Shifting a graph of Absolute Value Functions

The absolute value of a real number x is defined by the following:

$$|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x \leq 0 \end{cases}$$

If n is a positive number, there are two solutions to the equation $|f(x)| = n$ because there are exactly two numbers with the absolute value equal to n: n and $-n$. The existence of two distinct solutions is clear when the equation is solved graphically.

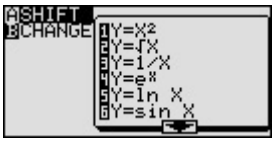
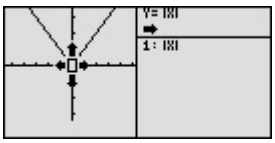
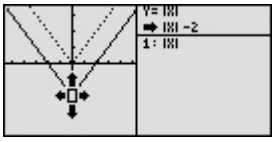
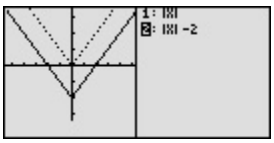
An absolute value function can be presented as $y = a|x - h| + k$. The graph moves as the changes of slope a, x-intercept h, and y-intercept k.

Example

Move and change graphs of absolute value function $y = |x|$ to check the relation between the graphs and the values of coefficients.

1. Move the graph $y = |x|$ downward by 2 using the Shift feature.
2. Move the graph $y = |x|$ to the right by 2 using the Shift feature.
3. Pinch the slope of $y = |x|$ to 2 or minus using the Change feature.

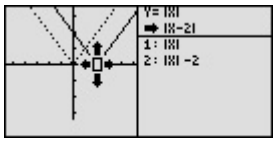
Before Starting There may be differences in the results of calculations and graph plotting depending on the setting. Return all settings to the default value and delete all data.

Step & Key Operation (When using EL-9650/9600c) *Use either pen touch or cursor to operate.	Display (When using EL-9650/9600c)	Notes
1-1 Access the Shift feature. Select $y = \|x\|$. 2nd F SHIFT/CHANGE A * (ENTER ALPHA ▼ *) 8 *	 	
1-2 Move the graph downward by 2. ▼ ▼ ENTER *		$y = \|x\|$ changes to $y = \|x\| - 2$
1-3 Save the new graph and look at the relationship of the function and the graph. ENTER ALPHA ▶ ▼		The graph of the equation that is highlighted is shown by a solid line. Notice that the y-intercept k in the standard form $y = a\|x - h\| + k$ takes charge of vertical movement of the graph.

Step & Key Operation (When using EL-9650/9600c) *Use either pen touch or cursor to operate.	***Display*** (When using EL-9650/9600c)	***Notes***

2-1 Move the original graph to the right by 2.

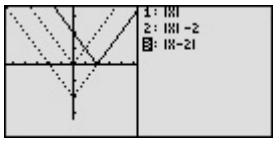
▲ ALPHA ◀* ▶ ▶ ENTER*



$y = |x|$ changes to $y = |x-2|$

2-2 Save the new graph and look at the relationship of the function and the graph.

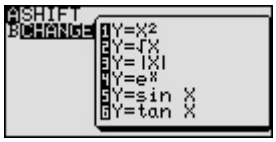
ENTER ALPHA ▶* ▼ ▼*



Notice that the function h in the standard form $y = a|x - h| + k$ takes charge of horizontal movement of the graph.

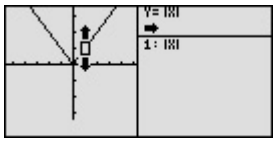
3-1 Access the Change feature.

2nd F SHIFT/CHANGE B*



3-2 Select $y = |x|$.

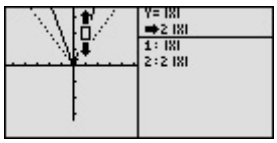
3*



3-3 Make the slope of the graph steeper. Save the new graph.

▲ ENTER

ENTER

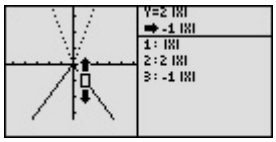


$y = |x| \rightarrow y = 2|x|$

3-4 Make the slope of the graph minus. Save the new graph.

▼ ▼ ▼ ENTER

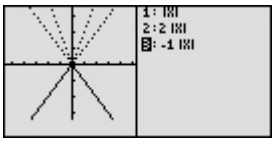
ENTER



$y = |x| \rightarrow y = -|x|$

3-5 Look at the relationship of the function and the graph.

ALPHA ▶* ▼* ▼*



Notice that the coefficient a in the standard form $y = a|x - h| + k$ takes charge of changing the slope.

EL-9650/9600c/9450/9400 shows absolute values with | |, just as written on paper, by using the Equation editor. Use of the calculator allows various absolute value functions to be graphed quickly and shows their characteristics in an easy-to-understand manner. The Shift/Change feature of the EL-9650/9600c/9450/9400 allows visual understanding of how graph changes affect the form of absolute value functions.