Edgenuity

Warm-Up | Absolute Value Functions

Review of Absolute Value

The **absolute value** of a real number can be thought of as its distance from zero on the number line.

Solve: $|x| + 10 = 6$

$|x| = -4$

[ ] solutions

Absolute value can never be negative because [ ] can never be negative.

$|x| = 5 \quad x = 5,$ [ ]

Lesson Objectives

By the end of this lesson, you should be able to:

- Analyze absolute value function to determine key [ ] of the graph.
- Model and solve mathematical and real-world problems with [ ] value functions.

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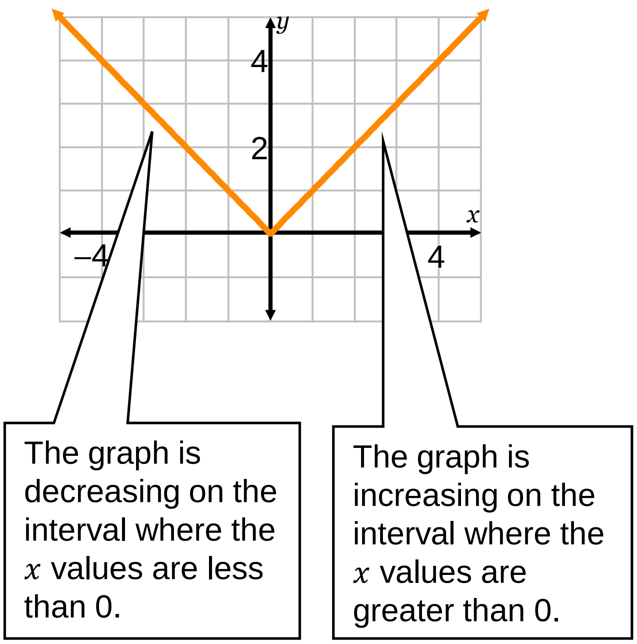
? **Lesson Question**

Slide 2

Graph of Parent Function

$f(x) = |x|$ is the parent function of the absolute value functions.



Domain:

Range: $f(x) \geq 0$ or $[0, \infty)$

The graph is an even function because it is symmetric about the y-axis.

$$(x, y) \longrightarrow (-x, y)$$

$(2, 2)$ and $(-2, 2)$ are on the graph.

The vertex is at $(0, 0)$.

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Graphs of Absolute Value Functions

The standard form of an absolute value function is $f(x) = a|x - h| + k$.

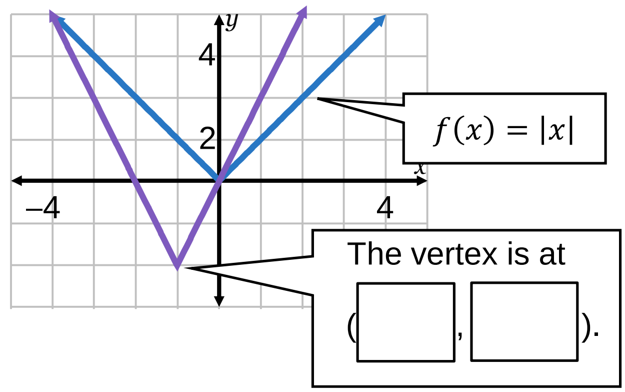
Vertex: (______ , ______)

Opening: $a > 0$, ______

$a < 0$, downward

Scaling: $|a| > 1$, horizontal compression

$|a| < 1$, horizontal ______



Example: $f(x) = 2|x + 1| - 2$

That's a horizontal compression by a factor of 2.

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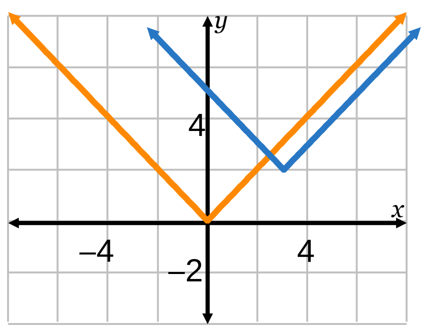
Transformations of the Parent Function

Translation of the parent function:

$$f(x) = |x - 3| + 2$$

$h = \square$ $k = \square$

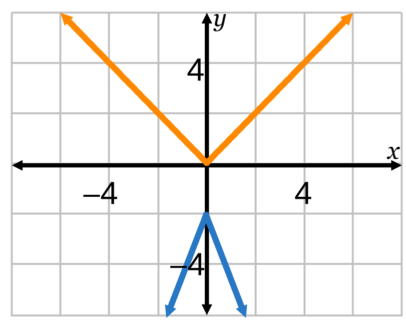


The vertex is translated 3 units to the right and 2 units up.

Reflection, dilation, and translation of the parent function:

$$f(x) = -3|x| - 2$$

$a = \square$ $h = 0$ $k = \square$



The vertex is not translated horizontally. It is translated 2 units down.

Because the value of a is negative, the graph is reflected across this horizontal line that contains the vertex. The $|a| = 3$ means it is a horizontal compression.

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Writing an Equation for the Graph of an Absolute Value Function

Write the equation for the function graphed on the right.

First identify the values of a, h, and k.

$h = \square$, $k = \square$

$f(x) = a|x+1| + 3$

To find the exact value of a, substitute into the equation the coordinates of any point on the graph.

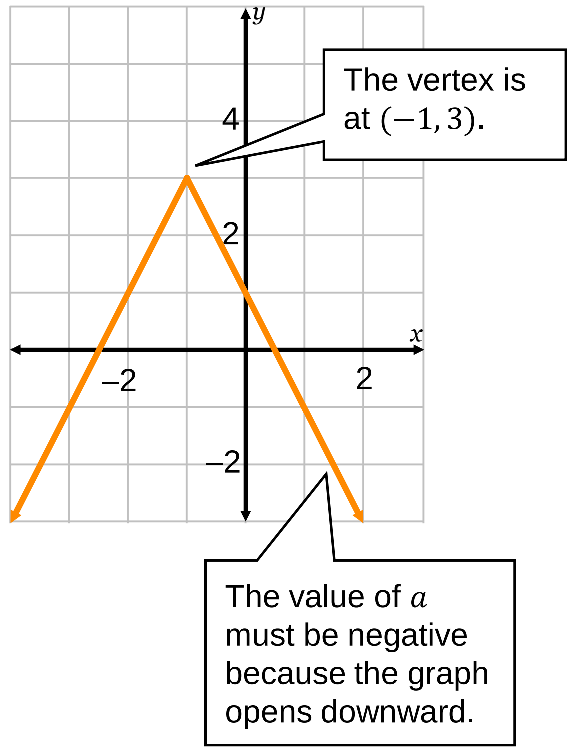
$(0, 1)$

$1 = a|0+1| + 3$

$1 = a + 3$

$\square = a$

$f(x) = -2|\square| + 3$



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Absolute Value Functions

Example:

Given that $f(x) = 3|x + 1| - 4$, for what values of x is $f(x) = 11$?

$3|x + 1| - 4 =$ ☐

$3|x + 1| = 15$

$|x + 1| = 5$

Positive case:

$x + 1 = 5$

$x = 4$

Negative case:

$x + 1 = -5$

$x = -6$

The solutions are 4 and -6.

- When you have a system of equations, remember the way to solve this graphically is you want to locate the ☐-coordinates of the points where the two graphs ☐.

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How to Use Absolute Value Functions to Model a Real-World Problem

The ideal diameter for the beads on a pearl necklace is 12.00 mm.

At the factory that sorts the beads to make different sized necklaces, the quality control inspector allows beads to be chosen with a diameter that can vary, at most, 0.2 mm from 12.00 mm.

To the nearest tenth, find the maximum and minimum diameters of the beads that can be chosen.

$$f(x) = |\boxed{}|$$

$$f(x) = 0.2$$

$$0.2 = |12.0 - x|$$

$$12.0 - x = 0.2 \qquad 12.0 - x = \boxed{}$$

$$x = \boxed{}, \boxed{}$$

Summary | Absolute Value Functions

Lesson Question	How can I analyze and apply absolute value functions?

Answer

Summary | Absolute Value Functions

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Review: Key Concepts

The standard form of an absolute value function is $f(x) = a|x - h| + k$.

Vertex: (h, k)

Opening: $a > 0$, [ ]

$a < 0$, downward

Scaling: $|a| > 1$, horizontal compression

$|a| < 1$, horizontal stretch

- To graph absolute value functions, identify the transformations of the [ ] function from the function rule by finding the values of a, h, and k.
- The domain of an absolute value function in standard form is all [ ] numbers.

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Review: Common Problem Types

- To find the range of an absolute value function in standard form, locate the [ ]. The range will be:
  - $y \geq k$ if the graph opens up.
  - $y \leq k$ if the graph opens [ ].
- To write the equation from a given graph:
  - substitute values of h, k, x, and y into the [ ] form.
  - solve for a.
  - substitute the value of a into the equation.

Summary | Absolute Value Functions

Use this space to write any questions or thoughts about this lesson.