Introducing Absolute Value – ID: 8743

By Lynne Plettenberg

Time required
45 minutes

Activity Overview

This activity introduces absolute value from a data value perspective. Students examine data by comparing individual data points to the mean by finding the difference (positive or negative) and the distance from the mean. They then plot the distances versus the differences and examine the shape of the plot. This leads to an investigation of the absolute value function as a model of the relationship between the differences and the distances. A second problem, completed individually, guides students through an investigation of another absolute value equation by examining tables and graphs.

Concepts

- *Exploring the absolute value function*

Teacher Preparation

This activity is designed to be used in an Algebra 1 classroom.

- *Prior to beginning this activity, students should have experience graphing linear functions and analyzing simple graphs and function tables.*
- *The screenshots on pages 2–4 (top) demonstrate expected student results. Refer to the screenshots on pages 4 (bottom) and 5 for a preview of the student TI-Nspire document (.tns file).*
- ***To download the student .tns file, go to education.ti.com/exchange and enter "8743" in the quick search box.***

Classroom Management

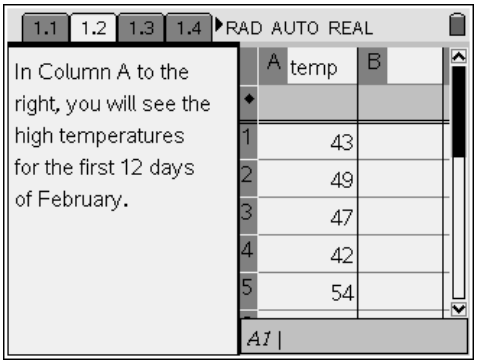
- *This activity has two sections. Problem 1 is intended to be mainly **teacher-led**, and Problem 2 is intended to be mainly **student-centered**. The student .tns file helps guide students through the activity and provides a place for students to record their answers.*
- *The TI-Nspire solution document (.tns file) Alg1Act35_IntroAbsValue_Soln_EN shows the expected results of working through the activity.*

TI–Nspire™ Applications

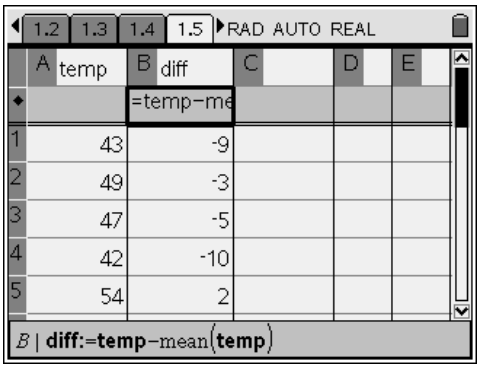
Calculator, Graphs & Geometry, List & Spreadsheet, Notes, Data & Statistics

Problem 1 – Difference vs. Distance

The high temperatures for the first twelve days of February are shown in Column A on page 1.2. On page 1.3, direct students to find the mean of the 12 temperatures by typing **mean(**, pressing (stor var), and choosing **temp**.

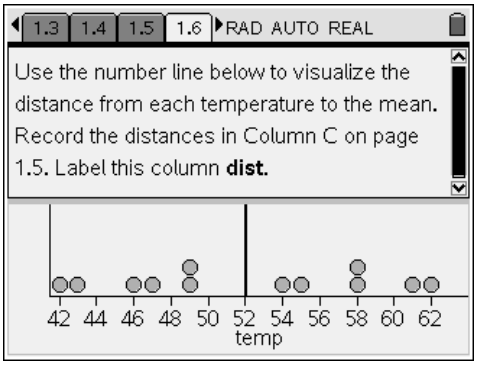


Students will advance to page 1.5 and arrow to the top of Column B. They should name this column **diff** and type **=temp−52** in the formula bar. (Alternatively, in the formula bar, students can type **=temp−mean(temp)**.) This will command the handheld to subtract the mean of 52 from each of the temperatures in Column A. As students complete the differences column, ask them questions like: *What do you notice about the numbers in Column B? What is the highest difference? What is the smallest difference? When are the differences negative? Where are they positive?*

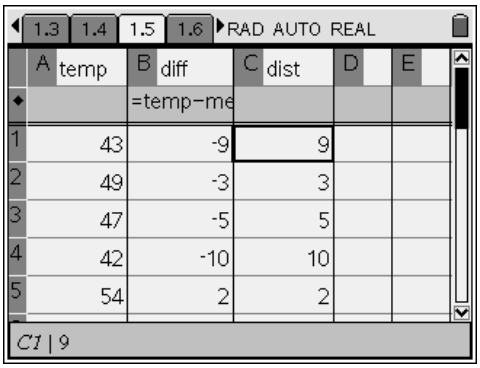


Direct students to move to the top of Column C and title it **dist**. Explain that they should enter the distance from the mean (how far away) for each temperature in this column.

To help them visualize the distance, the **temp** data has been plotted on a number line on page 1.6. The vertical line represents the mean. Use the temperature 42 as an example to demonstrate how to count the distance from a point to the mean. Return to page 1.5 and enter the distance **10** in cell C4.

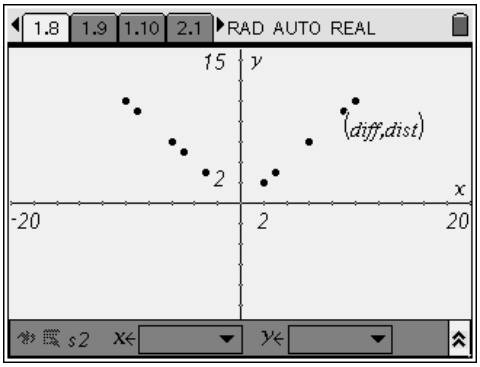


Have students complete the distance column. Remind them that the number line on page 1.6 has a scale of 2.



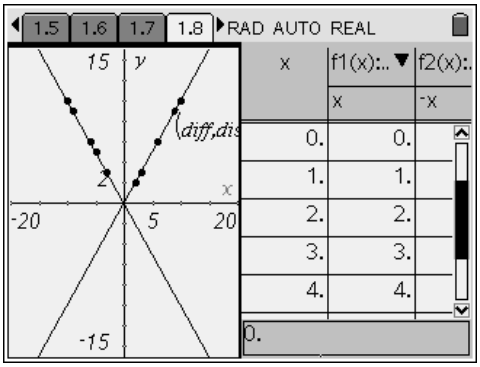
On page 1.8, students will set up a scatter plot to compare the distances to the differences. Students should choose **diff** for the *x*-values, and **dist** for the *y*-values. Discuss the scatter plot with students, asking questions such as: *When x is positive, what happens to y? When x is negative, what happens to y? When will y be negative? Why? When is x negative?*

(Sample responses: *x* is negative whenever the temperature was below the mean; *y* will not be negative because distances are positive)



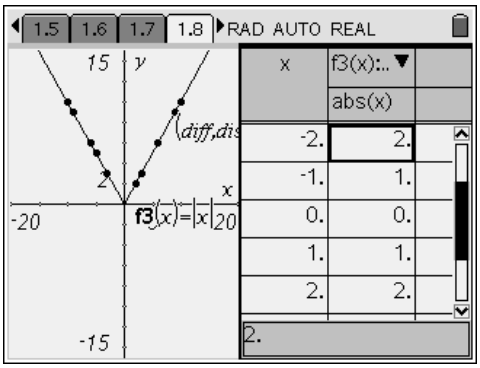
Direct students to select **MENU > Graph Type > Function** and enter **f1**(*x*) = *x*. Ask: *What is the relationship between y = x and the scatter plot?* Then have them enter **f2**(*x*) = *–x*. Ask: *What is the relationship between y = –x and the scatter plot?*

Now direct students to press ctrl + T or go to **MENU > View > Add Function Table** to view the tables for **f1** and **f2**. Examine the tables, asking questions like: *How are the values for x and **f1** related? How are the values for x and **f2** related? How are the values for **f1** and **f2** related? Where is each function equal to zero?*



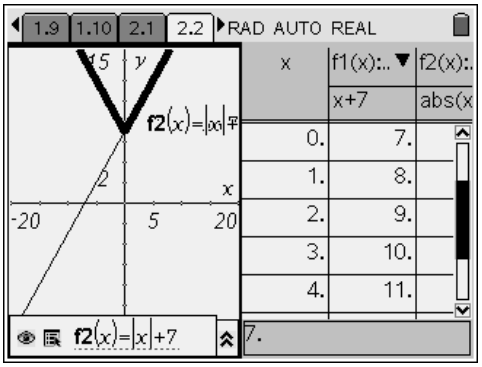
Students may return to the graph pane by pressing ctrl + tab. Have them graph **f3**(*x*) = abs(*x*). They can either type **abs** using the letter keys or select it from the catalog by pressing ctrl. To make the graph of **f3** easier to see, have students hide **f1** and **f2** by selecting **MENU > Tools > Hide/Show** and clicking on the graphs of *y = x* and *y = –x* at any point below the *x*-axis. Press esc to turn off the **Hide/Show** tool. Ask students, *What is the relationship between y = abs(x) and the scatter plot?* Explain that in their textbooks, this function is written as $y = |x|$.

Now have students press ctrl + tab to return to the function table. They should arrow over to an empty column and select **f3** from the drop down menu. This will display the table of values for the function **f3**(*x*) = abs(*x*). Ask students *How are the values for **f3** related to **f1** and **f2**? Where is the function equal to zero?*



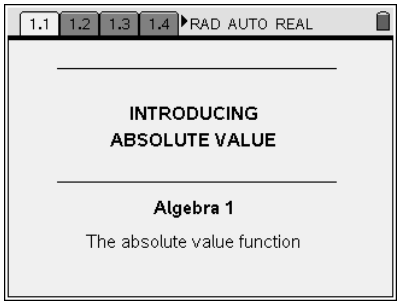
Problem 2 – Another absolute value equation

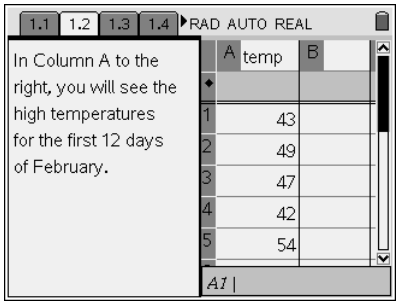
On page 2.2, students will graph the linear equation *y* = *x* + 7 and compare it with *y* = abs(*x*) + 7 and *y* = abs(*x* + 7). Students are asked questions that guide them in comparing the two functions. They can record their answers in the TI-Nspire document or on separate pieces of paper.

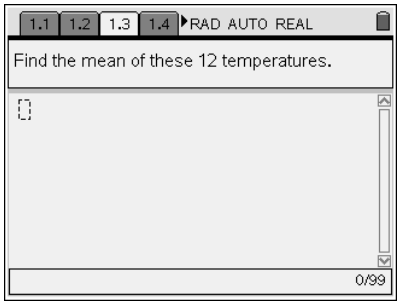


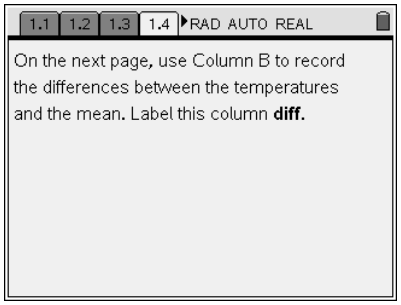
Introducing Absolute Value – ID: 8743

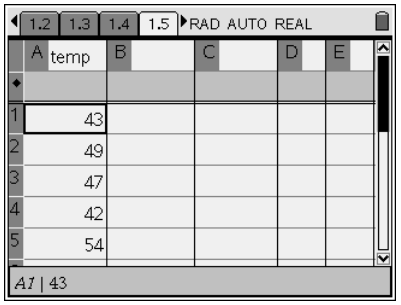
(Student)TI–Nspire File: *Alg1Act35_IntroAbsValue_EN.tns*

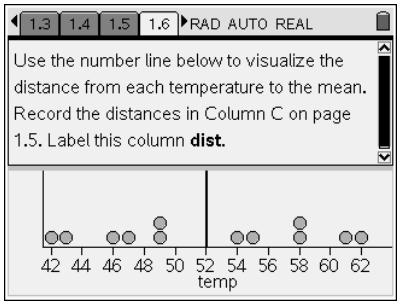








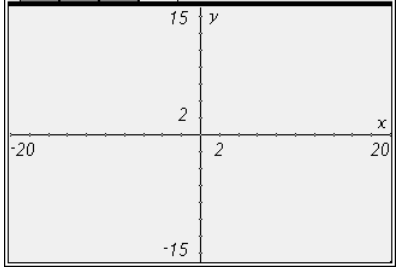




1.4 1.5 1.6 1.7 RAD AUTO REAL

On the next page, set up a scatter plot to compare the differences and distances. Use **diff** for the x–values and **dist** for the y–values.

1.5 1.6 1.7 1.8 RAD AUTO REAL



1.6 1.7 1.8 1.9 RAD AUTO REAL

On page 1.8, graph the functions **f1**(x) = x and **f2**(x) = $-x$. What do you notice about these functions and the scatter plot? Use a function table to help you.

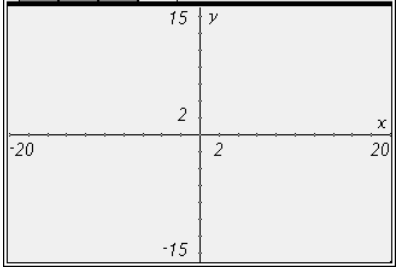
1.7 1.8 1.9 1.10 RAD AUTO REAL

Return once more to page 1.8, and graph **f3**(x) = abs(x). What is the relationship between **f3** and the scatter plot?

1.8 1.9 1.10 2.1 RAD AUTO REAL

Now you will examine another absolute value equation. On the next page, enter x + 7 for **f1**. Then display the function table and answer the questions on page 2.3.

1.9 1.10 2.1 2.2 RAD AUTO REAL



1.10 2.1 2.2 2.3 RAD AUTO REAL

When are the **f1** values positive?

When are they negative?

When is **f1** = 0?

2.1 2.2 2.3 2.4 RAD AUTO REAL

Return to page 2.2 and enter abs(x)+7 for **f2**. Examine the graph. What seems to be the relationship between the two graphs?

2.2 2.3 2.4 2.5 RAD AUTO REAL

Add **f2** to the function table and examine the values. Is the relationship between **f2** and **f1** what you were expecting? Why or why not?

Where are the y–values equal to 0?

2.3 2.4 2.5 2.6 RAD AUTO REAL

Return once more to page 2.2 and replace the expression for **f2** with abs(x + 7). Examine the graph. What seems to be the relationship between the graphs?

How is this graph different from the graph of y = abs(x) + 7?

2.4 2.5 2.6 2.7 RAD AUTO REAL

Examine the function table. Is the relationship between **f2** an **f1** what you were expecting? Why or why not? Where are the y–values equal to 0?

2.5 2.6 2.7 2.8 RAD AUTO REAL

Compare the graphs of y = abs(x) + 7 and y = abs(x + 7).