

Lesson #11 C-GUIDED DISCOVERY ACTIVITY: Understanding Translations and Shifts and Graphing Absolute Value Functions (Reference: Lesson #17 in book)

Problem

1. LESSON GOALS:

**Students will be able to sketch graphs of the given absolute value functions without a calculator or using the X/Y Chart.*

**Students will be able to explain in words the shifts and translations that occurred in the given function in relation to the original "Parent Function"*

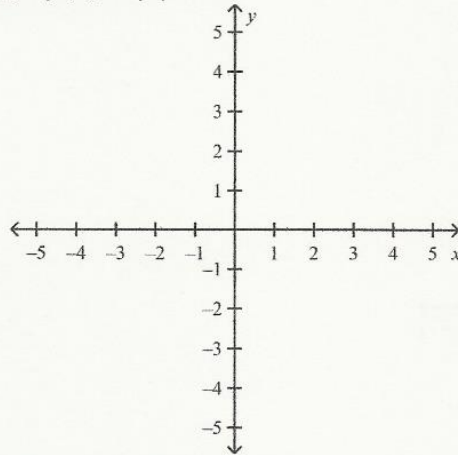
**Students will be able to graphically show the shifts and translations that occurred in the given function in relation to the original "Parent Function"*

**When given the graphs of different BASIC Absolute Value functions, students will be able to create the equation of the function that corresponds to the graph*

**For the more advanced students, When given the graphs of different COMPLEX Absolute Value functions, students will be able to create the equation of the function that corresponds to the graph*

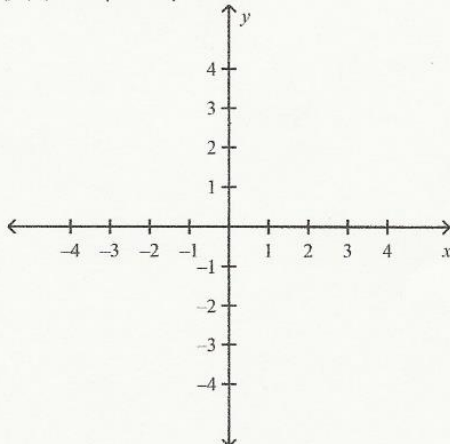
***GRAPH THE MOST BASIC ABSOLUTE VALUE FUNCTION, THE "PARENT FUNCTION" USING THE X & Y CHART METHOD THAT WE HAVE USED SO MANY TIMES WHEN GRAPHING LINEAR EQUATIONS.**

PARENT FUNCTION: $f(x) = |x|$



***GRAPH THE FOLLOWING IN THE SAME FASHION AS YOU GRAPHED THE PARENT FUNCTION (USE THE SAME METHOD AND POINTS AS ABOVE)**

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



**DID IT WORK? WERE YOU ABLE TO GET A GRAPH THAT LOOKS LIKE THE PARENT FUNCTION? WHAT DID YOU GET?*

**WHAT WOULD HAPPEN TO THE ABOVE GRAPH IF WE ADDED -2 TO OUR X & Y CHART? WOULD WE HAVE A GRAPH THAT LOOKS LIKE AN ABSOLUTE VALUE GRAPH THEN?*

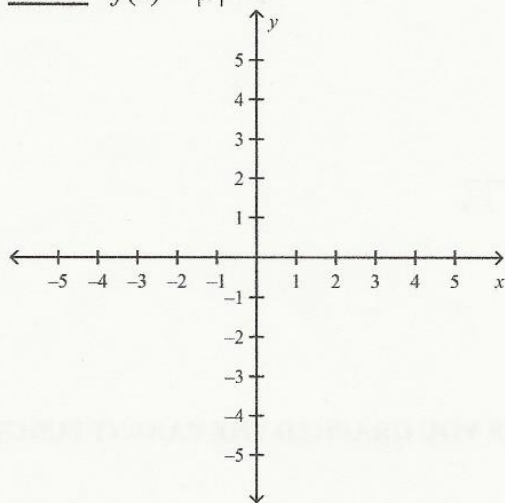
***THE FORMULA THAT WILL HELP US GRAPH THESE FUNCTIONS USING SHIFTS AND**

TRANSLATIONS: $f(x) = a|x - h| + k$

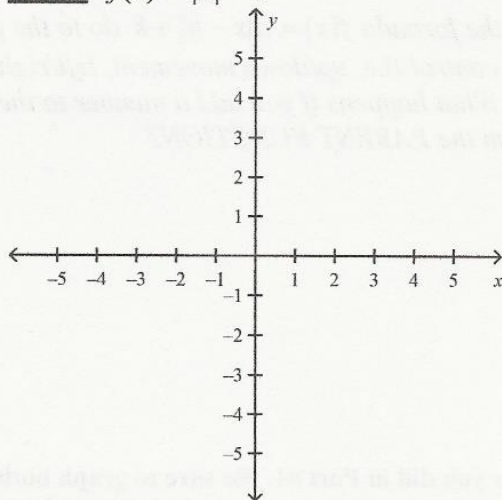
2. **PART #1:** The $+k$ Part $f(x) = a|x - h| + k$

Use your graphing calculator to graph each of the following functions. Draw both your PARENT FUNCTION and your SIBLING FUNCTION on each graph. Then, using your three critical points, explain what shifts occurred in each of the sibling functions and what part of the algebraic function you believed caused that function.

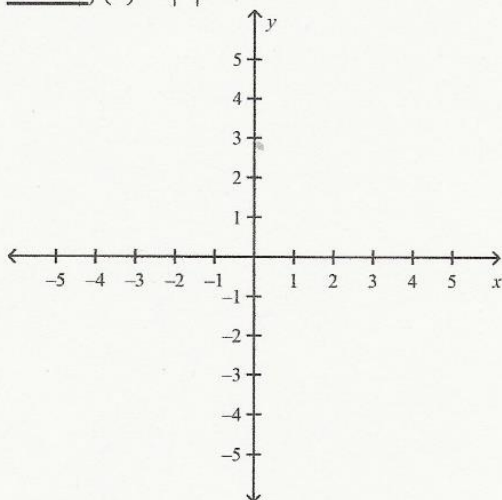
EX #1 $f(x) = |x| + 2$



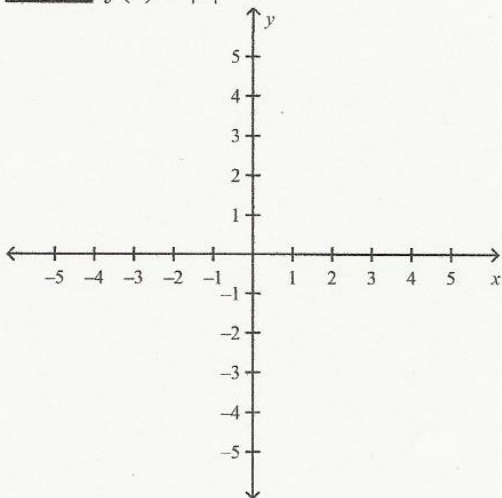
3. **EX #2** $f(x) = |x| - 3$



EX #3 $f(x) = |x| + 3$



EX #4 $f(x) = |x| - 4$



PART #1: FINAL QUESTION

*With what you learned in PART #1, what does the $+k$ in the formula $f(x) = a|x - h| + k$ do to the graph of a SIBLING FUNCTION? What shifts or movements does it control (i.e. up/down movement, left/right movement, narrowing of graph, widening of graph, etc)? What happens if you add a number to the PARENT FUNCTION? What happens if you subtract a number from the PARENT FUNCTION?

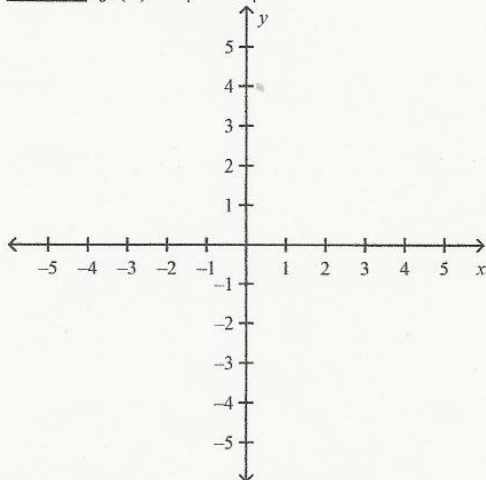
Answer:

4.

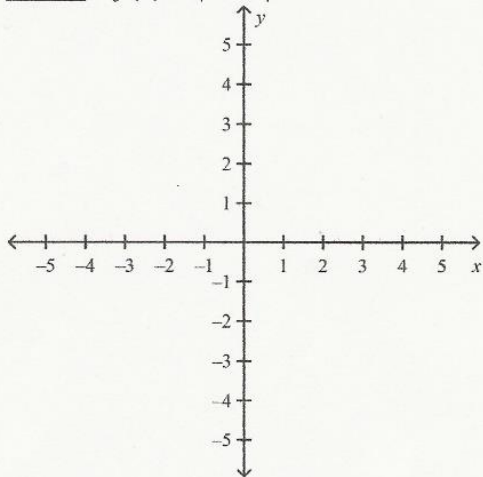
PART #2: The $-h$ Part $f(x) = a|x - h| + k$

Graph each of the following functions in that same fashion as you did in Part #1. Be sure to graph both the PARENT FUNCTION and the SIBLING FUNCTION on the same graph and explain the shifts and what you believe caused them to the right of the graph.

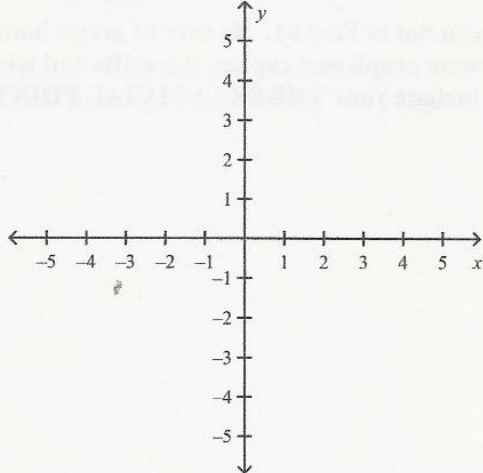
EX #5 $f(x) = |x + 3|$



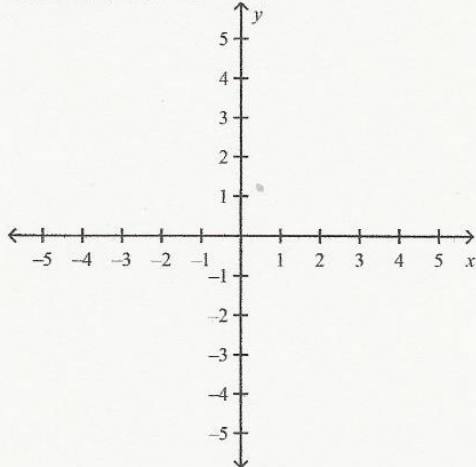
EX #6 $f(x) = |x - 2|$



5. **EX #7** $f(x) = |x + 4|$



EX #8 $f(x) = |x - 3|$

**PART #2: FINAL QUESTION**

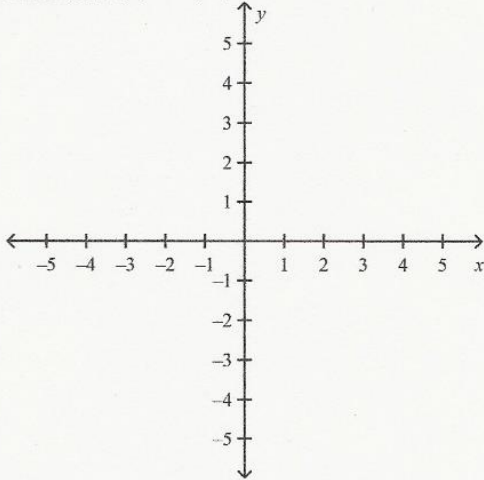
*With what you learned in PART #2, what does the $-h$ in the formula $f(x) = a|x - h| + k$ do to the graph of a SIBLING FUNCTION? What shifts or movements does it control (i.e. up/down movement, left/right movement, narrowing of graph, widening of graph, etc)? What happens to the PARENT FUNCTION if you add a number inside the absolute value sign? What happens to the PARENT FUNCTION if you subtract a number inside the absolute value sign?

Answer:

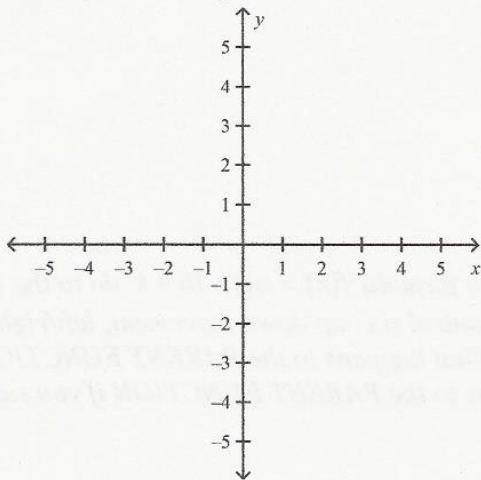
6. **PART #3:** The a Part $f(x) = a|x - h| + k$

Graph each of the following functions in that same fashion as you did in Part #1. Be sure to graph both the PARENT FUNCTION and the SIBLING FUNCTION on the same graph and explain the shifts and what you believe caused them to the right of the graph. (Make sure you include your THREE CRITICAL POINTS when graphing these and determining your shifts or translations.)

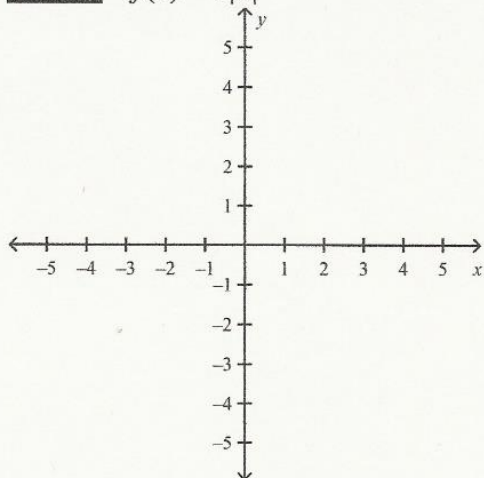
EX #9 $f(x) = 2|x|$



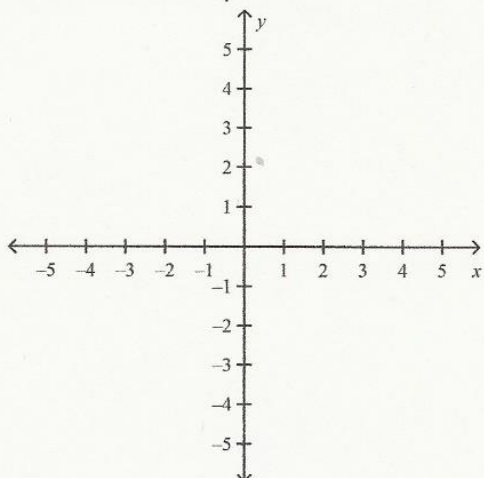
EX #10 $f(x) = \frac{1}{3}|x|$



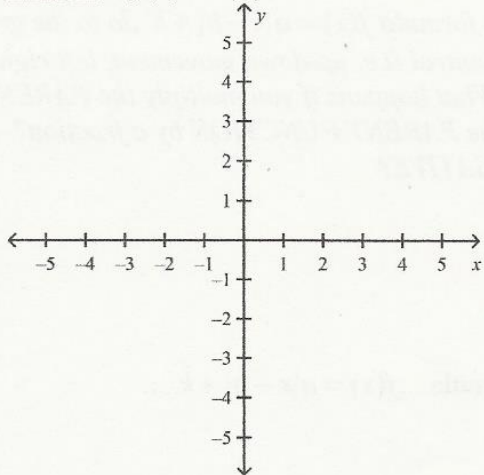
EX #11 $f(x) = 3|x|$



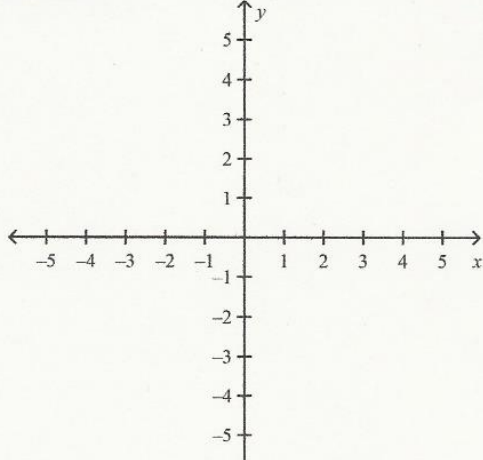
EX #12 $f(x) = \frac{1}{4}|x|$



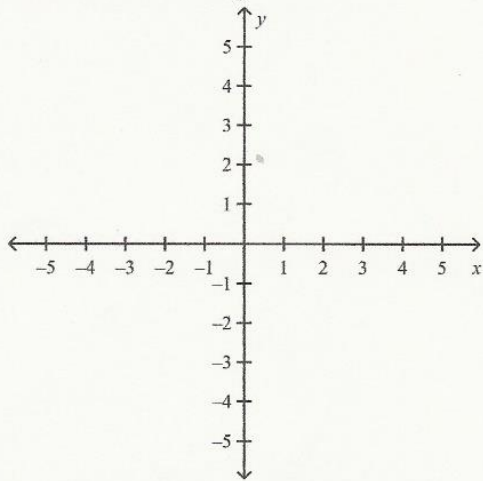
EX #13 $f(x) = -|x|$



EX #14 $f(x) = -2|x|$



EX #15 $f(x) = -\frac{1}{3}|x|$

**PART #3: FINAL QUESTION**

**With what you learned in PART #3, what does the a in the formula $f(x) = a|x - h| + k$ do to the graph of a SIBLING FUNCTION? What shifts or movements does it control (i.e. up/down movement, left/right movement, narrowing of graph, widening of graph, etc)? What happens if you multiply the PARENT FUNCTION by a number? What happens if you multiply the PARENT FUNCTION by a fraction? What happens if you multiply the PARENT FUNCTION by a NEGATIVE?*

Answer:

7.

***SO LET'S PUT IT ALL TOGETHER NOW!!!** In this formula.... $f(x) = a|x - h| + k$

The a controls the....

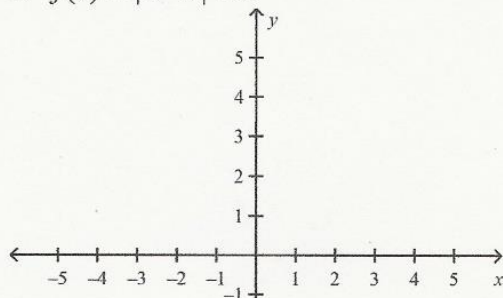
The $-h$ controls the...

And the $+k$ controls the...

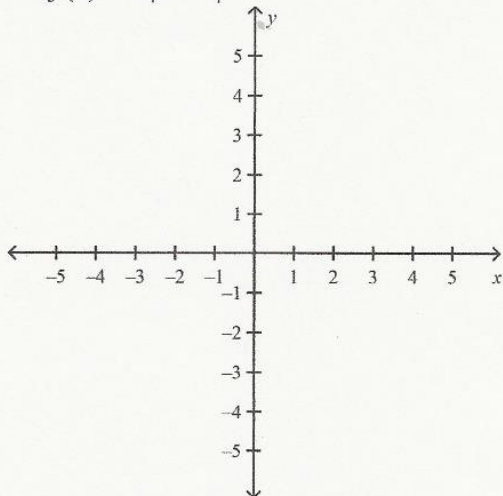
8. **PART #4:** THE PUTTING IT ALL TOGETHER PART

Graph each of the following absolute value functions with out using a graphing calculator or an X & Y chart, just use what you have learned about shifts and translations to graph them. Then to the right of the graph explain all of the shifts and translation that are going on and what parts of the Algebraic function are controlling them.

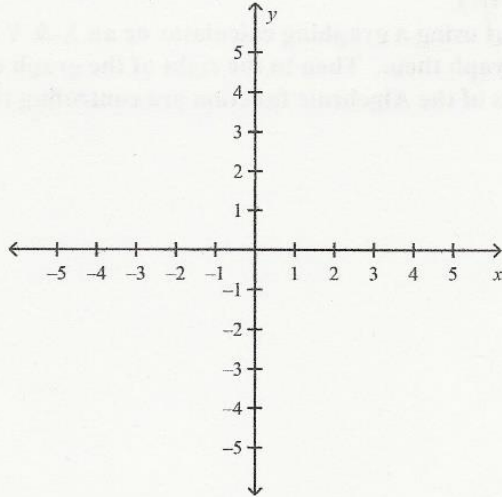
1. $f(x) = |x - 3| + 2$



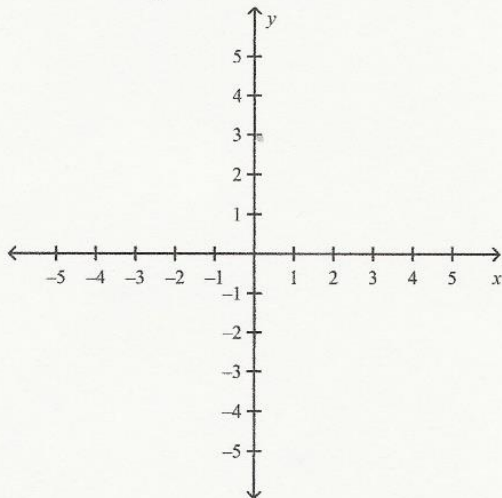
2. $f(x) = -|x + 2| - 1$



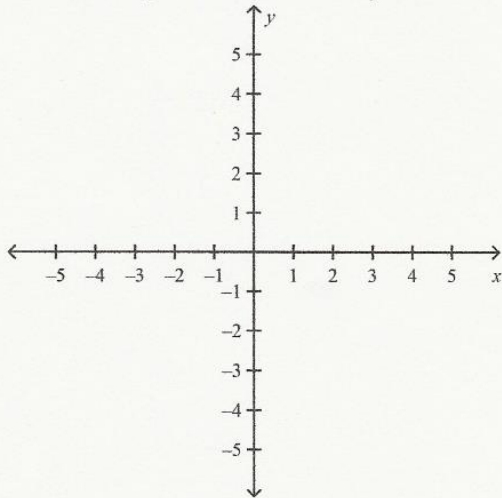
3. $f(x) = 2|x + 1| + 3$



4. $f(x) = -\frac{1}{2}|x - 1| + 3$



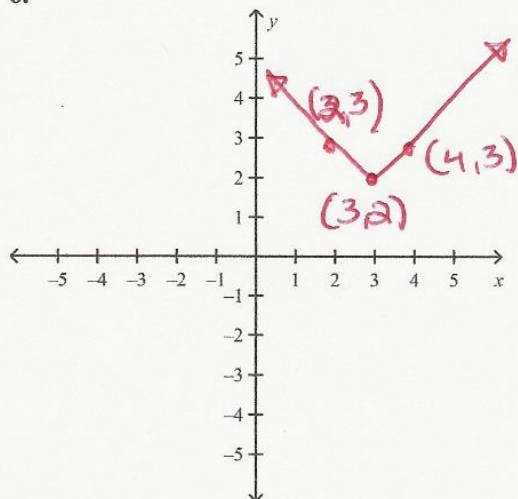
5. $f(x) = 3|2(3x - 4) - 5x + 7| + 80 - 82$



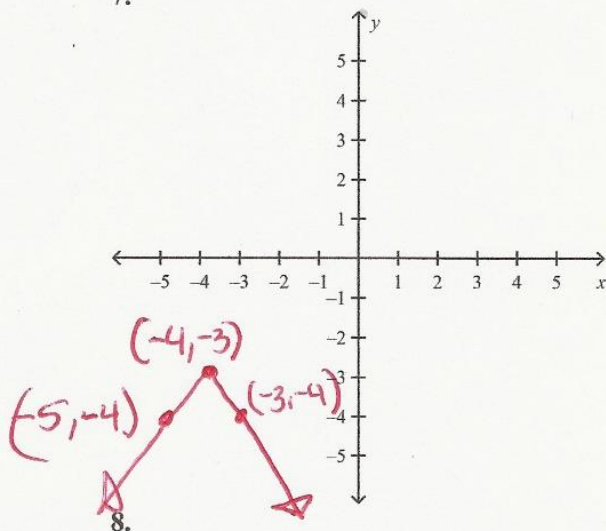
9. **PART #5:** THE EXTENSION PART

For each of the following graphs, interpret the graphs, determine the shifts that need to have gone on to reach the given graph in comparison to the PARENT FUNCTION and then create the ABSOLUTE VALUE FUNCTION that would model that graph. (SHOW ALL OF YOUR WORK INCLUDING FINAL ABSOLUTE VALUE FUNCTION IN THE OPEN SPACE TO THE RIGHT OF THE GRAPH.)

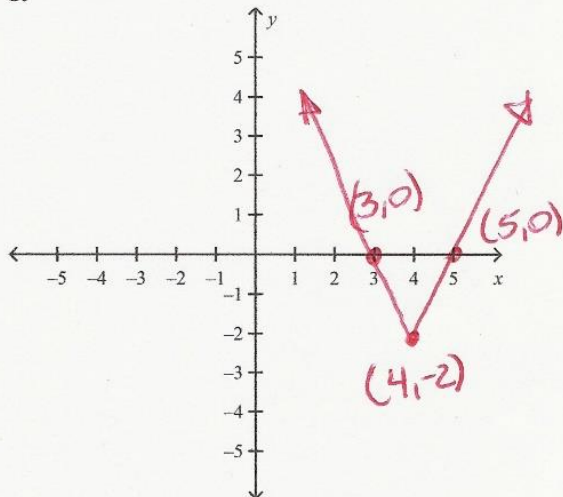
6.



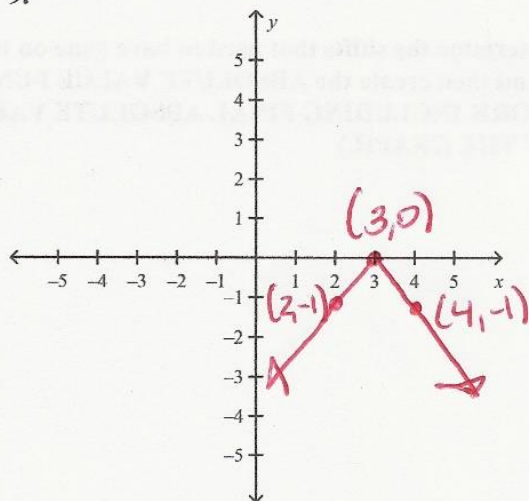
7.



8.



9.



10.

