Introduction to Absolute Value
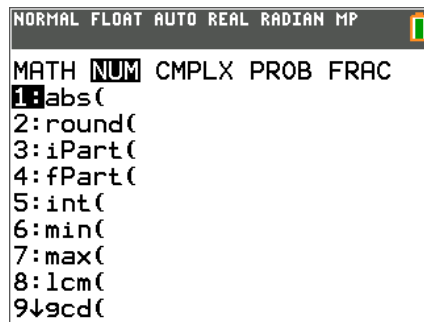
Student Activity

Name _____

Class _____

Problem 1 – Defining and Plotting Absolute Value

The absolute value function can be defined as $|x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$.

Explore this definition by using the absolute value function on the graphing calculator.

Press math. Move to the **NUM** menu and select **abs(**.

```
NORMAL FLOAT AUTO REAL RADIAN MP

MATH NUM CMPLX PROB FRAC
1:abs(
2:round(
3:iPart(
4:fPart(
5:int(
6:min(
7:max(
8:lcm(
9↓gcd(
```

1. Use the **abs** command on the Home screen to complete the following.

    a. |10.5| = _____   **b.** |–15| = _____   **c.** |–3.14| = _____
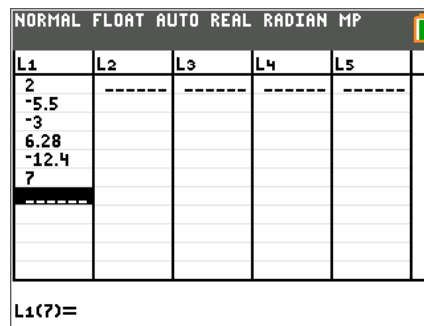
    d. |–12| = _____   **e.** |8| = _____   **f.** |2.71| = _____

2. What happens to the absolute value of numbers that are negative (to the left of zero on a number line)? How does this relate to the definition stated above?

To view a plot of the absolute value function, enter 10 random numbers (positive and negative) into **L1** using the stat editor.

To access the editor press stat enter.

Note: If there is data already in **L1**, clear it by moving the cursor to the top of **L1** and pressing clear enter.)

```
NORMAL FLOAT AUTO REAL RADIAN MP

L1      L2     L3     L4     L5     1
2       ------ ------ ------ ------
-5.5
-3
6.28
-12.4
7
------




L1(7)=
```

Now, move the cursor on top of **L2**, press [enter] and let the values of **L2** be equal to **abs(L1)** to compute the absolute values of the data you entered. To enter **L1**, press [2nd] [1].

The screen to the right just shows a sampling of six **L1** values you may use.

```
NORMAL FLOAT AUTO REAL RADIAN MP
L1    L2    L3    L4    L5    2
 2    ----- ----- ----- -----
-5.5
-3
6.28
-12.4
7
----

L2=|L1|
```

To graph the scatter plot of the data, press [2nd] [y=] [stat plot][STAT PLOT] and select **Plot1**. Match the screen to the right.

Press [zoom] and select **ZoomStat**.

```
NORMAL FLOAT AUTO REAL RADIAN MP
Plot1 Plot2 Plot3
On  Off
Type:▩ ⌁ ⊪ ⊞ ⊞ ⌁
Xlist:L1
Ylist:L2
Mark :□ + · .
Color:  BLUE
```

3. **L1** represents the *x*-values and **L2** represents the *y*-values. What trend do you notice about the *y*-values for the negative *x*-values? Describe the shape of the graph to the left of $x = 0$.

4. Describe the shape of the graph of $y = |x|$. Enter new numbers into the list, press [zoom], and select **ZoomStat** to check the shape you described.

Problem 2 – Exploring Functions with Absolute Value

Now you will explore how changing parts of an absolute value function affects its graph using the transformation graphing application.

Before you begin, turn off **Plot 1** by pressing [2nd] [y=] [stat plot][STAT PLOT] selecting **Plot1** and choosing the **Off** Option.

Start the transformational graphing application by pressing [apps] and selecting **Transfrm**.
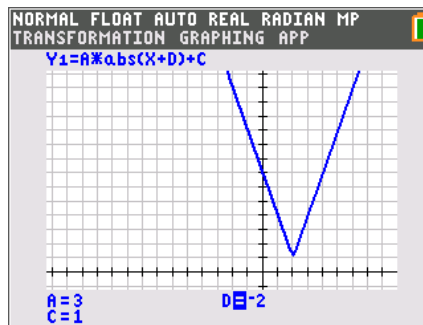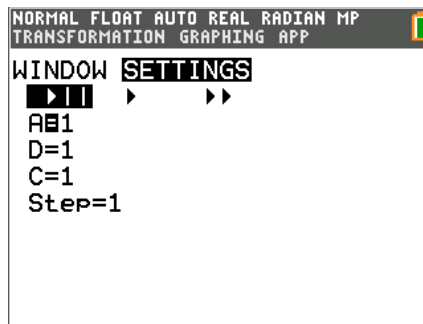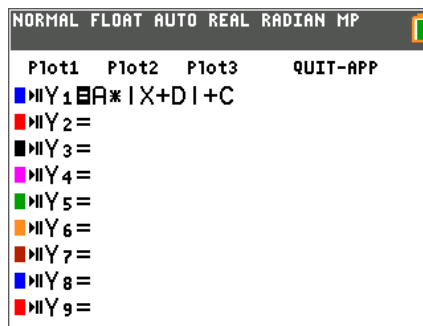
Press [y=] and enter **A*abs(X+D)+C** next to **Y₁**. Then press [zoom] and select **Zstandard**.

To enter the letter **A**, press [alpha] [math]. The letters **D** and **C** are entered in a similar manner by using [alpha] followed by the corresponding button to your desired letter.

```
NORMAL FLOAT AUTO REAL RADIAN MP      📱
 Plot1   Plot2   Plot3      QUIT-APP
■▶ıY₁⊟A*│X+D│+C
■▶ıY₂=
■▶ıY₃=
■▶ıY₄=
■▶ıY₅=
■▶ıY₆=
■▶ıY₇=
■▶ıY₈=
■▶ıY₉=
```

To change the window setting shown at the right, press [window] [▲] (up arrow).

To change the values of the constants, use the [▲] and [▼] arrow keys to select the desired variable and then use the [◄] and [►] arrow keys to change the value.

```
NORMAL FLOAT AUTO REAL RADIAN MP      📱
TRANSFORMATION GRAPHING APP
WINDOW SETTINGS
 ▶❙❙       ▶      ▶▶
 A⊟1
 D=1
 C=1
 Step=1
```

```
NORMAL FLOAT AUTO REAL RADIAN MP      📱
TRANSFORMATION GRAPHING APP
 Y₁=A*abs(X+D)+C



A=3             D⊟⁻2
C=1
```

5. What happens to the graph when *a* is negative? When *a* is positive?

6. In general, what effect does *a* have on the graph?

7. a. What happens to the graph when *d* is positive? When *d* is negative?

b. What happens to the graph when *c* is positive? When *c* is negative?

c. For this general function $y = |x + d| + c$, what are the coordinates of the vertex?

Problem 3 – Matching Equations to Graphs

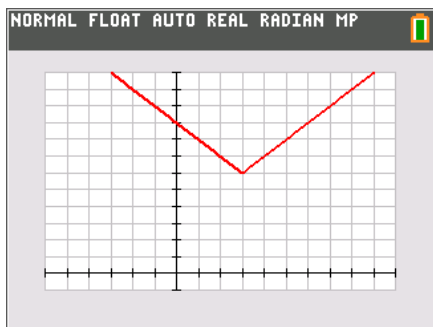Choose the correct equation from the options below for each graph shown.

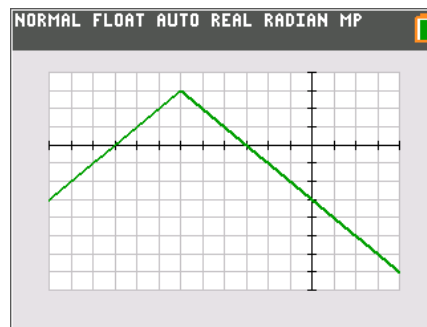**a.** $y = |x - 6| + 3$ **b.** $y = -|x + 3| - 6$

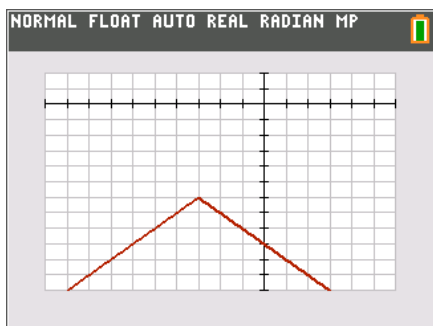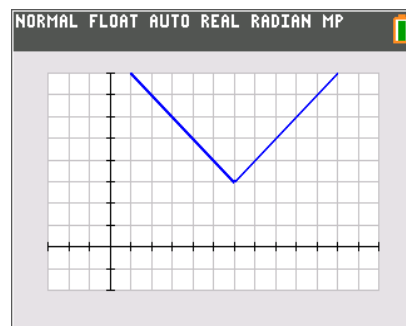**c.** $y = |x - 3| + 6$ **d.** $y = -|x + 6| + 3$

8.

9.

10.

11.

Extension – General Absolute Value Function

12. Using the Transformation Graphing App, explore the graph of **Y₁=A∗abs(BX+D)+C**. What does the graph look like when *a* is zero? What about when *b* is zero? Explain why.

13. List any other observations. For example, how is the slope related to *a* and *b*? Is the vertex always (*−d, c*)?