

ANDREW ROSS

A LESSON PLAN ON ABSOLUTE VALUE

AS PART OF A CONTINUUM

Unit: Number Systems

Section: The Integers

Unit essential question/big idea: We are all familiar with the counting numbers (1,2,3,4,...) from our early childhood, but did you know that there are an infinite number of numbers that lie between those numbers? What can we learn about the subsets of the real number system, and how can we relate them through the study of number lines, graphs and geometric figures?

Pre-requisite skills:

- the ability to add positive and negative numbers
- the ability to plot positive and negative numbers on a horizontal number line to show their relationship to each other
- order of operations
- the knowledge of certain vocabulary:
 - numbers = ideas
 - numerals = the symbols we use to represent numbers in writing
 - natural numbers = the counting numbers (1,2,3,4,5...)
 - whole numbers = zero and the natural numbers
 - set = a collection of distinct objects or elements
 - integers = the set that contains the counting numbers, 0 and the “opposites” of the counting numbers (aka negative integers)

PLANNING

Aim: What is meant by the absolute value of a number, how is it symbolized and how does one treat it when simplifying an expression? (Class length ~42 minutes)

Learning target/objective: I can evaluate the absolute value of a number and simplify expressions that contain it.

Content/Standards: Number Sense and Operations Strand: A.N.6

Evaluate expressions involving factorial(s), absolute value(s) and exponential expressions(s)

Common Misconception: Absolute value means to change the sign of the number in the brackets. (When in reality, you're ignoring the sign if it is a negative sign.)

Roadmap:

1) *What Are We Learning?* How to evaluate the absolute value of a number and simplify expressions that contain it

2) *Why Are We Learning It?* It is used in denoting distance, temperature readings ("the temperature dropped 15 degrees"), profit/loss ("the stock fell 10 points"), income/expenses, etc.

3) *How Will We Learn It?* Through hands-on activity sheets and pairing with your neighbor

4) *How Will We Know We Learned It?* Through consensus on activity sheets with your paired neighbor and class participation

Materials and Resources: subway map, activity handout

Key Vocabulary: Absolute value = the distance between zero and the graph of that number on the real number line; the greater of a nonzero number and its opposite

IMPLEMENTATION

Opening activity: Pre-Assessment Smart Start ~7 minutes

On the Smart board... Solve these:

a) $-6 + 10 = ?$ b) $-4 - 6 + 3 = ?$ c) $7 - (-8) - 5 = ?$ d) $-3 - (3) - (-3) = ?$

Review solutions.

Motivation: ~10 minutes

If you have lived in NYC for any length of time, you are probably familiar with a subway map. Oftentimes in NYC, we describe our distance from a place not by how many miles it is but by how many stops we are from it on the subway. (This can be misleading since I live in Queens four stops away from Manhattan on the E train, which is a much greater distance than going the four stops from the 59th Street/Columbus Circle stop on the B train to 96th Street.)

Pair off with your neighbor, making sure at least one of you knows how to accurately read the subway maps I have distributed. (*walk them through the first example*) Create and fill in a chart similar to the one below:

Train Line	Starting Station	Ending Station	Number of Stops	General Direction (N,S,E,W?)
B	59 St/Columbus Circle	96 St	4	N
6	110 St	68 St/Hunter College	5	S
N	5 Av/59 St	Lexington Ave/59 St	1	E
7	Grand Central 42 St	Hunters Point Av	2	W
7	Grand Central 42 St	Times Sq 42 St	2	E

KEY QUESTION: Compare the different trips in the chart. Judging purely on number of stops and not distance in miles, are any similar? (the last two)

Mini-lesson/development: ~15 minutes

Today, we are going to be discussing the concept of absolute value, which is a way of looking at the value of numbers as distance without being concerned about direction. Let's translate the information on those last two examples to a traditional real number line where each unit is considered a stop. If zero represented the Grand Central/42 St stop, where would we plot Hunter's Point Ave? Times Sq 42 St?



Absolute value = the distance between zero and the graph of that number on the real number line; the greater of a nonzero number and its opposite

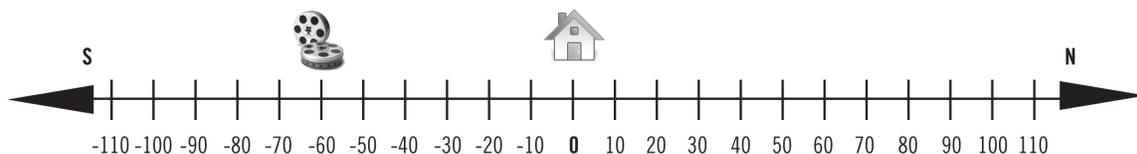
We symbolize the absolute value of a number by putting it in brackets. $| |$

Just like other symbols we use in math, these tell us we need to do something to the contents of those brackets. We always do the operation within the brackets before we take the absolute value.

How many feet is the bathroom from the bedroom in Wally's apartment? $|6| = 6$



How many yards is the movie theater from Elliot's house? $|-60| = 60$



Therefore, the absolute value of a positive number is the number itself. The absolute value of a negative number is the opposite of that number. The absolute value of zero is zero. Let's look at a few examples...

$$|41| = 41$$

$$|-7| = 7$$

$$|0| = 0$$

$$|-\frac{1}{2}| = \frac{1}{2}$$

KEY QUESTIONS: 1) If I gave you two numbers (-15 and 11), and asked you to choose the one that had the largest absolute value, which would you choose?
2) Looking back at the subway chart we constructed, which column would represent the absolute value? 3) Can two different numbers have the same absolute value? If so, when? Justify your answer. Each positive number can be paired with a negative number that is the same distance from 0 but on the opposite side of zero.

Pause for Learning: Now let's take a few minutes to think and absorb what we just experienced in our introduction to absolute value.

Evaluate: $|75| = ?$ $|100.25433| = ?$ $|-75| = ?$ $|-11.456| = ?$

Give the absolute value of each given number. Then provide a number that has the same absolute value as the given number.

6 -7 +43.6 $11\frac{1}{2}$ -8.25

Let's go through some examples of how we can incorporate absolute value into other expressions: (*these are variations on our Smart Start*)

$-6 + |10| = ?$ $|-4| + |6| = ?$ $|7| - |8| = ?$ $|-3| - |-3| = ?$ $|-3.225| + 0 = ?$

Activity: ~10 minutes

Work with your neighbor to complete the handout, and finish it up for homework. For each question worked on during class time, I want you to work independently on it and then compare your answer to your neighbor to see if you both got it. If you don't agree, explain your reasoning and see which one makes the most sense in order for you to achieve consensus.

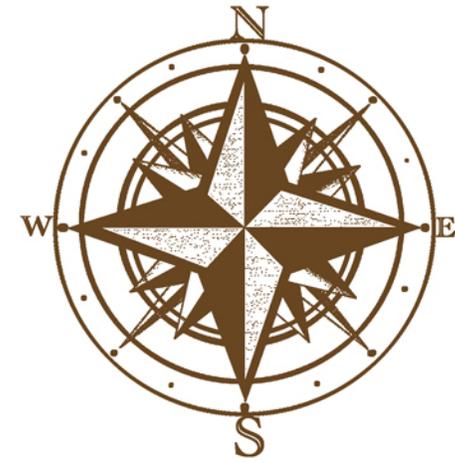
Summary/share-out: As students leave, randomly ask them at the door...

- So what is absolute value?
- What's the absolute value of 5?
- What's the absolute value of -311? *Etc.*

Assessment: Instead of having students immediately call out responses, ask them to write down their answers while you circulate to see if they are getting it. Review homework collected the following day (although part of it will be “graded” already by the work they do with their neighbors).

POST LESSON

Homework: Complete the activity sheet from class.



Simpson St
Subway 2, 6

NYC Transit Bus
Bx4 Westchester Av
Bx5 Story Av/Brukner Blvd
Bx11 George Washington Bridge
Bx19 Southern Blvd/E 149 St
Bx27 Qason Point
Bx35 George Washington Bridge

Metro-North

NYC Transit Bus
Bx9 Bway/Kingsbridge Rd
Bx12 Select Bus Service
Bx12 Pelham Rwy/Fordham Pkwy
Bx15 Third Av/125 St
Bx17 Crotona/Prospect Aves
Bx22 Castle Hill Av
Bx41 Webster Av/W Flains Rd
Bx55 Third Av
Bee-Line
60 White Plains
61 Port Chester
62 White Plains

Hunts Point Av
Subway 6

NYC Transit Bus
Bx5 Story Av/Brukner Blvd
Bx6 Hunts Point
Bx19 Southern Blvd/E 149 St

3 Av-149 St
Subway 2, 5

NYC Transit Bus
Bx2 Grand Concourse
Bx4 Westchester Av
Bx15 Third Av/125 St
Bx19 Southern Blvd/E 149 St
Bx21 Morris Pk Av/Boston Rd
Bx41 Webster Av/W Flains Rd
Bx55 Third Av

Grand Central Terminal
Metro-North Railroad
Subway 4, 5, 6, 7

NYC Transit Bus
M1 5th/Madison Aves
M2 5th/Madison Aves
M3 5th/Madison Aves
M4 5th/Madison Aves
M5 Riverside Dr/5 Av/6 Av
M42 42 St Crosstown
M68 Washington Hts
M101 Third/Lex Aves
M102 Third/Lex Aves
M103 Third/Lex Aves
M104 Broadway
Q32 Jackson Hts/Penn Station
X25 Downtown Manhattan

NY Airport Service
Newark Airport Express

Queens Plaza
Queensboro Plaza
Subway E, G, N, R, W, 7

NYC Transit Bus
B61 Red Hook
Q32 Midtown Manhattan
MTA Bus
Q39 Ridgewood
Q60 East Midtown-South Jamaica
Q65 Flushing
Q67 Middle Village
Q69 Jackson Heights
Q100 Rikers Island
Q101 East Midtown-Astoria
Q102 Astoria-Roosevelt Island

Bee-Line
45 Eastchester

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st Tren
way 6
Transit
Westch
Throgs
4 Coun
1 East
0 Thro
2 Thro

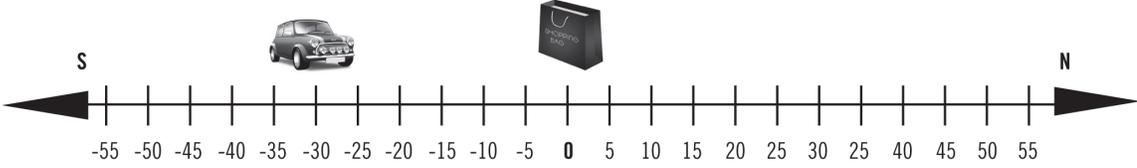
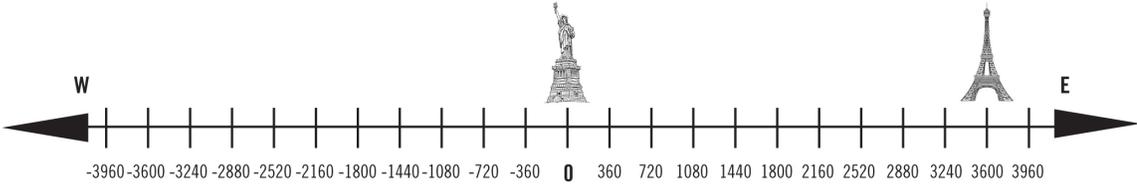
Park
Subw
NYC
Bx4 V
Bx14
Bx36
Bx39
Q44 B

Jack
74 S
Subw
NYC
Q32
MTA
Q33
Q45
Q47
Q49
Q53

NYC
Q32
MTA
Q33
Q45
Q47
Q49
Q53

Name: _____

Date: _____

1	<p><i>As you work, keep this question in mind and then come back to complete it:</i></p> <p>Is the absolute value of any real number always greater or equal to the number itself? Justify your answer.</p>
2	<p>How many parking spots is Jasmine's car from the mall?</p> 
3	<p>How many miles is Paris from NYC?</p> 
4	<p>Evaluate:</p> <p>a. $+17$ b. -13.8 c. $1\frac{1}{2}$ d. $-1\frac{1}{2}$</p>

5 Give the absolute value of each given number. Then provide a number that has the same absolute value as the given number.

a. 21

b. 4.25

-13

c. $1\frac{1}{2}$

d. +7.77

6 True or false?

a. $|15| = 15$

b. $|-11.00034| = 11.0034$

c. $|-6\frac{2}{3}| = -6\frac{2}{3}$

7 Find the value of each expression.

a. $|12| + |-3|$

b. $|12 - 3|$

c. $|-6| + |4|$

d. $|-10| - |-5|$

e. $|-10 - 5|$

f. $|+6 - 4|$

g. $|-7| + |-2 - 11|$

h. $|7-2|$

i. $|-13.5| - |-9|$