Learning Targets

1. Identify Anchor Points for the absolute value function
2. Given an absolute value function, describe the transformation and graph the function.
3. Given the transformation of an absolute value function, write the equation.

Example 1: Graph the function $g(x) = |x|$ by completing a table of values.
These are your ANCHOR POINTS! (MEMORIZE THEM!)

<table>
<thead>
<tr>
<th>$x$</th>
<th>$g(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Domain: _______ Range: _______

General Rule for ALL Transformations:

- inside the function … mess with $x$'s (horizontal)… do the opposite on the graph
- outside the function … mess with $y$'s (vertical) … do the same on the graph

Example 2: Consider the function $g(x) = |x|$.

a) Where is the “inside” of this function?  

b) Where is the “outside” of this function?

Example 3: Without using your calculator, describe the transformation using words.
Then check using your calculator to see if you were correct. … the absolute value sign is $\text{MATH. NUM, 1:abs(}$

a) $h(x) = |x + 5|$  
b) $h(x) = |x - 5|$  
c) $h(x) = |x| + 5$  
d) $h(x) = |x| - 5$

Did you notice how when you are “inside” the function, the movement is “opposite”?

Example 4: When we talk about stretching or compressing, we talk about multiplying by a factor. Without using division, what is the opposite of multiplying by a factor of $\frac{2}{3}$?

So, if we wanted to horizontally compress the absolute value function by a factor of $\frac{2}{3}$, we would write it as $h(x) = \frac{3}{2} |x|$.
Example 5: Let \( g(x) \) be the indicated transformation of \( f(x) = |x| \). Write the rule for \( g(x) \).

a) \( g(x) \) is a horizontal compression by a factor of \( \frac{4}{9} \)

b) \( g(x) \) is a vertical compression by a factor of \( \frac{4}{3} \).

c) \( g(x) \) is a horizontal stretch by a factor of \( \frac{5}{2} \)

d) \( g(x) \) is a vertical stretch by a factor of \( \frac{8}{7} \).

e) \( g(x) \) is a reflection across the \( x \)-axis.

f) \( g(x) \) is a reflection across the \( y \)-axis.

Example 6: Describe each transformation of the function \( g(x) = |x| \), then graph. Use a table of a values to help with the transformation if necessary.

a) \( y = -3x \)

b) \( y = \frac{1}{2} \left( \frac{1}{4} x \right) \)

Transformation: 

Example 7: Graph \( Y1 = |2x - 6| \). Before you graph it, make a guess as to the transformation rule. Were you correct?

… There is no difference between \( 2x - 6 \) and \( 2(x - 3) \), so when we combine two horizontal transformations, we will write it the second way instead of the first.

Example 8: If \( k(x) \) is a transformation of \( f(x) = |x| \), write an equation for \( k(x) \) that is a horizontal stretch by a factor of 4, a vertical stretch by a factor of 7, and a translation 6 units left and 5 units down.