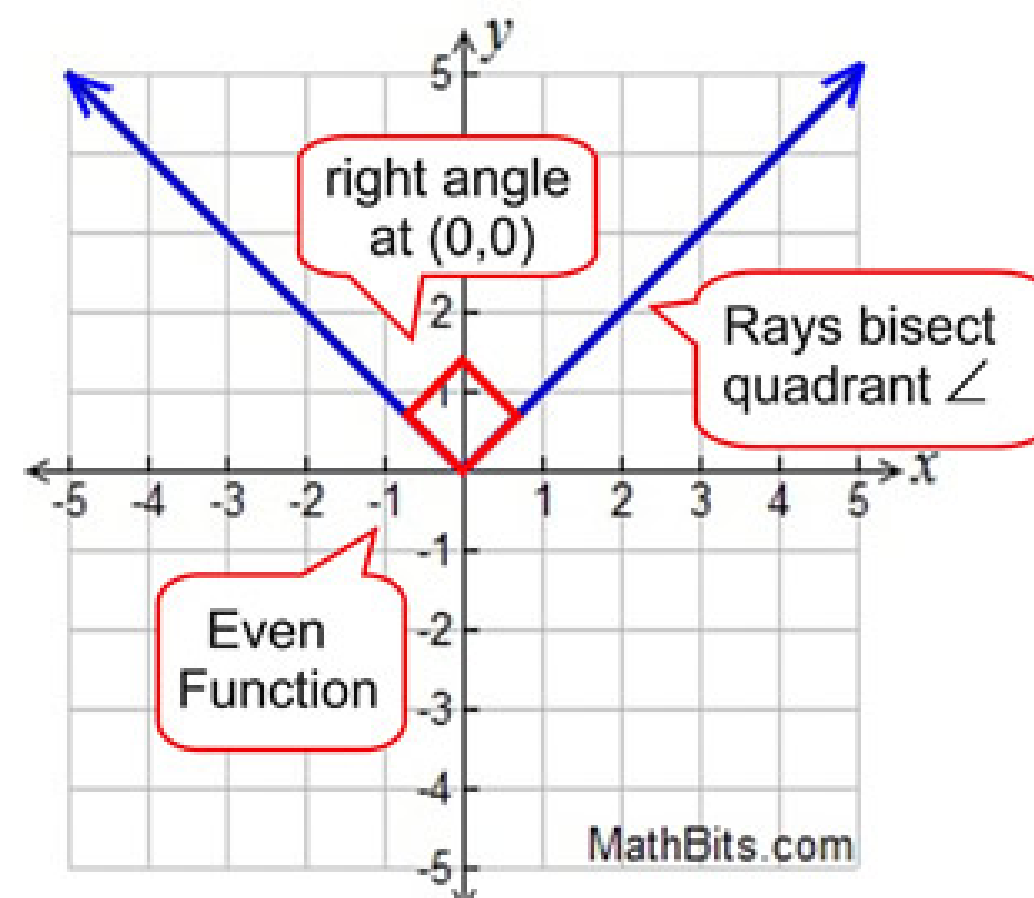# Absolute Value Graphs

MathBitsNotebook.com

We know that the absolute value of a number is always positive (or zero).

We can see this same result reflected in the graph of the absolute value parent function $y = |x|$. All of the graph's y-values will be positive (or zero).

The graph of the absolute value parent function is composed of two linear "pieces" joined together at a common vertex (the origin). The graph of such absolute value functions generally takes the shape of a V, or an up-side-down V. Notice that the graph is symmetric about the y-axis.

Linear "pieces" will appear in the equation of the absolute value function in the following manner: $y = |mx + b| + c$ where the vertex is $(-b/m, c)$ and the axis of symmetry is $x = -b/m$.
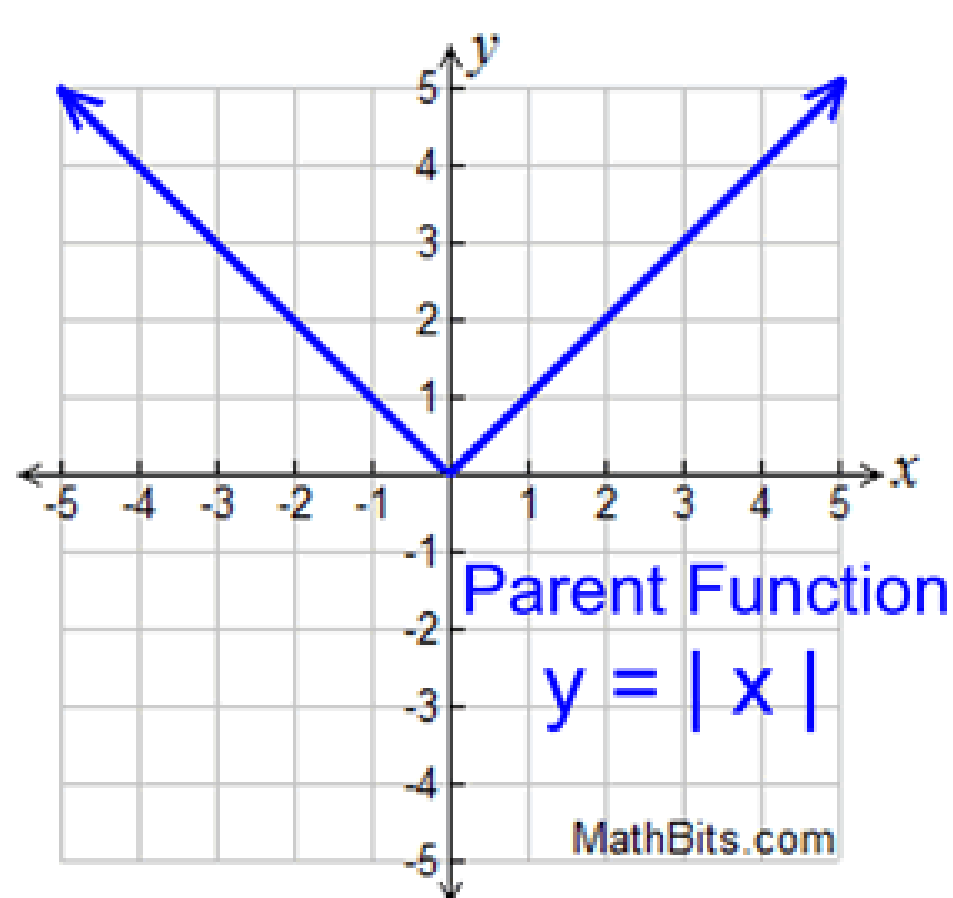

Parent Function: $y = |x|$

Note that the slope of the linear "pieces" are +1 on the right side and -1 on the left side. Remember that when lines are perpendicular (form a right angle) their slopes are negative reciprocals.

Features of Absolute Value Functions

The absolute value function is one of the most recognized piecewise defined functions.

Parent Function $y = |x|$

$$f(x) = \begin{cases} x; & x \geq 0 \\ -x; & x < 0 \end{cases}$$

Features (of parent function):
• **Domain**: All Reals $(-\infty, \infty)$ Unless domain is altered.
• **Range**: $[0, \infty)$

• **increasing** $(0, \infty)$
• **decreasing** $(-\infty, 0)$

• **positive** $(-\infty, 0) \cup (0, -\infty)$

• **absolute/relative min** is 0
• **no absolute max** (graph $\to \infty$)

• **end behavior**
$f(x) \to +\infty$, as $x \to +\infty$
$f(x) \to +\infty$, as $x \to -\infty$

Symmetric:
about $x = 0$
unless transformed

x-intercept:
intersects x-axis at $(0, 0)$
unless transformed

y-intercept:
intersects y-axis at $(0, 0)$
unless transformed

Vertex:
the point $(0,0)$
unless transformed

Table: Y1: $y = |x|$

X	Y1
-5	5
-4	4
-3	3
-2	2
-1	1
0	0
1	1
2	2
3	3
4	4
5	5

Range: When finding the range of an absolute value function, find the vertex (the turning point).
• If the graph opens upwards, the range will be greater than or equal to the y-coordinates of the vertex.
• If the graph opens downward, the range will be less than or equal to the y-coordinate of the vertex.
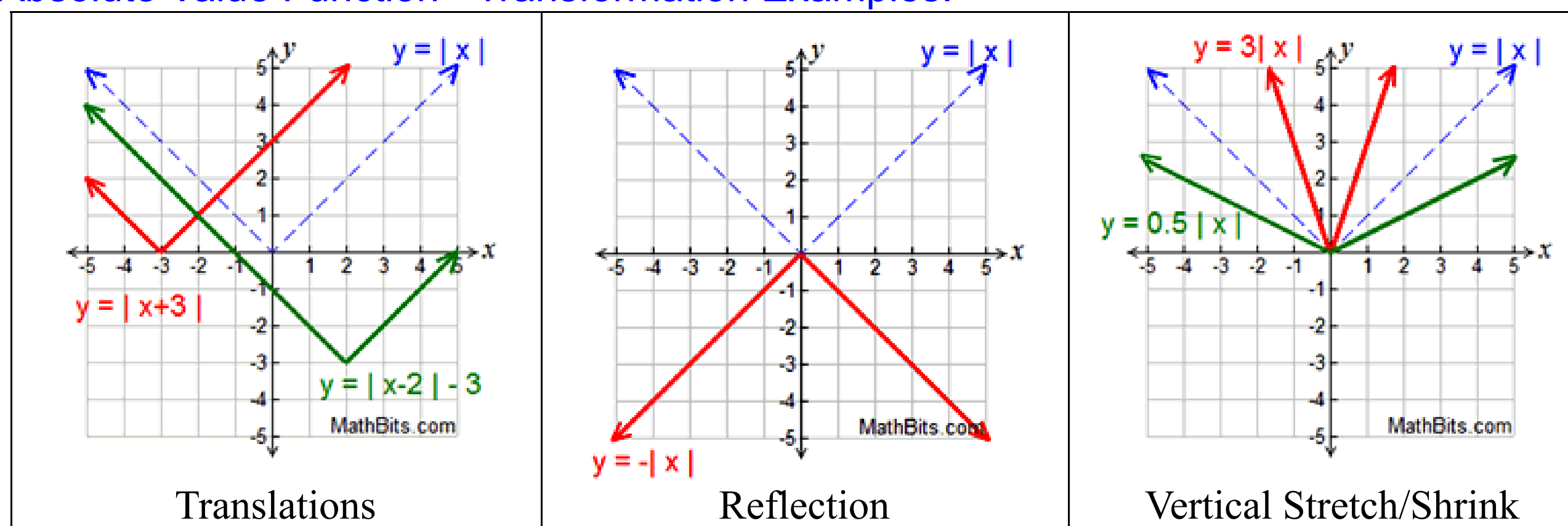
Average rate of change: is constant on each straight line section (ray) of the graph.
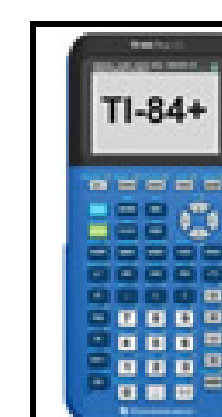
For help with absolute value graphs on your calculator, Click Here!

Read more about Absolute Value.

Absolute Value Function - Transformation Examples:

Translations

Reflection

Vertical Stretch/Shrink

General Form of Absolute Value Function: $f(x) = a|x - h| + k$
• the vertex is at (h, k)
• the axis of symmetry is $x = h$
• the graph has a vertical shift of k
• the graph opens up if $a > 0$, down if $a < 0$