Name: _____ Date: _____

Absolute Value Functions

Objective

In this lesson, you will analyze key features of absolute value functions algebraically and graphically.

absolute value function: a function defined by

Analyzing Absolute Value Functions Graphically

Absolute value functions are _____ functions with a V-shaped graph, sometimes viewed as _____ functions with two linear pieces reflected _____.

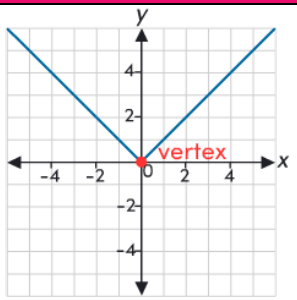
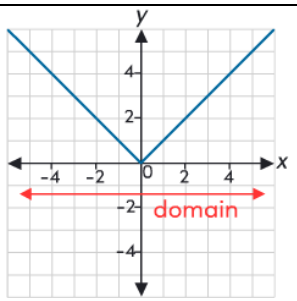
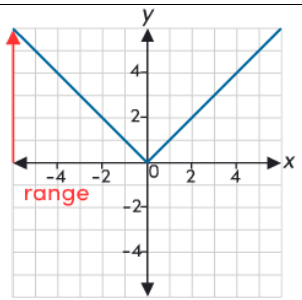
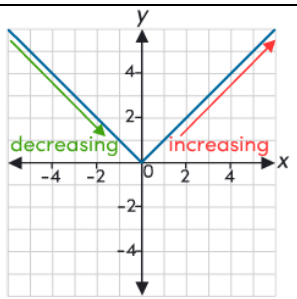
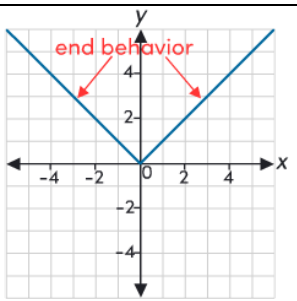
a function with an infinite set of values in the domain

a function made of multiple non-overlap overlapping pieces

We can write the **parent function**, or simplest example, of an absolute function in two ways:

$$f(x) = \begin{cases} -x, x < 0 \\ x, x \geq 0 \end{cases} \quad \text{or} \quad f(x) = |x|$$

Key Features of Absolute Value Functions (with the parent function, $f(x) = |x|$, as an example)

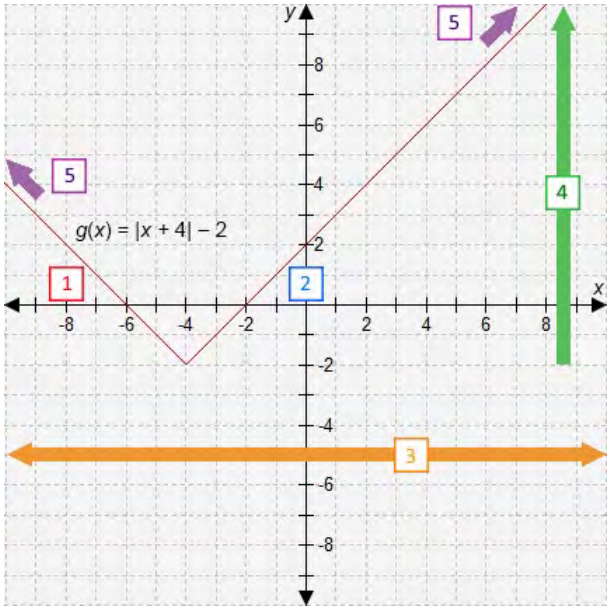
Feature	Definition	Example
Vertex	The vertex is either the maximum or the _____ of the function. The function is _____ about the vertical line passing through the vertex.	
Domain	The domain in a non-contextual situation will always be all _____ numbers. In a real-world context, pay attention to _____ factors.	
Range	The range depends on whether the graph opens _____ or _____. Up: $[0, \infty)$ Down: $(-\infty, 0]$	
Increasing and Decreasing	A function is _____ on intervals where *y*-values increase as *x*-values increase. A function is _____ on intervals where *y*-values decrease as *x*-values increase.	
End Behavior	The end behavior is always the _____ on _____ sides of the function.	

Consider the graph of the function $g(x) = |x + 4| - 2$.

1. The function is _____ on the interval (-∞, _____).
2. The function is _____ on the interval _____< x < ∞.

So, the vertex is at _____.

3. The function has the _____ of all real numbers, (-∞, ∞).
4. The _____ is $[-2, \infty)$.
5. As x approaches both negative and positive infinity, $f(x)$ approaches _____ infinity.



Analyzing Absolute Value Functions Algebraically

ABSOLUTE VALUE FUNCTION TRANSFORMATIONS

The standard form of an absolute value function is shown.
The callouts describe the transformations caused by different values of a, b, h, and k.

$$f(x) = a|b(x - h)| + k$$

causes a _____ dilation

$|a| > 0$: stretches
$0 < |a| < 1$: compresses

$a < 0$ reflects the graph across the x-axis

causes a _____ translation, or shift

$k > 0$: up
$k < 0$: down

causes a _____ dilation

$|b| > 0$: compresses
$0 < |b| < 1$: stretches

$b < 0$ reflects the graph across the y-axis

causes a _____ translation, or shift

$h > 0$: right
$h < 0$: left

Question

If the graph of $f(x) = |x|$ is stretched vertically by a factor of 5 and shifted 2 units to the left, what function represents the new graph?

The vertical dilation relates to the value of ____, and the horizontal shift relates to the value of ____.

The graph is vertically _____ by a factor of 5, so the value of *a* is ____.

The graph is shifted to the _____, so the value of *h* is _____.

There is no _____ dilation, so the value of *b* is ____.

There is no _____ shift, so the value of *k* is ____.

$g(x) = a|b(x - h)| + k$

$g(x) =$ ____|____(x – (_____)| + ____

$g(x) = 5|$_____|