

Middle Grades Activity: Absolute Value and Distances on the Number Line, part 1

CALCULATORS: Casio *fx-300ES*

INTRODUCTION:

This activity allows students to establish the idea that absolute value should be equated with the concept of *distance*. In addition, it teaches the correspondence between a distance and a *difference* (subtraction) of two real numbers.

PROCEDURE:

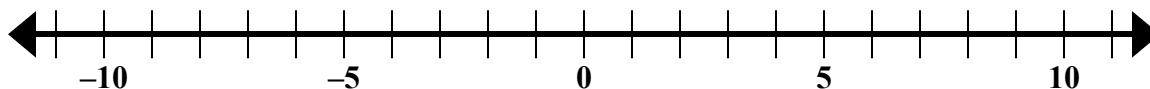
Turn the calculator **[ON]**.

Make sure the *fx-300ES* is set up correctly for this activity by pressing the following key sequences:

1:MthIO	2:LineIO
3:Deg	4:Rad
5:Gra	6:Fix
7:Sci	8:Norm

[SHIFT]-[SETUP] [1] to enter Math Input/Output mode;
[SHIFT]-[SETUP] [8] [1] to enter Normal Display 1.

Consider the following number line:



Plot the points A, B, C, D, and E on the number line, with these coordinates:

$$A = -8$$

$$B = -3$$

$$C = -1$$

$$D = 4$$

$$E = 6$$

Exercise 1. How far are each of these points from zero?

Distance from A to zero = _____

Distance from B to zero = _____

Distance from C to zero = _____

Distance from D to zero = _____

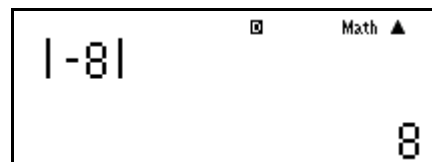
Distance from E to zero = _____

The **absolute value** of a number computes that number's *distance* from zero on the number line. It is written with two vertical bars: $| |$

As an example, $|-8|=8$, since -8 is 8 units from zero.

The *fx-300ES* calculator can be used to find absolute value, using a feature called Natural Display.

Type **[Abs] [(-)] [8] [=]**. This calculates the distance from -8 to zero on the number line.



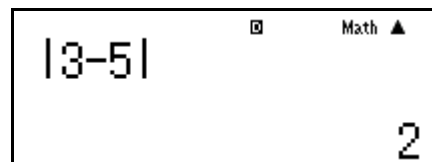
Exercise 2. Use your *fx-300ES* to find the following absolute values:

$$|0 - 8| = \quad |0 - 3| = \quad |0 - 1| = \quad |4 - 0| = \quad |6 - 0| =$$

Compare your results to the answers from Exercise 1.

The absolute value of a *difference* of two numbers computes the *distance* between those two numbers on the number line. For example, $|3 - 5|$ represents the distance between 3 and 5 on the number line.

Type **[Abs] [4] [-] [6] [=]** to calculate this distance.



Exercise 3. Use your *fx-300ES* to find the following distances. Use the number line provided at the beginning of this activity and the points that you plotted.

Distance between D and E =

Distance between C and E =

Distance between B and E =

Distance between A and E =

When finding the distance between points A and E in Exercise 3, you may have calculated your absolute difference by using $|6 - (-8)|$ rather than $|-8 - 6|$. Notice that these distances are the same: the first describes the distance between 6 and -8 on the number line, while the second describes the distance between -8 and 6.

In Part 2 of this activity, you will learn to interpret absolute values of *sums* as distances. You will also investigate the effect that multiplication has on these distances.

SOLUTIONS TO EXERCISES:

Exercise 1. The correct distances are as follows:

$$\text{Distance from A to zero} = \boxed{1} \quad \text{Distance from B to zero} = \boxed{3}$$

$$\text{Distance from C to zero} = \boxed{1} \quad \text{Distance from D to zero} = \boxed{4}$$

$$\text{Distance from E to zero} = \boxed{6}$$

Exercise 2. The correct absolute values are:

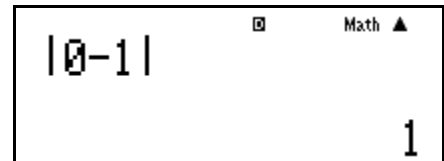
$$|0 - 8| = \boxed{8} \quad \text{Type: [Abs] [0] [-] [8] [=]}$$

$$|0 - 3| = \boxed{3} \quad \text{Type: [Abs] [0] [-] [3] [=]}$$

$$|0 - 1| = \boxed{1} \quad \text{Type: [Abs] [0] [-] [1] [=]}$$

$$|4 - 0| = \boxed{4} \quad \text{Type: [Abs] [4] [-] [0] [=]}$$

$$|6 - 0| = \boxed{6} \quad \text{Type: [Abs] [6] [-] [0] [=]}$$



A calculator display showing the expression $|0-1|$ on the left and the result 1 on the right. The display also shows a small square icon and the word "Math" with an upward arrow.

The results are exactly the same as those from Exercise 1!

Exercise 3.

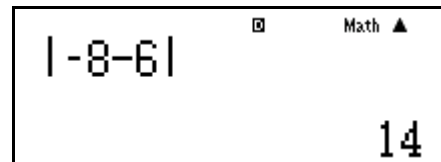
$$\text{Distance between D and E} = \boxed{6} \quad \text{Type: [Abs] [4] [-] [6] [=]}$$

$$\text{Distance between C and E} = \boxed{1} \quad \text{Type: [Abs] [(-)] [1] [-] [6] [=]}$$

$$\text{Distance between B and E} = \boxed{3} \quad \text{Type: [Abs] [(-)] [3] [-] [6] [=]}$$

$$\text{Distance between A and E} = \boxed{8} \quad \text{Type: [Abs] [(-)] [8] [-] [6]$$

[=]



A calculator display showing the expression $|-8-6|$ on the left and the result 14 on the right. The display also shows a small square icon and the word "Math" with an upward arrow.