Algebra II

Lesson 2-6: Families of Functions

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Last section we studied the absolute value function. We saw that the general form of an absolute value function is, $y = |x|$, then we saw that this v-shaped function could be translated up, down, left, right, and even made skinnier or wider. This brings us to today's lesson. Our equation $y = |x|$ is called a **parent function**. It is the simplest form of a given function with a certain set of **diagnostic characteristics**. Here the diagnostic characteristic of an absolute value function is the tell-tale v-shape graph.

When numbers are placed inside or outside of the absolute value function we learned that these cause a shift of the **V**. These shifts are known as **translations.**

Vertex Form of the Absolute Value Function $\boldsymbol{y = |x - h| + k}$

The parent absolute value function is translated horizontally *h* units and vertically *k* units.

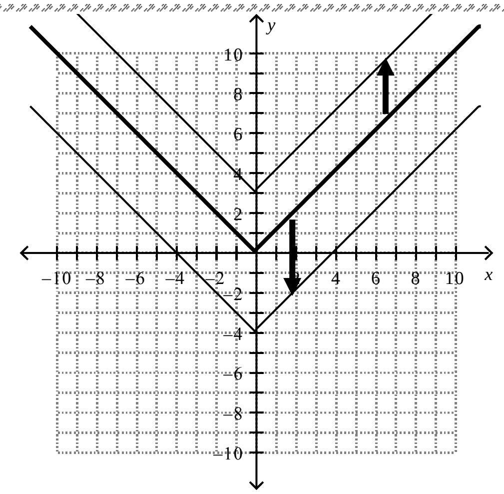
Examples:

Vertical Translation: $y = |x| \pm k$

$y = |x|$ the parent function is centered about the origin

$y = |x| + 3$ adding **k** shifts the **V** up by **k** units

$y = |x| - 4$ subtracting **k** shifts **V** down by **k** units

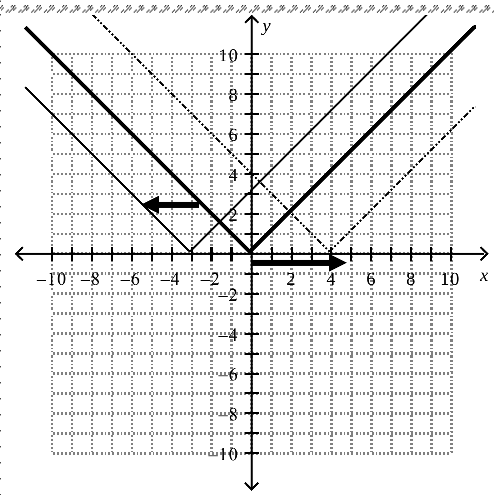


Horizontal Translation: $y = |x \pm h|$

$y = |x|$ the parent function is centered about the origin

$y = |x + 3|$ adding **k** inside the absolute value, shifts the **V** to the left

$y = |x - 4|$ subtracting **k** inside the absolute value, shifts the **V** to the right

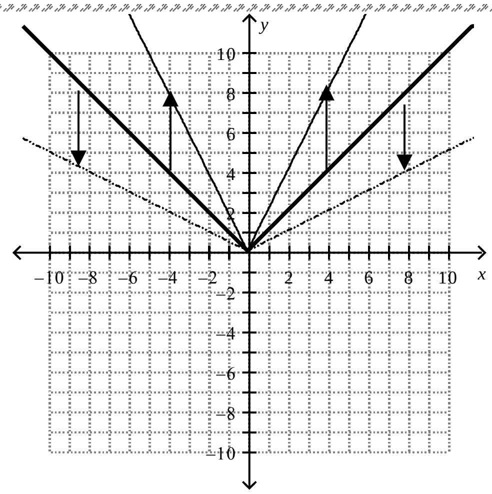


Stretch/Shrink: $y = a|x|$

$y = |x|$ the parent function is centered about the origin

$y = 2|x|$
an integer coefficient **stretches** the absolute value by a factor of **a**. The **y-value** will be "a" times greater. *(Makes it look skinnier)*

$y = \frac{1}{2}|x|$
fraction coefficient **shrinks** the absolute value by a factor of "$\frac{1}{a}$." The **y-value** will be $\frac{1}{a}$ times greater. *(Makes it look fatter)*
remember: fat-fractions

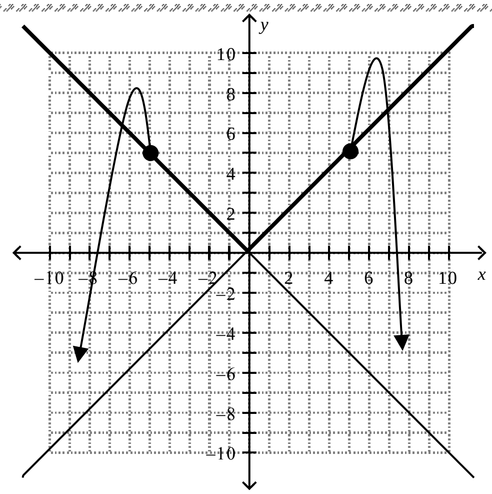


Reflection: $y = -|x|$

$y = |x|$ the parent function is centered about the origin, opening upward

$y = -|x|$ the negative causes **y** to be equal to negative values, hence it opens downward

When you are negative, you frown that is, a smile upside down or In this case an absolute value upside down.



Combined Transformation: $y = \pm a|x \pm h| \pm k$

Here we can see the parent function shifted up, down, left, right, flipped over, made skinny or widened, **OR** a combination of any of these transformations

$$y = -|x + 2| - 3$$

1. reflection

2. vertical translation of______________

3. horizontal translation of _________________