Absolute Values

Overview – Activity ID: 9855

Students will review the set of integers along with the addition and subtraction of integers using a number line. Then, they will learn that the absolute value of a number is defined as the distance from zero. Students will learn how to interpret the absolute value symbol algebraically, as well as see real-world examples of scenarios involving absolute values.

Math Concepts

- Number sense
- Absolute value
- Graphing
- Integer operations
- Order of operations

Materials

- TI-34 MultiView™
- Pencil
- Paper

Activity

Review integers and integer operations as a class.

The set of integers consists of the positive counting numbers {1, 2, 3, ...}, zero, and the opposite (or negative) of the counting numbers { -1, -2, -3,...}. We can graph these numbers on a number line.

(Graphic included at the end of the activity for classroom use as a transparency or projection.)

On any number line, which direction is positive? And which direction is negative?

Since the positive direction is to the right and the negative direction is to the left, you'll recall we can think of adding and subtracting as "moving right" and "moving left" on a number line.

For example, 4 + 8 means to begin at zero, move four units right, then move another eight units right. Where does this put us on a number line?

At this point, make sure the students understand by asking them to do a few examples in their seats.

Try these on your own, using a number line to justify your answers:

$$10 - 7 =$$
$$15 - 18 =$$
$$-11 - 6 =$$

Go through each of the above examples as a class. Check to ensure students are moving to the right with any positive numbers or addition, and to the left with negative numbers or subtraction. In the first example, students would need to begin at zero, move 10 units right, then 3 units left. In the last example, students would move 1 unit left, then another 6 units left. Discuss any misperceptions the students have, if any.

Double check your answers with the TI-34 MultiView.

Now, let's use these graphs and solutions to go a step further. In the first example (10 – 7 = 3), how far do we end up from the number zero on the number line? You can easily see we end up three units from zero. What about in the second example (15 – 18 = –3)? How far do we end up from the number zero? Write down your answer.

Some students will invariably think you end up "negative three" units from zero. This is a good opportunity to discuss distance and how distance is always positive.

Absolute Values

How far is it from your house to the school? Is it three blocks? Ten miles? Regardless of where you live, you have a distance in mind. Write that distance down. Now, what if you leave your house and drive that same distance but in the opposite direction of the school? Where do you end up? How far will you have driven from your house? Did you write down the same answer again? Explain.

Hopefully, students will say it's irrelevant which direction they drive; 10 miles is 10 miles. Their distance traveled will be 10 miles, but their position will be different depending upon which direction they go. Relate this example back to the initial question.

Above, I asked how far from zero on a number line we were when we calculated 5 – 8 = –3. Now how would you answer? Explain.

Define *absolute value*.

The absolute value of a number is defined as the distance between a number and the origin, or zero.

When discussing distance driven in a car, we came to the conclusion that distance is always positive. Since absolute value represents distance, absolute value must always be positive, too.

The symbol used to denote the absolute value of any real number, x, is $|x|$.

Work through some examples with the students, first using a number line to ensure understanding.

Let's try these examples of absolute value to begin:

$$|6| =$$
$$|-4| =$$
$$\left|-\tfrac{2}{3}\right| =$$

Now, let's evaluate expressions involving absolute value.

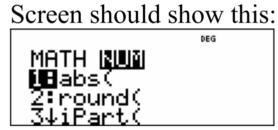
$$|-4| - |7| =$$

Students may struggle with this concept:

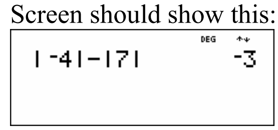
$$|-4| - |7| =$$
$$4 - 7 = -3$$

Follow these steps:

1. Press [math] to access the math menu. Press ▶.
2. Screen should show this:



3. Press 1 to access absolute value.
4. Press [(−)] 4 ▶ [−] [math] ▶ 1 7 ▶ [enter].
5. Screen should show this:



Absolute Values

Discuss the order of operations with them. Remind them that while each individual absolute value is, in fact, positive, the difference of the two can be negative.

The TI-34 MultiView has the functionality to calculate the absolute value of any real number, x. Let's use this feature to check our work.

Now we can progress to more-complex expressions. Simplify this by hand first, and then use the TI-34 MultiView to check your answer.

$\left| 2^2 + \frac{3(-4)}{2} \right|$

Calculate by hand, keeping the order of operations in mind.

$\left| 2^2 + \frac{3(-4)}{2} \right| = \left| 4 + \frac{-12}{2} \right| = | 4 + -6 | = | -2 | = 2$

Now check using your calculator.

Show the students one example of how to use the absolute value function in a real-world situation.

You and two friends are hiking a mountain trail and get separated. Fortunately, each of you is carrying a long-distance radio, so you can still communicate with each other. Your friend Alex is ahead of you by 720 meters, and your friend Bree is 100 meters behind you. How far apart are Alex and Bree?

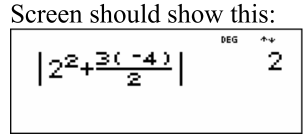
We can use the idea of positive and negative numbers to set this problem up. Alex is 720 meters ahead of you. Since you are in the middle, it's easiest to use yourself as a reference point, or the origin. Therefore, Alex's position would be 720. Bree is behind you, so it makes sense to identify her position with respect to yours. She is at –100 meters. Since we're asking for a distance, keep in mind we will need the absolute values of both their positions.

$$|720| + |-100| =$$
$$720 + 100 = 820$$

Bree and Alex are 820 meters apart.

Follow these steps:

1. Press [math] ▶ 1 to access absolute value.
2. Enter the expression by pressing 2 [x²] [+] [n/d] 3 [(] [(−)] 4 [)] ▼ 2 ▶ ▶ [enter].
3. Screen should show this:



Absolute Values

Name ____________________________

Date ____________________________

Directions: Simplify each of the expressions below. Justify your work using a number line. Label each number line appropriately.

1. –2 – 5

2. –5 + 4

3. –3 + 5

4. 4 – 11

5. –3 + 6

6. 7 – 9 + 2

Absolute Values

Name ______________________

Date ______________________

Directions: Complete the table below. Problems with 💡 should be done mentally rather than with the calculator. Show all steps in each problem, then verify your answer with the TI-34 MultiView™.

		Steps—SHOW ALL WORK	**Distance from the origin**
7.	Simplify $\lvert -8 \rvert$		
8.	Simplify $\lvert 0 - 6 \rvert$		
9.	Simplify $\left\lvert \frac{4-12}{2} \right\rvert$		
10.	Simplify $\lvert (2-5)^2 \rvert$		
11.	Simplify $-\lvert 2(-4) \rvert$		
12.	Simplify $-\lvert (-3)^2 \rvert$		
13.	Simplify $\lvert (-3)^2 - 5^2 \rvert$		

14. You and your family are taking a skiing vacation over spring break, and you have a school assignment to complete while you're gone. Part of the assignment deals with the difference in temperature between your home and Park City, Utah, where you'll be skiing. The high temperature at home the day you left was 81°F, and the low temperature was 66°F. Your first day in Park City, the high temperature was 49°F, and the low temperature was 25°F. What is the difference between the low temperature in Park City and the high temperature at home?

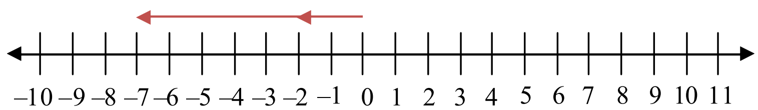
    Explain how you arrived at your answer.

Absolute Values

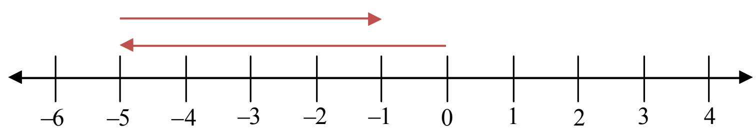
Answer Key

Directions: Simplify each of the expressions below. Justify your work using a number line. Label each number line appropriately.

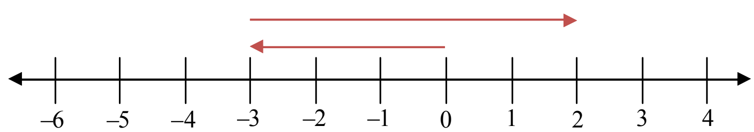
1. –2 – 5 = –7



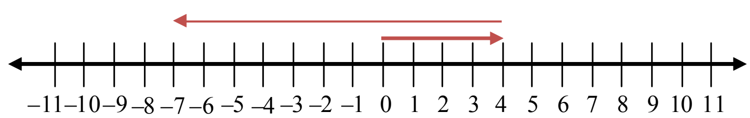
2. –5 + 4 = –1



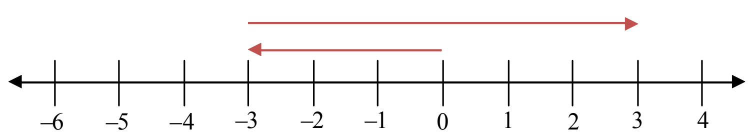
3. –3 + 5 = 2



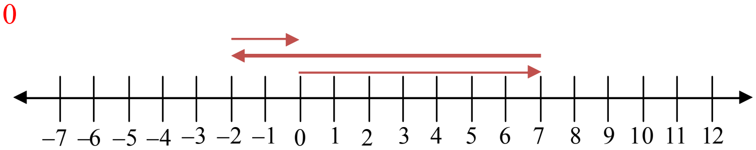
4. 4 – 11 = –7



5. –3 + 6 = 3



6. 7 – 9 + 2 = 0



Absolute Values

Directions: Complete the table below. Problems with [light bulb icon] should be done mentally rather than with the calculator. Show all steps in each problem, then verify your answer with the TI-34 MultiView™ .

		Steps—SHOW ALL WORK	Distance from the origin
7.	Simplify $\lvert -8 \rvert$	$\lvert -8 \rvert = 8$	8
8.	Simplify $\lvert 0 - 6 \rvert$	$\lvert 0 - 6 \rvert = 6$	6
9.	Simplify $\lvert \frac{4-12}{2} \rvert$	$\lvert \frac{4-12}{2} \rvert = \lvert \frac{-8}{2} \rvert = \lvert -4 \rvert = 4$	4
10.	Simplify $\lvert (2-5)^2 \rvert$	$\lvert (2-5)^2 \rvert = \lvert (-3)^2 \rvert = \lvert 9 \rvert = 9$	9
11.	Simplify $-\lvert 2(-4) \rvert$	$-\lvert 2(-4) \rvert = -\lvert -8 \rvert = -8$	8
12.	Simplify $-\lvert (-3)^2 \rvert$	$-\lvert (-3)^2 \rvert = -\lvert 9 \rvert = -9$	9
13.	Simplify $\lvert (-3)^2 - 5^2 \rvert$	$\lvert (-3)^2 - 5^2 \rvert = \lvert 9 - 25 \rvert = \lvert -16 \rvert = 16$	16

14. You and your family are taking a skiing vacation over spring break, and you have a school assignment to complete while you're gone. Part of the assignment deals with the difference in temperature between your home and Park City, Utah, where you'll be skiing. The high temperature at home the day you left was 81°F, and the low temperature was 66°F. Your first day in Park City, the high temperature was 49°F, and the low temperature was 25°F. What is the difference between the low temperature in Park City and the high temperature at home?

$\lvert 25 - 81 \rvert = \lvert -56 \rvert = 56$

Explain how you arrived at your answer.

When we discuss and/or work with temperatures, we don't typically use negative numbers to describe a difference between them. We say "the temperature dropped *x* degrees" or something similar, but without using a negative. Therefore, it is necessary to use the absolute value function to find the difference between the two temperatures.

Absolute Values

Transparency