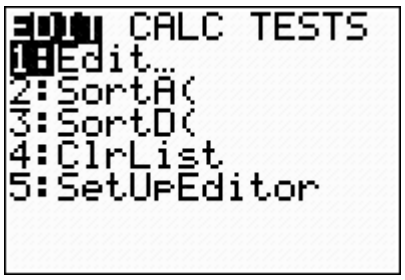
Introducing the Absolute Value Function

Name _____

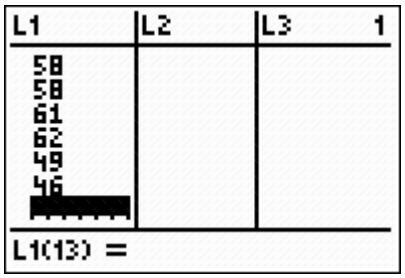
Class _____

In this activity, you will examine data by comparing individual data points to the mean by finding the difference (positive or negative) and the distance from the mean, plot the distances versus the differences to examine the shape of the plot, investigate the absolute value function in the Y= register to model the relationship between the distances and the differences, and extend the investigation of absolute value equations by examining tables and graphs.

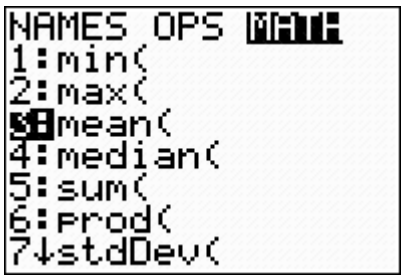


The high temperatures in the first twelve days of February were: 43, 49, 47, 42, 54, 55, 58, 58, 61, 62, 49, 46.

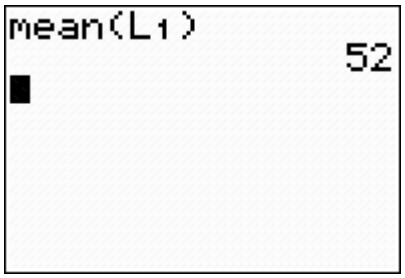
Press [STAT] [ENTER]. Enter these 12 data points into L1.



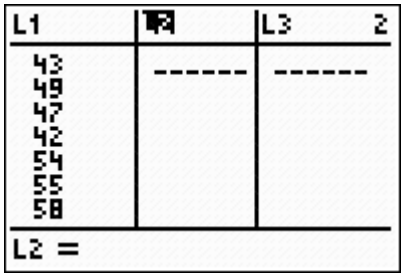
Press [2nd] [QUIT] to return to the home screen. Press [2nd] [LIST] ▶ ▶ to the 'Math on Lists' menu. Press [3] to select **3:mean(**.



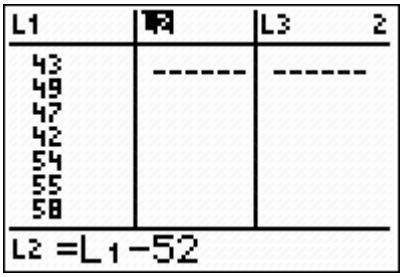
This will paste the command onto the home screen. Press [2nd] [L1] [)] to complete the command to find the mean of L1. Press [ENTER] to execute.



Now that you know the mean of the temperatures, press [STAT] [ENTER] to return to the 'statistics editor.' Arrow to the top of L2 as shown.

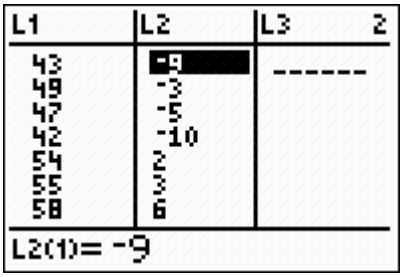


Press [2nd] [L1] [−] [5] [2]. This will command the calculator to subtract the mean of 52 from each of the temperatures in L1.



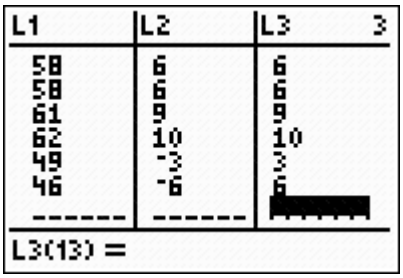
Press [ENTER] to execute.

- What do you notice about the numbers in L2? What is the highest difference? What is the smallest difference? When are the differences negative? Positive?

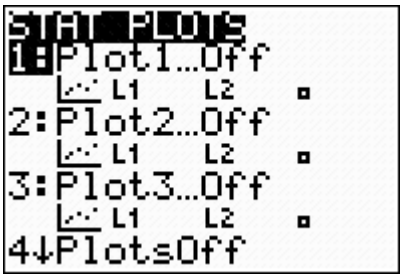


Move over to L3. Examine each entry in L1 and determine is DISTANCE from the mean (how far away). Enter the distances in L3.

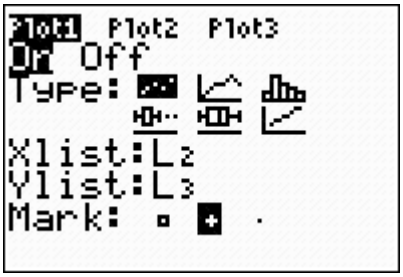
- What is the relationship between the distances and the differences from L2? Why is this so?



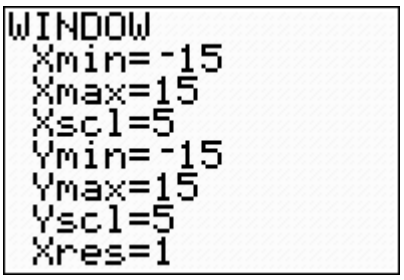
Set up a scatter plot to compare the distances to the differences (L3 to L2). Press [2nd] [STAT PLOT]. Press [1] to select **1:Plot 1**.



Press [ENTER] to turn the plot **On**. Arrow down to the **Xlist**. Press [2nd] [L2] to use L2 (the differences) as the *x* list. Arrow down to the **Ylist**. Press [2nd] [L3] to use L3 (the distances) as the *y* list.

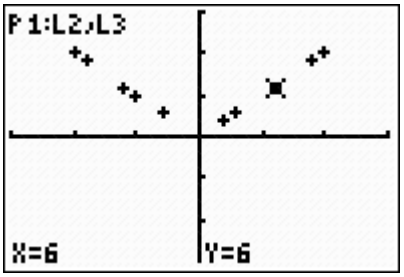


Press [WINDOW]. Set the window as shown

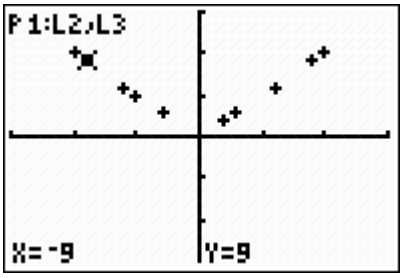


Press [GRAPH]. Press [TRACE] to examine the relationships between the *x*- and *y*-coordinates of each point.

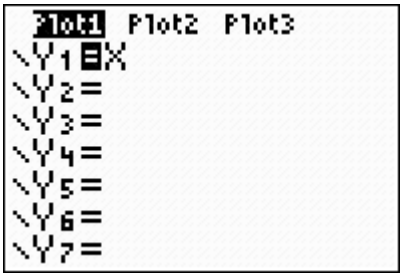
- When *x* is positive, what happens to *y*?



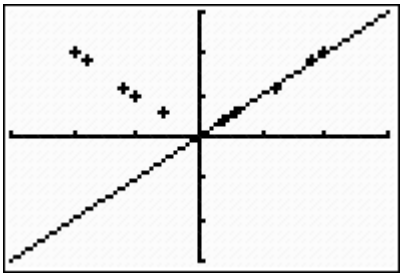
- When *x* is negative, what happens to *y*? When will *y* be negative? Why? When is *x* negative?



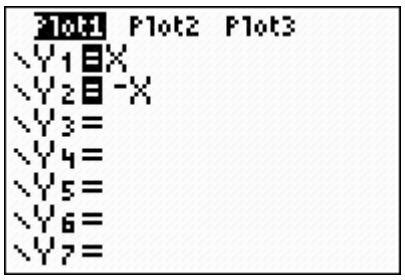
Press [Y=]. Enter the equation *y* = *x* into **Y1** as shown.



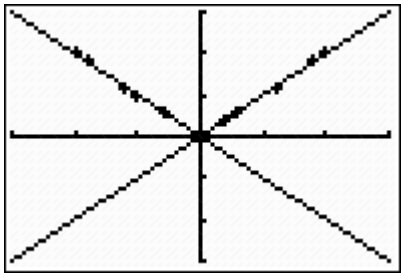
- Press [GRAPH]. What is the relationship between *y* = *x* and the scatter plot?



Return to [Y=]. Enter the equation $y = -x$ into **Y2** as shown.

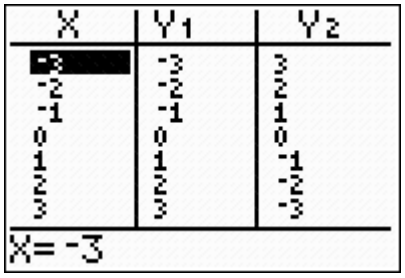


- Press [GRAPH]. What is the relationship between $y = -x$ and the scatter plot?

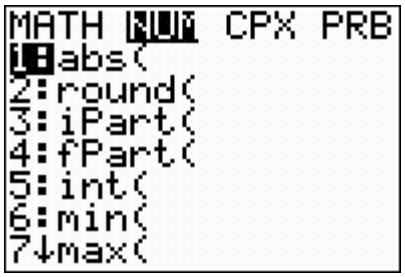


Press [2nd] [TABLE] to examine the tables for **Y1** and **Y2**.

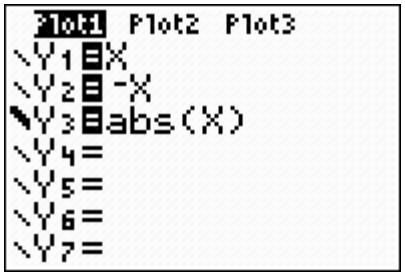
- How are the values for **X** and **Y1** related? How are the values for **X** and **Y2** related? How are the values for **Y1** and **Y2** related? Where is each Y equal to zero?



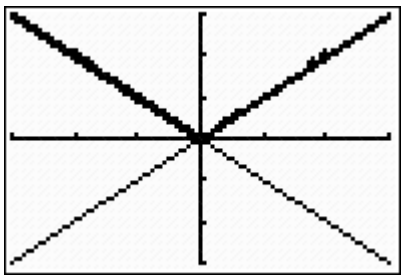
Return to [Y=]. Arrow down to **Y3**. Press [MATH] [▸] to find the absolute value command **1:abs(**. Press [ENTER]. This will paste the command into **Y3**.



Complete the function as shown. Arrow left of **Y3**. Press [ENTER] to change the graph to a 'thick line.'

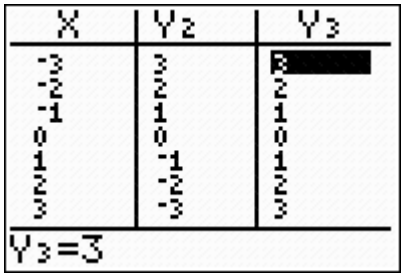


- Press GRAPH. What is the relationship between y = abs(x) and the scatter plot? NOTE: In your textbook this function will be written as $y = |x|$.



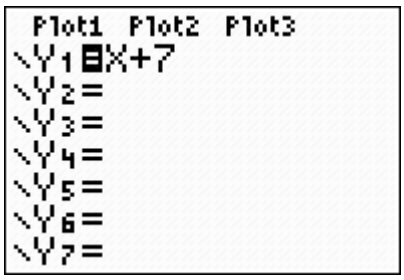
Press 2nd [TABLE] to examine the tables.

- How are the values for **Y3** related to **Y1** and **Y2**? Where is Y equal to zero?



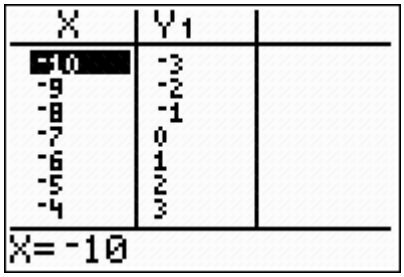
Extension

Examine another absolute value equation. First, clear Y= and enter another linear equation.

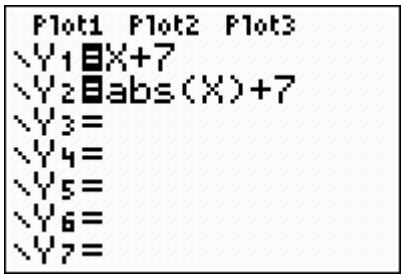


Examine the table.

- When are the **Y1** values positive? When are they negative? When is **Y1** zero?

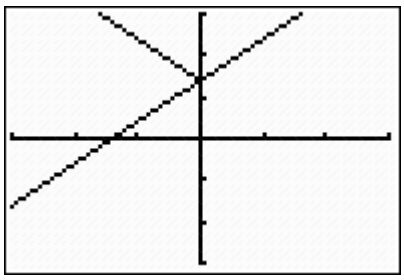


Return to Y=. Enter the equation y = abs(x) + 7 into **Y2** as shown.



Examine the graph.

- What seems to be the relationship between the graphs?



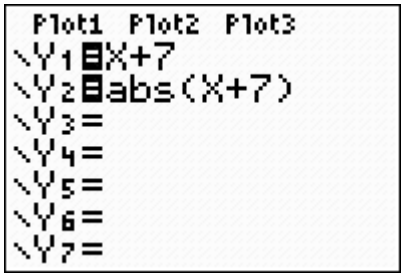
Examine the table.

- Is the relationship between **Y2** and **Y1** what you were expecting? Why or why not? Where are the Y values equal to zero?

X	Y1	Y2
-10	-3	17
-9	-2	16
-8	-1	15
-7	0	14
-6	1	13
-5	2	12
-4	3	11

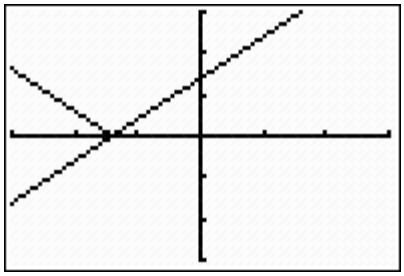
X=-10

Return to [Y=]. Enter the equation $y = \text{abs}(x + 7)$ into **Y2** as shown.



Examine the graph.

- What seems to be the relationship between the graphs? How is this picture different from the graph with $y = \text{abs}(x) + 7$?



Examine the table.

- Is the relationship between **Y2** and **Y1** what you were expecting? Why or why not? Where are the Y values equal to zero?

X	Y1	Y2
-10	-3	3
-9	-2	2
-8	-1	1
-7	0	0
-6	1	1
-5	2	2
-4	3	3

X=-10

- Compare $y = \text{abs}(x) + 7$ to $y = \text{abs}(x + 7)$.