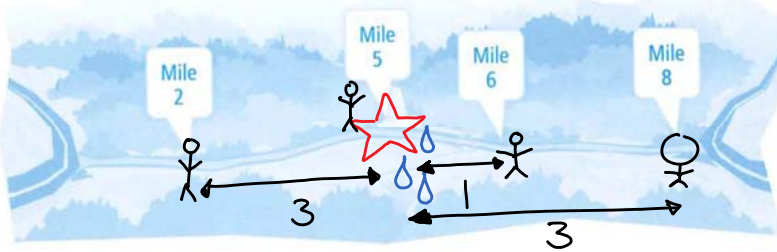


**5-1**  
**The Absolute Value Function**  
 PearsonRealize.com

**EXPLORE & REASON**

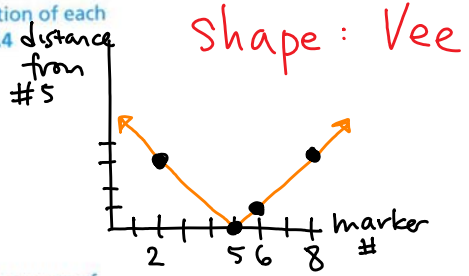
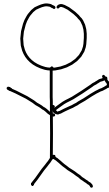
Groups of students are hiking from mile markers 2, 6 and 8 to meet at the waterfall located at mile marker 5.



A. How can you use the mile marker to determine the number of miles each group of students needs to hike to the waterfall?

Subtract the marker numbers & make positive

B. **Model With Mathematics** Make a graph that relates the position of each group on the trail to their distance from the waterfall. © MP.4



C. How would the points in your graph from part B change as the groups of students approach the waterfall?

Points will shift down..

**HABITS OF MIND**

**Reason** Why is the absolute value of a number always positive? How does it relate to real-world situations? Explain. © MP.2

Distance (from zero)

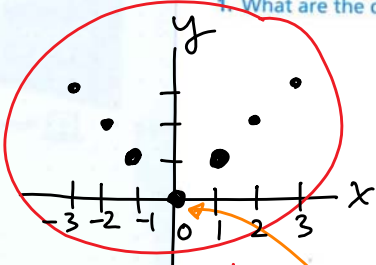
$$f(x) = |x|$$

x	y
-3	3
-2	2
-1	1
0	0
1	1
2	2
3	3

domain:  $x \in \{-3, -2, -1, 0, 1, 2, 3\}$   
range:  $y \in \{0, 1, 2, 3\}$

**EXAMPLE 1** Try It! Graph the Absolute Value Function

1. What are the domain and range of  $f(x) = |x|$ ?



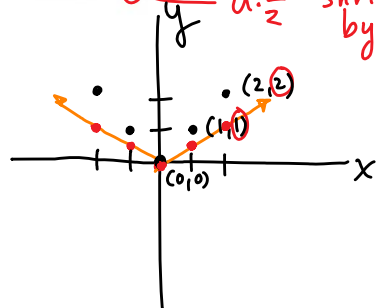
$d$ : all real #s or  $\mathbb{R}$   
 $r$ :  $y \geq 0$   
all pos & zero

parent graph  $(h, k) = (0, 0)$

**EXAMPLE 2** Try It! Transform the Absolute Value Function

2. How do the domain and range of each function compare with the domain and range of  $f(x) = |x|$ ?

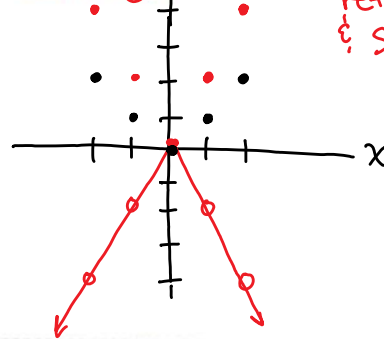
a.  $g(x) = \frac{1}{2}|x|$



$a: \frac{1}{2}$  vert shrink by  $\frac{1}{2}$  (height in half)

$d: \mathbb{R}$   
 $r: y \geq 0$

b.  $h(x) = -2|x|$



$a: -2$  vert reflection & stretch by 2

$d: \mathbb{R}$   
 $r: y \leq 0$

$$y = a|x - h| + k$$

vertical reflection / stretch/shrink (compression)  
left/right  
up/down

**HABITS OF MIND**

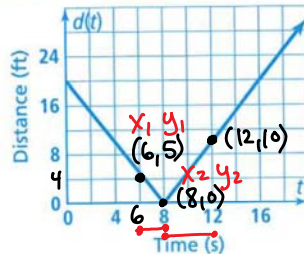
**Generalize** Are there statements you can make about the domain of  $f(x) = a|x|$  that are always true? Explain. © MP8

**EXAMPLE 3** Try It! Interpret the Graph of a Function

3. A cyclist competing in a race rides past a water station. The graph of the function  $d(t) = \frac{1}{3}|t - 60|$  shows her distance from the water station at  $t$  minutes. Assume the graph represents the entire race. What does the graph tell you about her race?

**EXAMPLE 4** Try It! Determine Rate of Change

4. Kata gets on a moving walkway at the airport. Then 8 s after she gets on, she taps Lisa, who is standing alongside the walkway. The graph shows Kata's distance from Lisa over time. Calculate the rate of change in her distance from Lisa from 6 s to 8 s, and then from 8 s to 12 s. What do the rates of change mean in terms of Kata's movement?



Slope:  $\frac{\text{rise}}{\text{run}}$

$$\frac{y_2 - y_1}{x_2 - x_1}$$

rate of change  
(6 → 8 secs)

$$\rightarrow \frac{0 - 5}{8 - 6} \rightarrow \frac{-5}{2} = \left| \frac{-2.5 \text{ ft}}{\text{sec}} \right|$$

$\frac{2.5 \text{ ft}}{\text{sec}}$

rate of change  
(8 → 12 secs)

$$\rightarrow \frac{10 - 0}{12 - 8} \rightarrow \frac{10}{4} = \frac{2.5 \text{ ft}}{\text{sec}}$$

**HABITS OF MIND**

**Make Sense and Persevere** If a function that includes an absolute value expression represents a real-world distance situation, what is the vertex of the graph likely to represent? Explain. © MP.1

### Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** What are the key features of the graph of the absolute value function?

$$y = a|x|$$

2. **Communicate Precisely** How do the domain and range of  $g(x) = a|x|$  compare to the domain and range of  $f(x) = |x|$  when  $0 < a < 1$ ? Explain. © MP.6

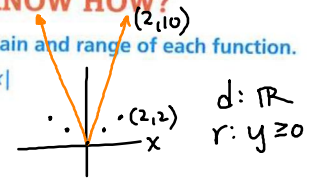
3. **Make Sense and Persevere** The graph of the function  $g(x) = a|x|$  includes the point  $(1, 16)$ . What is another point on the function? What is the value of  $a$ ? © MP.1

4. **Error Analysis** Janiece says that the vertex of the graph of  $g(x) = a|x|$  always represents the minimum value of the function  $g$ . Explain her error. © MP.3

### Do You KNOW HOW?

Find the domain and range of each function.

5.  $g(x) = 5|x|$

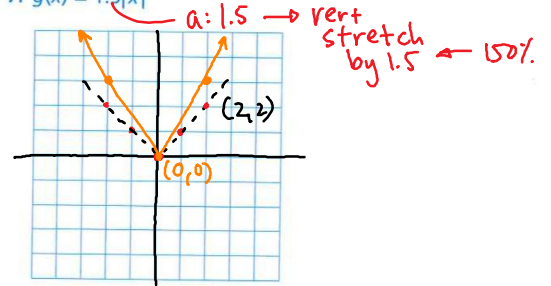


6.  $h(x) = -2|x|$

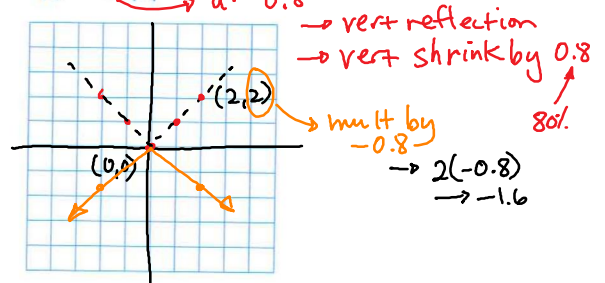
Same as EX 2b)

Graph each function.

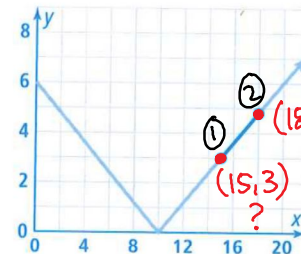
7.  $g(x) = 1.5|x|$



8.  $h(x) = -0.8|x|$



9. What is the slope rate of change over the interval  $15 \leq x \leq 18$ ?



$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4.8 - 3}{18 - 15} = \frac{1.8}{3} = 0.6$$