

**Goal:** Demonstrate vertical and horizontal translations in a graph.



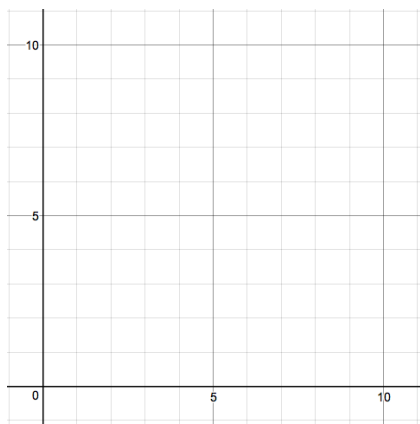
Questions

**Warm Up:** Compare the graphs of  $f(x) = x^3$  and  $g(x) - 25 = (x - 12)^3$ . Find the coordinates of a point on each graph.

**The Translation Image of a Graph**

A transformation is \_\_\_\_\_. The four types are \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_. Today we will focus on the first, which can simply be described as \_\_\_\_\_. In a transformation, one set, the \_\_\_\_\_ is mapped to another set, the \_\_\_\_\_.

Graph  $f(x) = \sqrt{x}$  and  $g(x) = \sqrt{x} + 5$  on the same coordinate plane. Also, complete the table.



$x$	$f(x)$	$g(x)$
1		
2		
3		
4		
5		



The translation can be written as \_\_\_\_\_ or \_\_\_\_\_, which is read “ $(x,y)$  is mapped to  $(x,y+5)$ .”

**Definition of Translation**

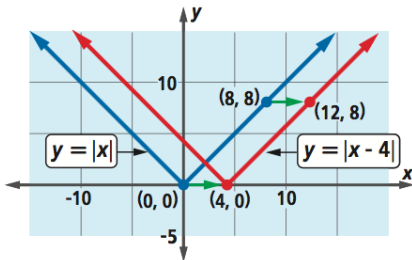
A **translation** in the plane is a transformation that maps each point  $(x, y)$  onto  $(x + h, y + k)$ , where  $h$  and  $k$  are constant.

Example 1: Under a translation, the image of  $(0,0)$  is  $(-12,5)$ . Find a rule for this translation. Then find the image of  $(6,-10)$  under this translation.

### Graph-Translation Theorem

Given a preimage graph described by a sentence in  $x$  and  $y$ , the following two processes yield the same image:

- (1) replacing  $x$  by  $x - h$  and  $y$  by  $y - k$  in the sentence;
- (2) applying the translation  $(x, y) \rightarrow (x + h, y + k)$  to the preimage graph.



### Example 2

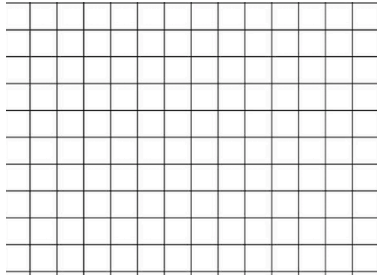
- a. Compare the graphs of  $y = x^3 + 1$  and  $y = (x + 4.2)^3 - 5$ .
- b. Find the coordinates of a point on one graph and its corresponding image on the second graph.
- c. What is the image of  $(0,0)$  under the translation that maps the first graph to the second graph?

### Example 3

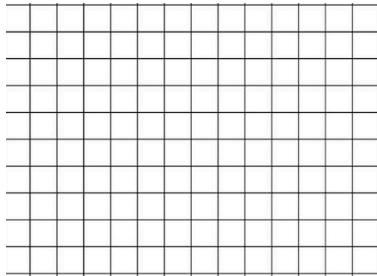
If the graph of  $y = -\frac{1}{2x^2}$  is translated 8 units up and 17 units to the left, what is an equation for its image?

## Questions

Example 4a: Sketch a graph of  $y = \frac{1}{(x+1)^2} - 4$



Example 4b: Sketch a graph of  $y = \sqrt{x-3} - 5$



**Summary:**