

Algebra 1 9.3

Apply transformations to quadratic functions

Apply dilations and reflections to quadratic functions

parent graph →

$$y = x^2$$

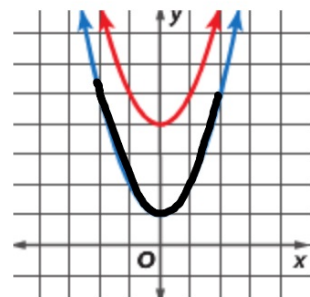
transformation

translation

reflection

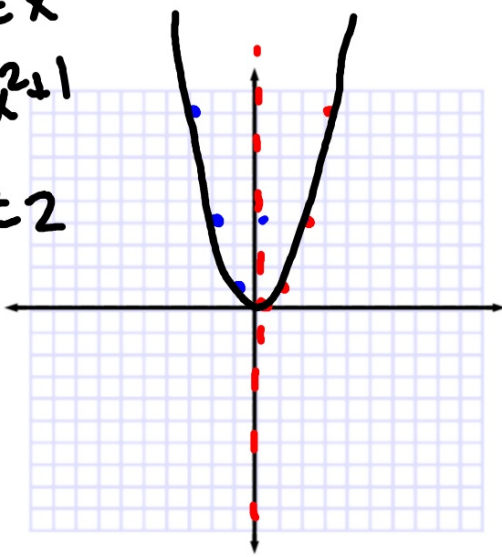
dilation

x	x · x	
0	0 · 0	0
1	1 · 1	1
2	2 · 2	4
3	3 · 3	9



Are these the same shape?

$$y = x^2$$
$$y = x^2 + 1$$
$$y = x^2 - 2$$



Parent graph

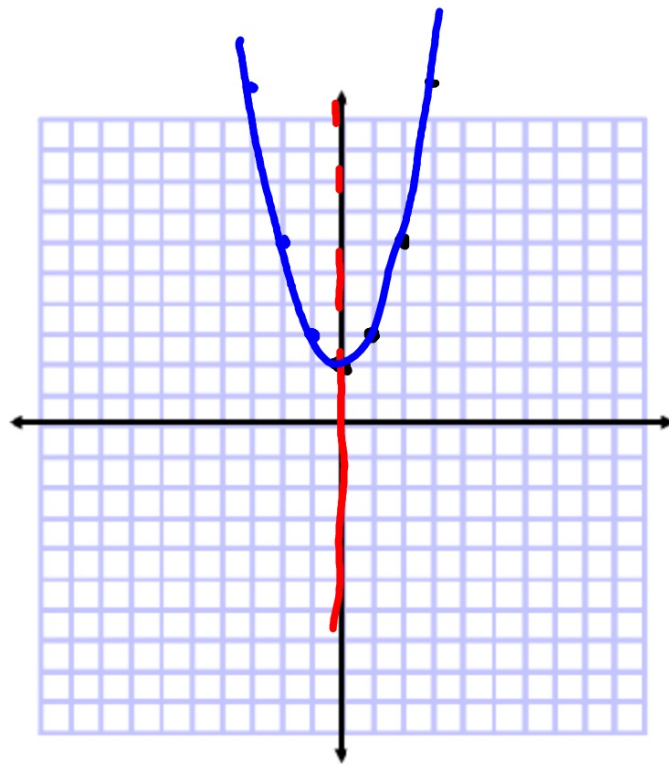
$$f(x) = x^2$$

in words:

in symbols:

$$y = x^2 + 2$$

$(0, 2)$

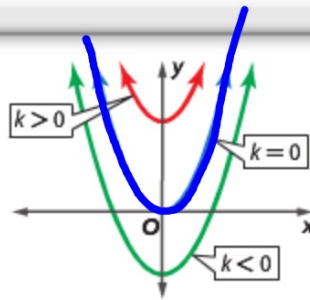


### KeyConcept Vertical Translations

The graph of  $f(x) = x^2 + k$  is the graph of  $f(x) = x^2$  translated vertically.

If  $k > 0$ , the graph of  $f(x) = x^2$  is translated  $|k|$  units **up**.

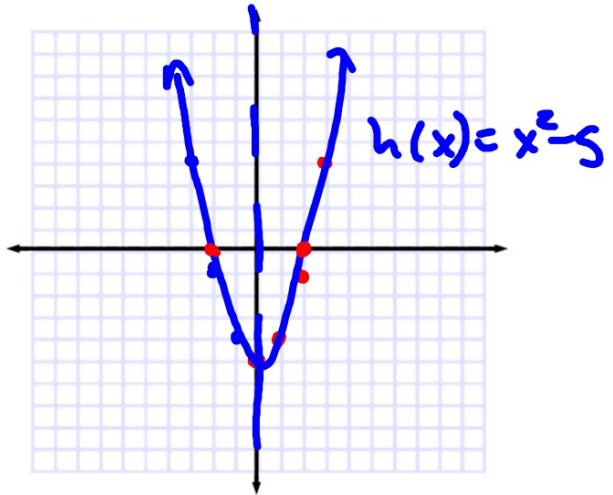
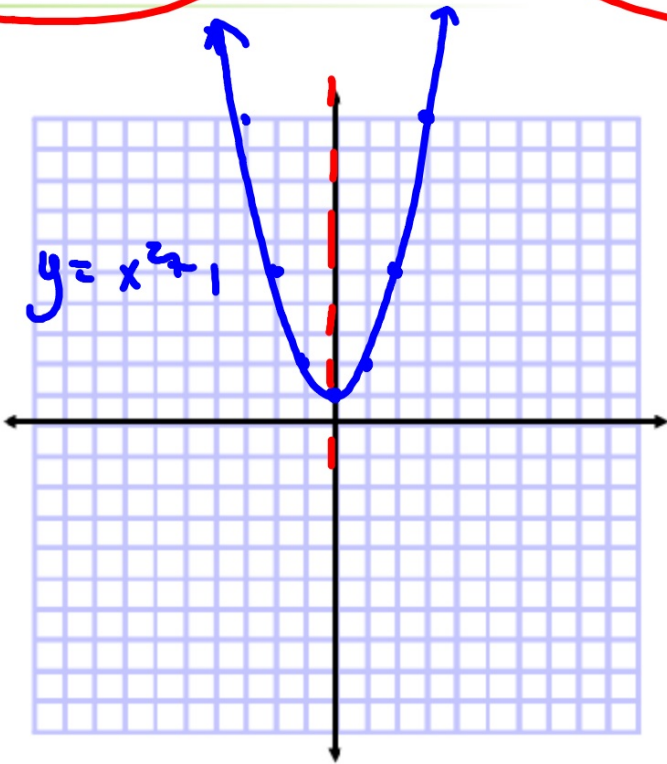
If  $k < 0$ , the graph of  $f(x) = x^2$  is translated  $|k|$  units **down**.



1. parent graph
2. move vertex
3.  $1^2=1$   $2^2=4$   $3^2=9$
4. symmetry

1C.  $h(x) = -5 + x^2$     1D.  $f(x) = x^2 + 1$

$h(x) = x^2 - 5$



Notice the subtraction in the formula...  
(related to the distance formula...trust me)

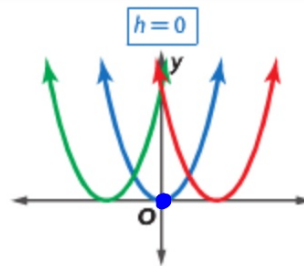
A quadratic graph can be translated horizontally by subtracting an  $h$  term from  $x$ .

 **KeyConcept** Horizontal Translations



The graph of  $g(x) = (x - h)^2$  is the graph of  $f(x) = x^2$  translated horizontally.

$$y = x^2 +$$



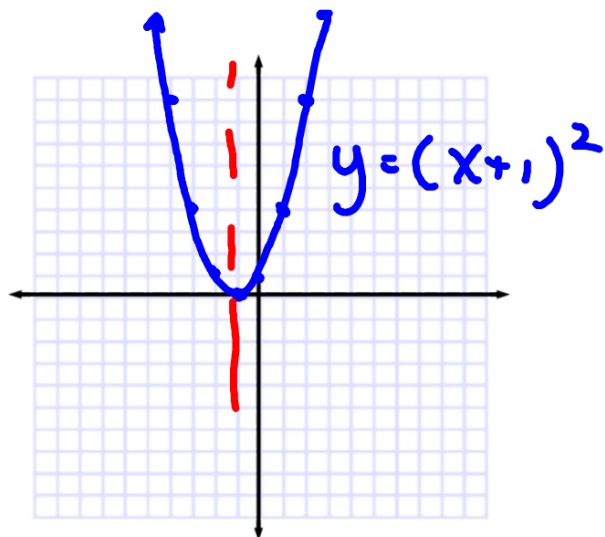
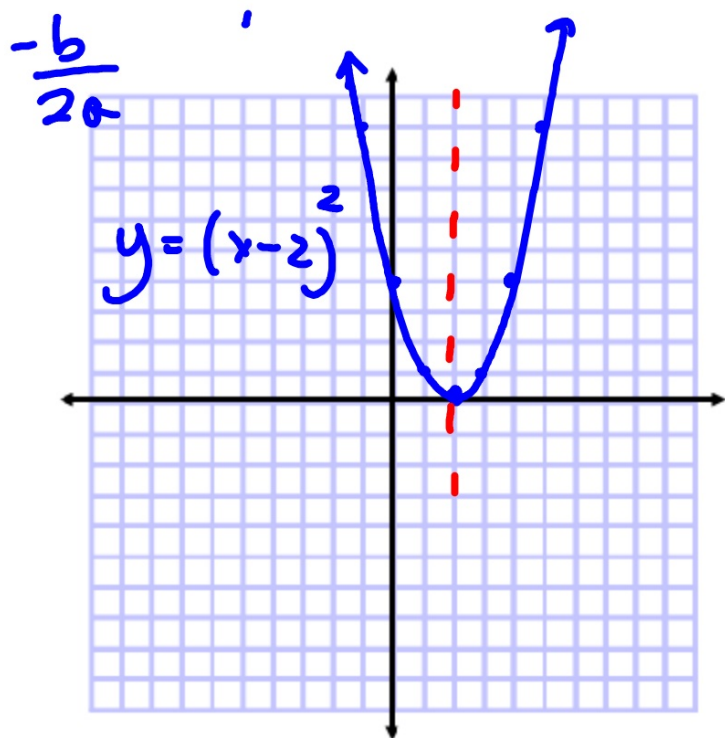
Remember the - in the formula? What did you subtract?  
in words:

**Example 2** Horizontal Translations

Describe how the graph of each function is related to the graph of  $f(x) = x^2$ .

a.  $g(x) = (x - 2)^2$

b.  $g(x) = (x + 1)^2$

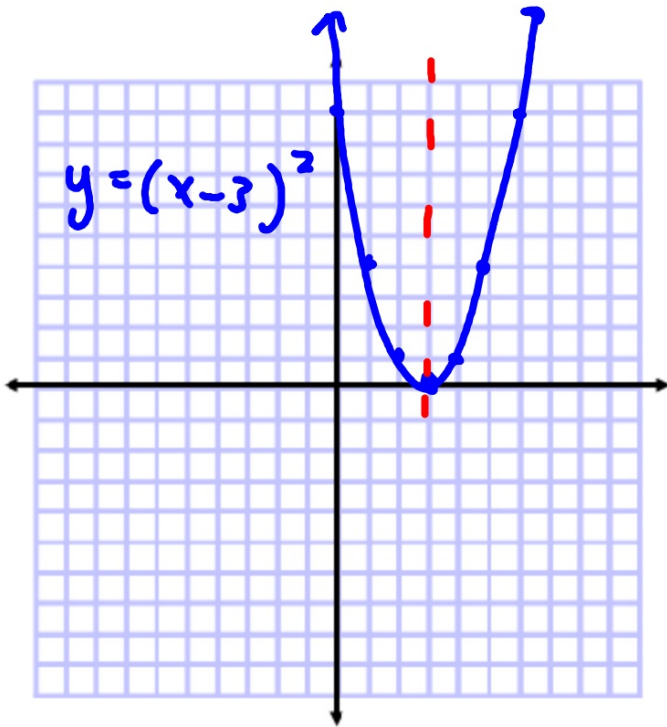


in words:

**Guided Practice**

**2A.**  $g(x) = (x - 3)^2$

**2B.**  $g(x) = (x + 2)^2$





in words:



**Example 3** Horizontal and Vertical Translations

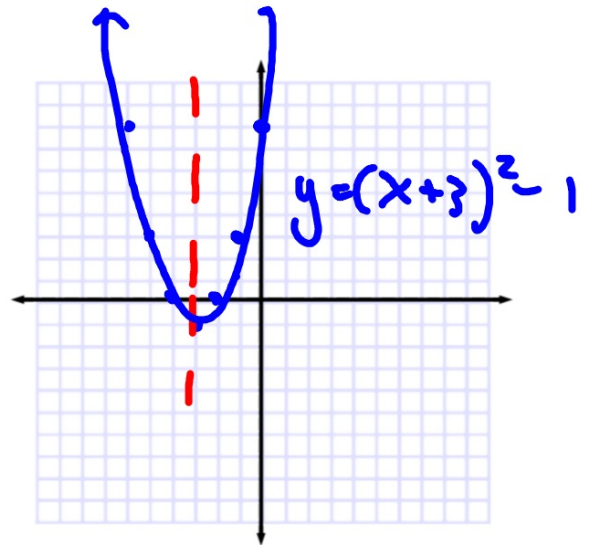
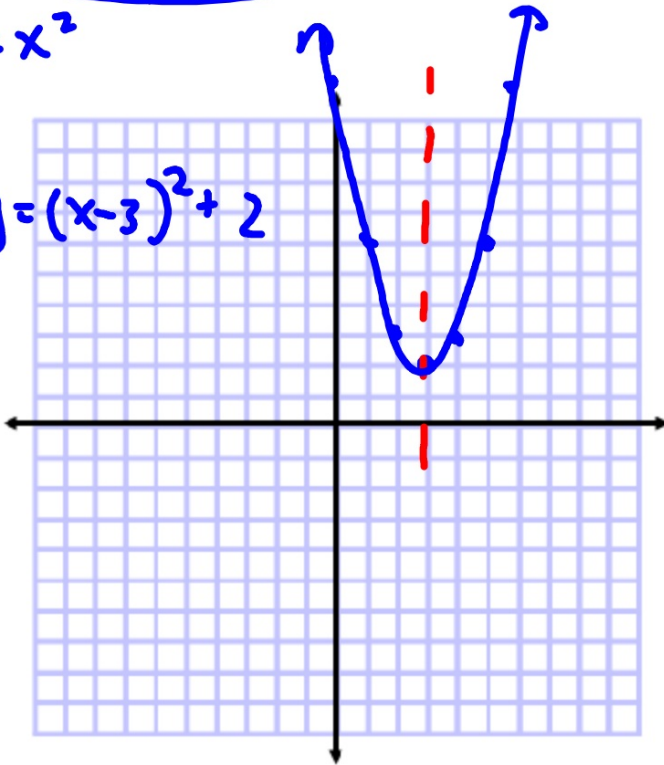
Describe how the graph of each function is related to the graph of  $f(x) = x^2$ .

a.  $g(x) = (x - 3)^2 + 2$

b.  $g(x) = (x + 3)^2 - 1$

$y = x^2$

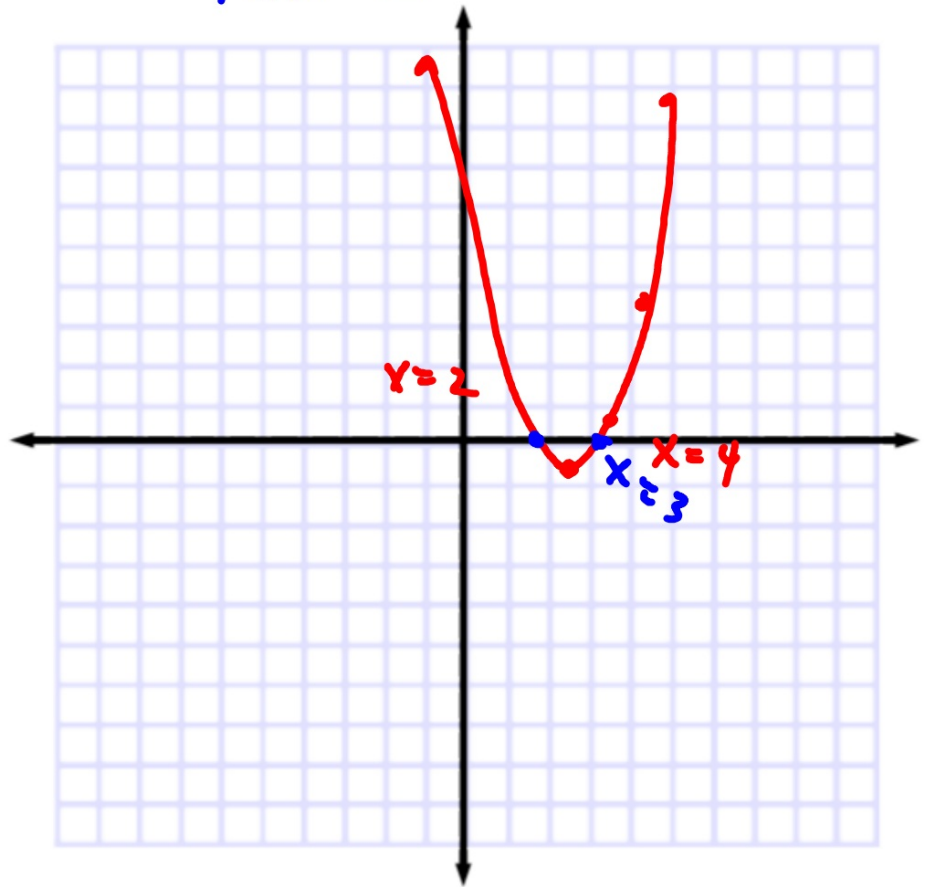
$y = (x - 3)^2 + 2$



$$1 < x < 2$$

Parent graph  
(TOV)

$$y = (x - 3)^2 - 1$$



Graph from parent graph:

**Guided Practice**

3A.  $g(x) = -(x + 2)^2 + 3$

$\sqrt{(-2, 3)}$

3B.  $g(x) = (x - 4)^2 - 4$

