



Math Objectives

- Students will explore transformations of an absolute value function.
- Students will use the table feature to examine the effect that stretching and translating has on the coordinates of the graph.

Vocabulary

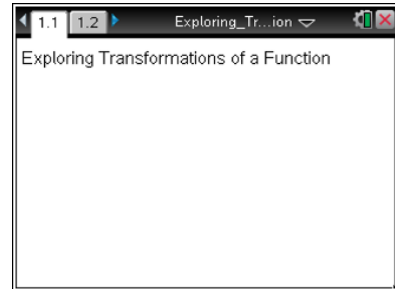
- absolute value function
- coefficient
- transformation

About the Lesson

- The teacher has the option of whether or not the student will create the document. It is suggested that the student create the document. Pass back the document Exploring Transformations of a Function Create, and have your students follow the directions.
- Otherwise, use the pre-created document that is supplied.

TI-Nspire™ Navigator™ System

- Use **Screen Capture** to observe students' work as they proceed through the activity.
- Use **Live Presenter** to have a student illustrate how he/she used a certain tool.



TI-Nspire™ Technology Skills:

- Create a document
- Move between pages
- Use a function table

Tech Tips:

- You can hide or show the function entry line by pressing **ctrl** **G**.
- You can hide or show a table by pressing **ctrl** **T**.

Lesson Materials:

Create Instructions

Exploring_Transformations_of_a
_Function_Create.doc

Student Activity

Exploring_Transformations_of_a
_Function_Student.doc


TI-Nspire™ document

Exploring_Transformations_of_a
_Function.tns

Visit www.mathnspired.com for lesson updates and tech tip videos.



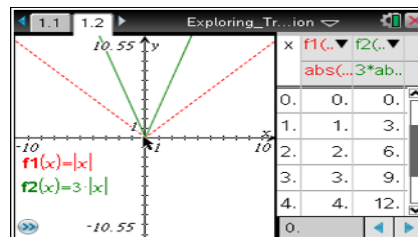
Discussion Points and Possible Answers

Tech Tip: If students experience difficulty dragging an object, check to make sure that they have moved the arrow until it becomes a hand (☞). Press **ctrl**  to close the hand (☞) and grab the point.

Move to page 1.2

Step 1:

The dashed graph is $f_1(x) = |x|$ and the solid graph is $f_2(x) = 3 \cdot |x|$.



Step 2:

Study the graphs, and then record the coordinates of the two functions in the tables below.

To place the cursor in the table, you may need to press **ctrl** **tab** (you can also use the touchpad mouse to click on a cell). Then use **▶** **▲** to maneuver through the table.

Step 3:

Double-click on the cell containing $3 \cdot \text{abs}(x)$. Replace the 3 with -3 , press **enter**, and complete the third table below.

Step 4:

Repeat the previous step to replace -3 with 2, and then complete the fourth table.

x	$f_1(x) = x $		x	$f_2(x) = 3 \cdot x $		x	$f_2(x) = -3 \cdot x $		x	$f_2(x) = 2 \cdot x $
-1	1		-1	3		-1	-3		-1	2
0	0		0	0		0	0		0	0
1	1		1	3		1	-3		1	2
2	2		2	6		2	-6		2	4



Answer these questions.

1. How does changing the coefficient of $|x|$ affect the x -coordinates? Justify your answer.

Answer: Changing the coefficient does not affect the x -coordinates at all. The x -coordinate is the independent variable, so we choose those values independent of the coefficients.

2. How does changing the coefficient of $|x|$ affect the y -coordinates? Justify your answer.

Answer: The coefficient of $|x|$ is the scale factor, and it affects the sign and size of the y -coordinate. The sign of the y -coordinate will be the same as the sign of the coefficient. If the magnitude of the coefficient is greater than 1, the y -coordinates are scaled larger; if its magnitude is between 0 and 1, the y -coordinates are scaled smaller.

3. If $f_1(x) = |x|$ contains the point (x, y) , what corresponding point will be found on the graph of $f_2(x) = a \cdot |x|$?

Answer: $(x, a \cdot y)$ will be on the graph.

Step 5: Given $f_1(x) = |x|$, change the definition of the function $f_2(x)$ to $f_2(x) = 1 \cdot |x| - 2$.

Step 6: Complete the first table below.

Step 7: Repeat the process by changing the definition of the function to $f_2(x) = 1 \cdot |x| + 1$, and then complete the second table.

x	$f_2(x) = 1 \cdot x - 2$	x	$f_2(x) = 1 \cdot x + 1$
-1	-1	-1	2
0	-2	0	1
1	-1	1	2
2	0	2	3



Answer these questions.

4. How does changing the constant affect the y -coordinates? Justify your answer.

Answer: If the constant is positive, the y -coordinates are increased by the value of the constant. If the constant is negative, the y -coordinates are decreased by the absolute value of the constant.

5. If $f_1(x) = |x|$ contains the point (x, y) , what corresponding point will be found on the graph of $f_2(x) = 1 \cdot |x| + c$?

Answer: $(x, y + c)$ will be on the graph.

Wrap Up

Upon completion of the discussion, the teacher should ensure that students can explain:

- How changing the coefficient of the absolute value of x changes the values in the table and the change in the graph.
- How changing the constant that is added (or subtracted) to the absolute value of x changes the values in the table and the change in the graph.

Assessment

Explain how the graph of each of the following compares to the graph of $y = |x|$.

1. $y_1 = |x| + 3$

Answer: The graph of y_1 is exactly the same shape as $y = |x|$, but each point is moved up 3 units.

2. $y_2 = 4 \cdot |x|$

Answer: The graph of y_2 has the same vertex as $y = |x|$, but its branches are steeper, passing through the points $(1, 4)$ and $(-1, 4)$, rather than $(1, 1)$ and $(-1, 1)$ of the parent function $y = |x|$.