Exploring Absolute Value Transformations with TI-Nspire **Teacher Guide**
Algebra II

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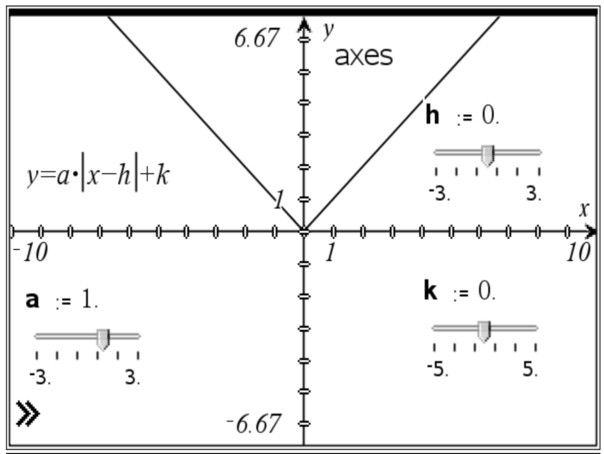
Activity Overview
Students will explore the characteristics of an absolute value function.

TN Algebra II Standards:
CLE 3103.3.2 Understand, analyze, transform and generalize mathematical patterns, relations and functions using properties and various representations. *(Level 4 on Webb's Depth of Knowledge)*
SPI 3103.3.10 Identify and/or graph a variety of functions and their translations.
✓ 3103.3.4 Analyze the effect of changing various parameters on functions and their graphs.
✓ 3103.3.11 Describe and articulate the characteristics and parameters of a parent function.

- **Open the TI-Nspire document Exploring AbsoluteValue Transformations**
- **Press ctrl ▸ to move to page 1.2 and begin the lesson**

1. Write the **vertex form** of a absolute value function. ________________________________.

2. Observe the characteristics of the absolute value parent graph on page 1.2.



List the characteristics observed:
Answers will vary. Teacher will be looking for:
"V" shape graph; opens upward; looks like a smile; the graph goes through (0, 0) or the origin; a = 1; h and k equal zero.

Exploring "*a*."
3. Increase and decrease the value of "*a*." Describe what is happening to the function.
Possible answers: The graph opens upward when a > 0. When a < 0, the graph opens downward. When 0< a < 1 and -1 < a < 0, the function is wider. When a < -1 and a > 1, the graph is stretched up or down.

4. Complete the statements below.
When "*a*" positive, the function ***opens upward.***
Therefore, when "*a*" is positive, the graph has a __________ ***Maximum*** __________________.
*(**Maximum** or Minimum)*
When "*a*" negative, the function ***opens downward.***
Therefore, when "*a*" is negative, the graph has a _______________ ***Minimum*** _____________.
*(Maximum or **Minimum**)*

5. What happens when $a = 0$ and $-1 < a < 1$? ***<u>The graph is a horizontal line. y = 0 (Explain to the students mathematically by substituting zero in for a in the vertex form of the absolute value function.) Reinforce that when a is between -1 and 1, the function is wider.</u>***

<u>Exploring "*h*."</u>
6. Increase and decrease the value of "*h*." Describe what is happening to the function.
The function moves ***<u>left and right.</u>***

7. Complete the statements below.
When "*h*" positive, the function ***<u>moves right.</u>***

When "*h*" negative, the function ***<u>moves left.</u>***

<u>Exploring "*k*."</u>
8. Increase and decrease the value of "*k*." Describe what is happening to the function.
The function moves ***<u>up and down.</u>***

9. Complete the statements below.
When "*k*" positive, the function ***<u>moves up.</u>***

When "*k*" negative, the function ***<u>moves down.</u>***

10. Use your TI-Nspire to discover **<u>how to find the Vertex?</u>**

Parameters: $a = 1$ $h = 0$ $k = 0$	This is called the **<u>parent function</u>**. Vertex form: $y = 1\|x - 0\| + 0$ Simplify $y = \|x\|$ Identify the coordinates of the minimum. ***(0, 0)***
Parameters: $a = .5$ $h = -3$ $k = 0$	How did the function move? ***The function moved to the left 3 units.*** Vertex form: $y = .5\|x + 3\|$ Identify the coordinates of the minimum. ***(-3, 0)***
Parameters: $a = 2$ $h = 1$ $k = 2.5$	How did the function move? ***The function moved to the right 1 units and up 2.5 units.*** Vertex form: $y = 2\|x - 1\| + 2.5$ Identify the coordinates of the minimum. ***(1, 2.5)***
Parameters: $a = -\frac{1}{3}$ $h = -2.3$ $k = -1.5$	How did the function move? ***The function moved left 2 units and down 3.5 units.*** Vertex form: $y = -\frac{1}{3}\|x + 2.3\| - 1.5$ Identify the coordinates of the minimum. ***(-2.3, -1.5)***

11. Define vertex. (Use *h*, *k* and vertex form in your definition) **Possible answer:** ***<u>The vertex of an absolute value function is where the maximum or minimum is located at (h, k). You can also find the vertex from vertex for.</u>***

Assessment:

On a piece of paper, do the following:

- Make a sketch of the absolute value functions.
- Identify the vertex.
- Is there a maximum or minimum? Why?

a.) $y = 3|x - 4| - 2$

Vertex: (4, -2); minimum

b.) $y = -|x + 4| + 2$

Vertex: (-4, 2); maximum

c.) $y = \frac{1}{2}|x + 1| + 3$

Vertex: (-1, 3); minimum

d.) $y = -2|x - 3|$

Vertex: (3, 0); maximum