Objective: Evaluate an Absolute Value Expression.

Absolute Value

The absolute value of $x$, denoted $|x|$, is defined as

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

Essentially, we are looking at the distance from zero on the number line.

For example:

$$ |5| = 5 $$
$$ |-5| = 5 $$

So even though 5 and -5 are different they have the same absolute value.

Note that $|x|$ is always nonnegative.

Critical Thinking:

1. What is the value of $\frac{x}{|x|}$ when $x$ is positive?

2. What is the value of $\frac{x}{|x|}$ when $x$ is negative?

3. Are there any values of $x$ that would make the following true? $|3x + 7| = -4$
Recall that **evaluating** algebraic expressions means to **substitute** a number for each variable in the expression and calculate the result.

For example: Evaluate $|x + y|$, use $x = 3$, and $y = -5$

**Solution:** $|3 + (-5)| = |-2| = 2$

More examples:

1. Evaluate the following expression when $v = -3$
   
   $12 - |2v|$

   **Solution:**
   
   $12 - |2(-3)|$
   
   $12 - |-6|$
   
   $12 - 6 = 6$

2. Evaluate the following expression when $m = 4$, $n = -4$ and $p = -4$

   $3 - (p + |m - n|)$

   **Solution:**
   
   $3 - (-4 + |4 - (-4)|)$
   
   $3 - (-4 + 8)$
   
   $3 - 4 = -1$

**You try:**

1. **Evaluate** $-3|2t + 6|$ if $t = -1$

   **Answers:**
   
   1. -12

2. Evaluate $|6x + y|$ if $x = -2$ and $y = 3$

   2. 9

3. Evaluate $|-x| - |y|$ if $x = -2$ and $y = 3$

   3. -1

**Note about the TI 83/84 Graphing Calculator:**

To find the absolute value of a number, press [MATH], arrow (►) to NUMeric, select 1:abs( and press [ENTER].

For the **older versions of TI-83/84**, abs( will be on your home screen. Type the numerical express you want to take the absolute value of, press the right parentheses [)] and then press [ENTER].

For the **newer TI-84s**, when you select [MATH] [X][ENTER], absolute value bars will appear on the home screen. Type the numerical expression you want to find the absolute value of and press [ENTER].