

## 5.5 - Translations (Shifts)

Shifts use addition and subtraction

### Two Types

- 1) Vertical Shift moves the graph up or down
- 2) Horizontal Shift moves the graph left or right

## Vertical Shift

The graph of  $y = f(x) + \mathbf{k}$  is shifted vertically  $\mathbf{k}$  units from the graph of  $y = f(x)$ .

Given  $y = |x|$

$y = |x| + \mathbf{5}$  is shifted 5 units up

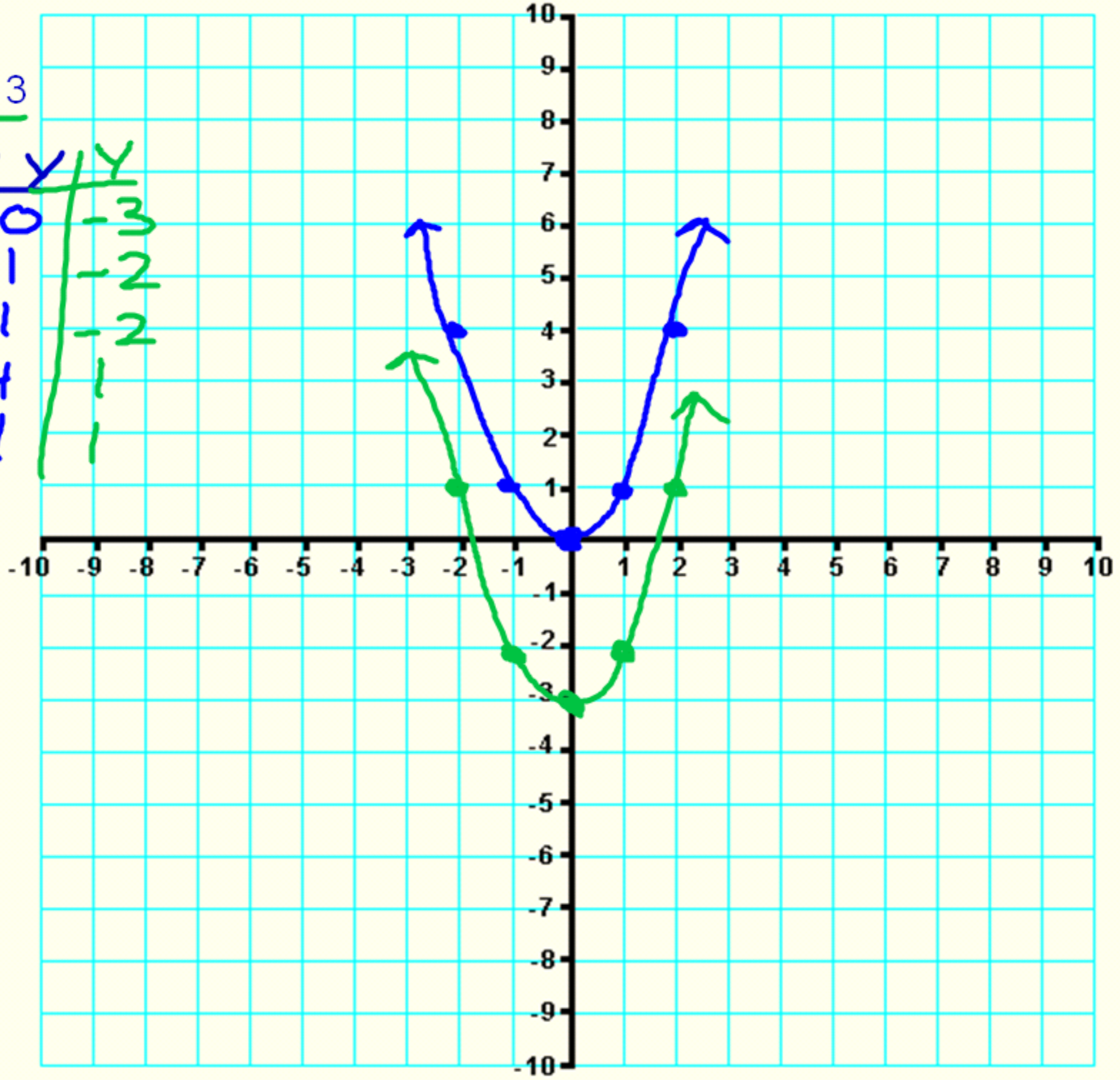
$y = |x| - \mathbf{4}$  is shifted 4 units down

+ means shifted up

- means shifted down

$y = x^2$   
 $y = x^2 - 3$

x	y	Y
0	0	-3
1	1	-2
-1	1	-2
2	4	1
-2	4	1



## Horizontal Shift

The graph of  $y = f(x - \mathbf{h})$  is translated horizontally  $\mathbf{h}$  from the graph of  $y = f(x)$

Given  $y = |x|$

$y = |x - 3|$  is shifted 3 units to the right

$y = |x + 6|$  is shifted 6 units to the left

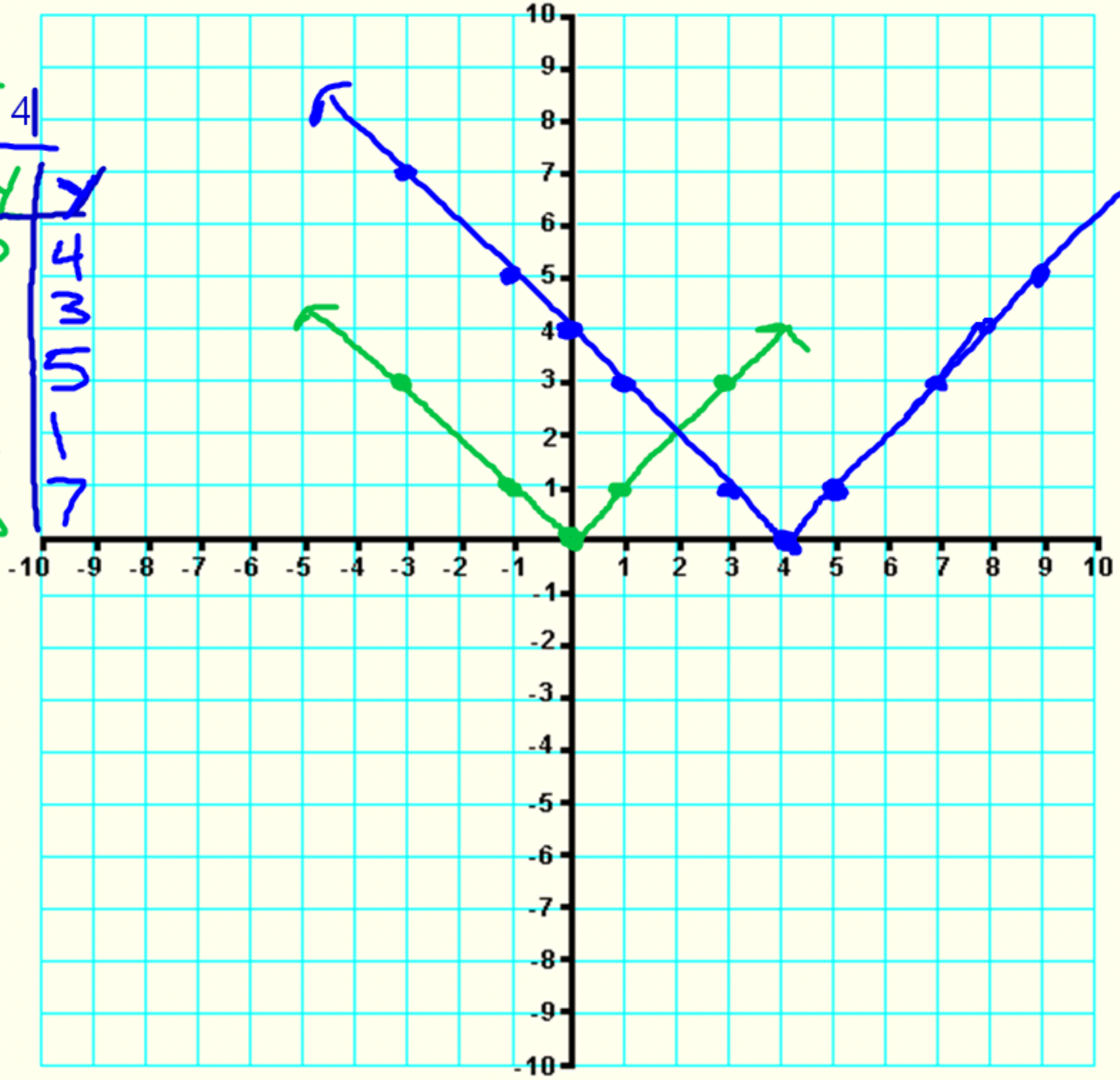
Horizontal shifts are the opposite of what you'd think would happen

"-" means shift to the right

"+" means shift to the left

$$y = |x|$$
$$y = |x - 4|$$

X	Y
-5	4
-3	3
-1	1
0	0
1	1
3	3
4	4



Given  $y = x^2$

$$f(x) = y$$

Note that  $f(3) = 9$ , so the point  $(3, 9)$  would be on the graph.

State how the parent function is translated for the graph of each function given.

$$f(x) = x^2 + 5$$

up 5

$$f(x) = x^2 + 6$$

up 6

$$f(x) = x^2 - 9$$

down 9

$$f(x) = (x - 2)^2$$

right 2

$$f(x) = (x + 1)^2$$

left 1

The point  $(3, 5)$  is on the graph of  $f(x)$ . Find the new coordinates of the point when each transformation is applied to the function.

Vertical Translation by 6  
 $(3, 11)$

Horizontal Translation by -3  
 $(0, 5)$

Vertical Translation by -19  
 $(3, -14)$

Horizontal Translation by 7  
 $(10, 5)$