Teaching Absolute Value Meaningfully

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ABSOLUTE VALUE INVESTIGATION
Materials
- 1 yardstick or tape measure for each group
- 1 stopwatch for each group

Problem
A classroom is located on a hallway between a school's front and back stairwells, and students often sprint down the hallway to make it to class on time. How can a student know from his or her location just how much time there is until the bell rings?

Step 1: Gathering Data
- Measure, to the nearest foot, the length of the hallway.
- Measure, to the nearest foot, the distance from the front stairwell to the middle of the classroom door.
- Time, to the nearest second, a member of your group walking at a steady rate from one end of the hallway to the other.
- Note the time, to the nearest second, that he or she reaches the middle of the classroom door.
- Record your data, to the nearest foot or second, in the chart below:

Step 2: Finding a Function
- How fast was the student walking (ft./sec.)?
- You want to find a function of time (x-axis) and distance from the classroom (y-axis). What three points do you already know from the recorded data?

Distance	Measurement
Total length of hallway	
Distance from front stairwell to classroom	
Distance from back stairwell to classroom	
Total time from front stairwell to back stairwell	
Time from front stairwell to classroom	
Time from classroom to back stairwell	

- Plot these points on a graph.
- If the student walked at a constant rate from the front stairwell to the classroom, what type of function would model his or her path? Sketch your function on the graph.
  - How would you model the student's path from the classroom to the back stairwell? Sketch your function on the graph.
  - Is it possible to have a negative distance from the classroom or a negative time? Should the functions ever cross the x-axis or the y-axis?
- Looking at your sketch, what shape do your two functions make? What type of function is this?
- Find the slope of the two lines that represent the student's walking path.
  - How does the absolute value of the slopes relate to the student's walking rate?
- Write a function in terms of time (t) and distance from the classroom (d) using your knowledge of slope, absolute value, and horizontal translation of the absolute value equation.
- What is the domain and range of your function?
- How can a student know just how much time he or she needs to make it to class on time?
- Can you generalize this formula in terms of rate (r), time (t), distance from the classroom (d), and the time it takes to reach the classroom from the front stairwell (a)? Explain.

Step 3: Going Deeper
- What function represents a student adding 20 more seconds to his or her walk to the classroom from the front stairwell? When will this student reach the back stairwell?
- What if a student walks twice as fast or three times as slow? How do these changes in rate affect the graph?
- If a student is walking down the hallway at a rate of 1/2 ft./sec., at what times is he or she 10 feet away from the classroom? At what time will he or she be at the classroom?