum.

❖ In general the vertex of an absolute value equation is located at:________________

A. By Transformation: (on TI-83)

Graph each of the functions below on your calculator with a partner.
Explain how each graph differs from the graph of y = |x|.

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

5. $y=-\lvert x\rvert$
6. $y=3\lvert x\rvert$
7. $y=\lvert 3x\rvert$
8. $y=\frac{1}{3}\lvert x\rvert$
9. $y=\left\lvert \frac{1}{3}x\right\rvert$

Summary:

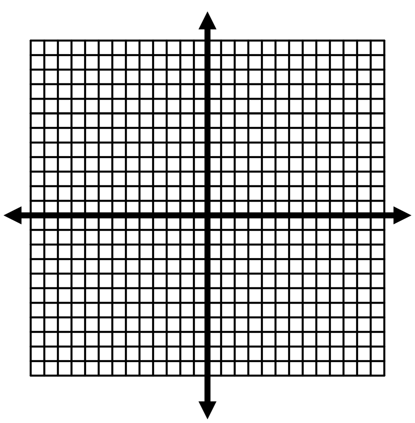
$$y=a\lvert x-h\rvert+k$$

Examples: (without a calculator, explain how each graph would differ from y = $\lvert x\rvert$)

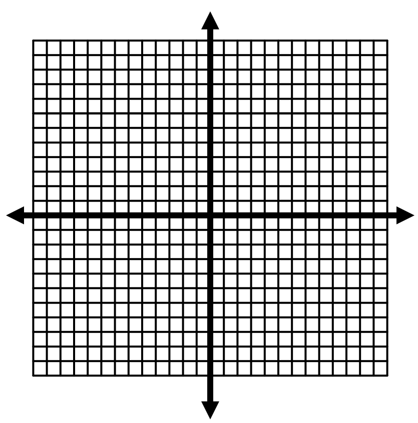
1. $y=\lvert x+2\rvert-3$ ________________________ 3. $y=\lvert 2x\rvert+4$ ______________________________

IV. Use a chart and graph. Be sure to identify the vertex.

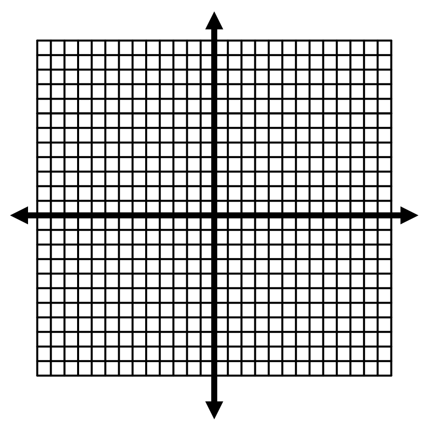
1. $y=\lvert x-3\rvert+1$



2. $y=\lvert 2x+4\rvert-3$



3. $y=\lvert -3x+5\rvert$



Day 5 ~ Piecewise Functions

A ________________ _________________ is defined as a function that uses different rules for different parts of its domain.

For example, let's look at an application. Lisa makes \$4/hr baby-sitting before midnight and \$6/hr after midnight. She begins her job at 7 pm.

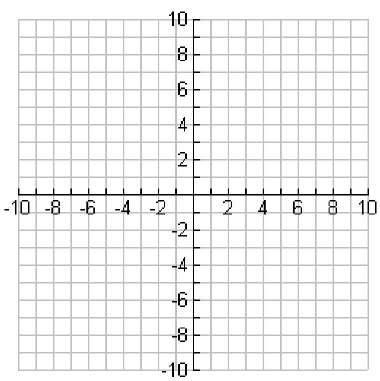
a) Complete the table below for the total amount of money Lisa makes.

Time	8 pm	9 pm	10 pm	11:30	12:00	12:30 am	1 am	2 am
Hour Sitting		2	3		5		6	7
Amount Earned	\$4							

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 baby-sits after midnight. Since the rate changes at t=5, we need two different rules: one for t≤5 and one for t>5. Find the two different functions that would define how much money Lisa makes with respect to the number of hours she baby-sits.

Part II: Graphing Piecewise Functions

1) $f(x)=\begin{cases} x & \text{if } x\le 0 \\ x^2 & \text{if } x>0 \end{cases}$

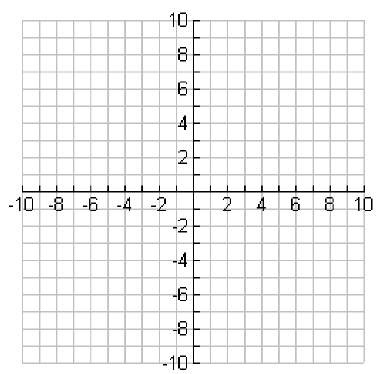


Function? Yes or No

f(-4)=

f(3)=

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

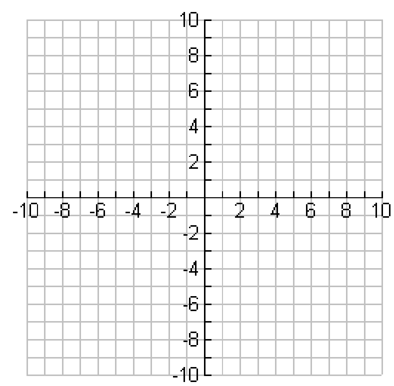


Function? Yes or No

h(4)=

h(-2)=

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



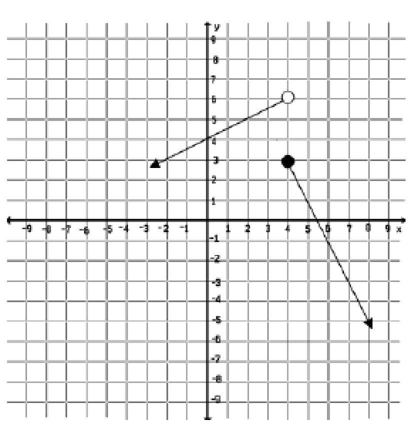
Function? Yes or No

h(0)=

h(1)=

Part III: Write the equations for the piecewise functions whose graphs are shown below. Assume the units are 1 for every tic mark.

4)



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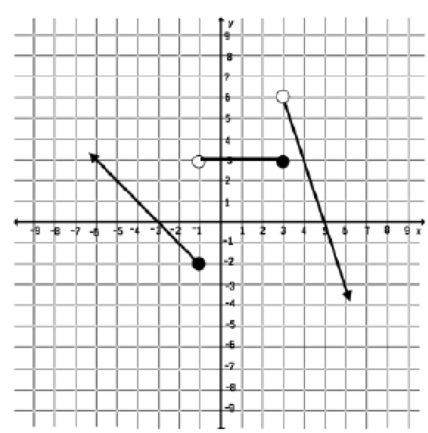
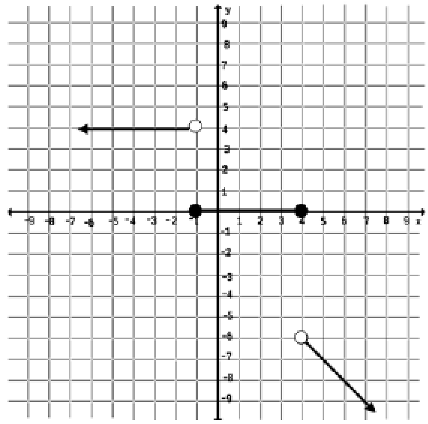
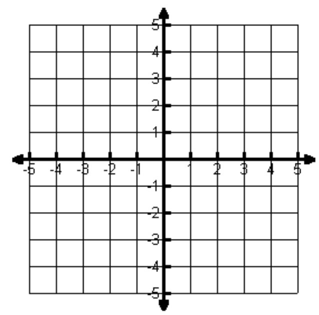


6) 

D... Inequalities

I. Intro: Graph the line $y = -\frac{1}{3}x + 2$



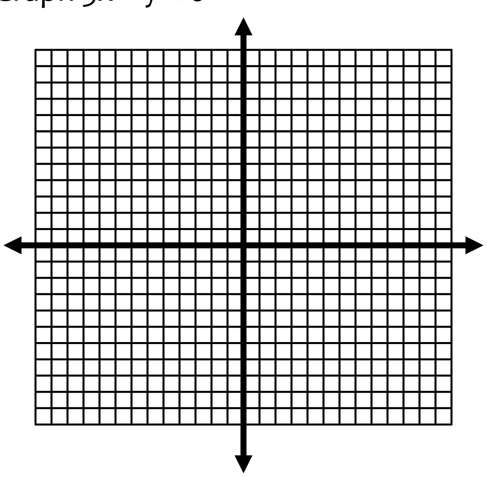
II. Graphing Linear Inequalities

A. To graph linear inequalities:

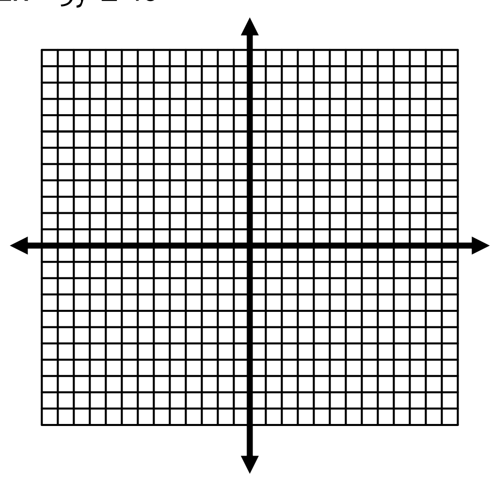
1. Treat the inequality as an equality and graph the associated line.
2. If you include the line ($\leq \geq$), then use a ____________ line
3. If you do not include the line (< >) then use a ____________ line.
4. Choose a ____________________ to decide which way to shade.(use (0, 0) unless it lies on the line)

B. Examples:

1) Graph $3x - y < 6$

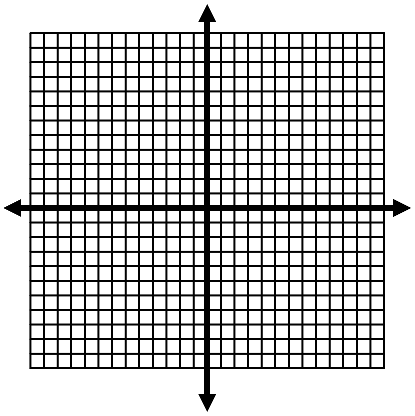


2)Graph $2x - 5y \geq -10$



You can graph two-variable absolute value inequalities the same way you graph linear inequalities.

3. $y \le |x-4|+5$



4. $-y+3>|x+1|$