Algebra 1 9.3 $y = x^2$

Apply transformations to quadratic functions

Apply dilations and reflections to quadratic functions

parent graph

transformation

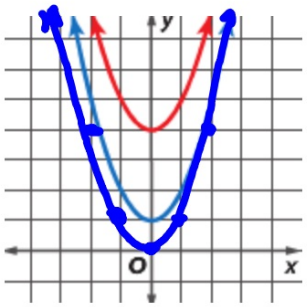
translation

reflection

dilation

activity: whiteboards

x	x^2
0	0
1	1
2	4
-1	1
-2	4



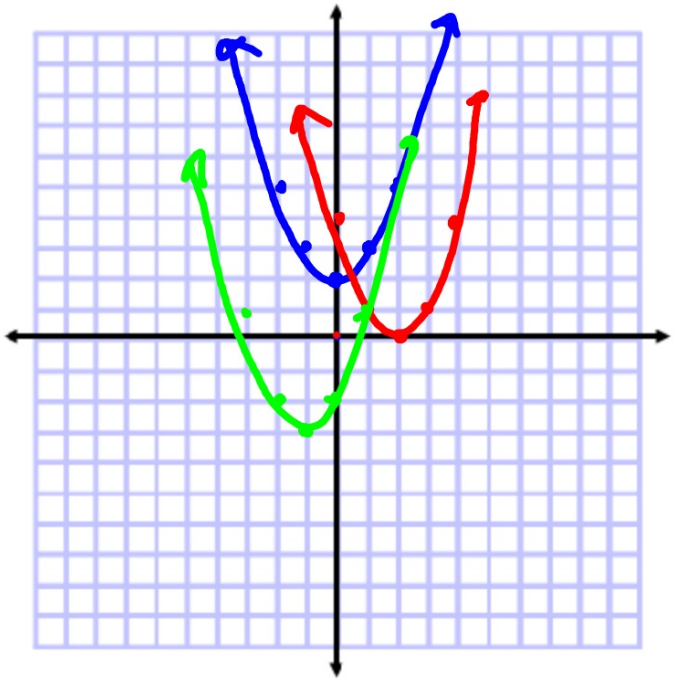
Quiz 9.1-9.2 today

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

$y = x^2 + 2$

$y = (x-2)^2$

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

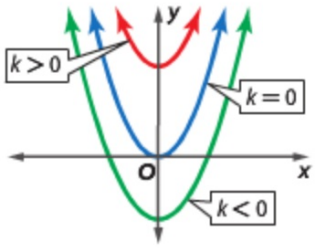


KeyConcept Vertical Translations

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**.



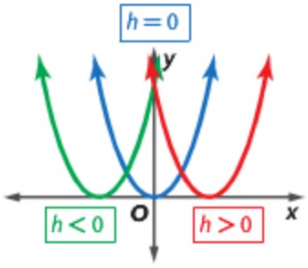
A quadratic graph can be translated horizontally by subtracting an h term from x.

KeyConcept Horizontal Translations

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

If $h > 0$, the graph of $f(x) = x^2$ is translated h units to the **right**.

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

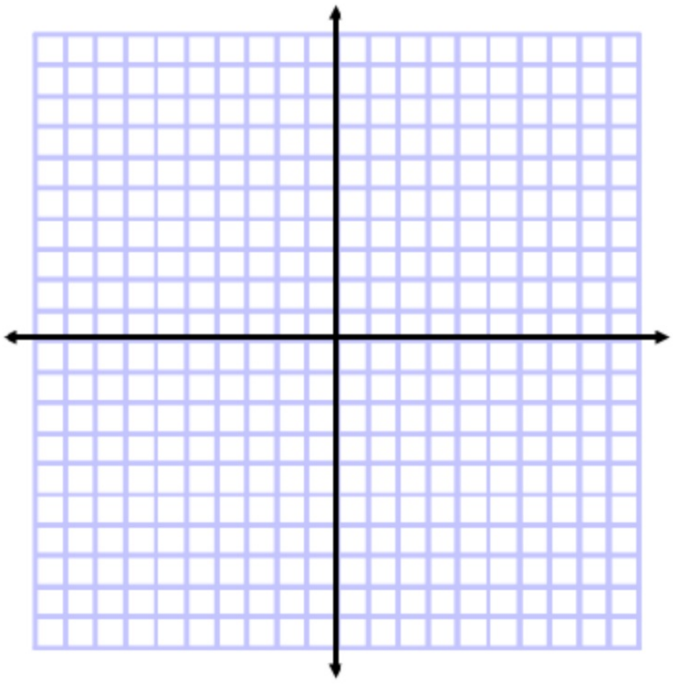


Whiteboards: Graph

GuidedPractice

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

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

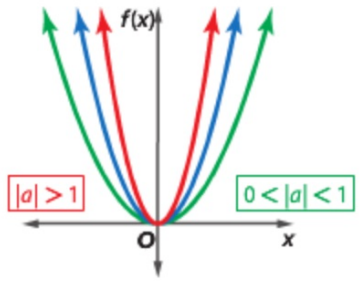


KeyConcept Dilations

The graph of $g(x) = ax^2$ is the graph of $f(x) = x^2$ stretched or compressed vertically.

If $|a| > 1$, the graph of $f(x) = x^2$ is stretched vertically.

If $0 < |a| < 1$, the graph of $f(x) = x^2$ is compressed vertically.



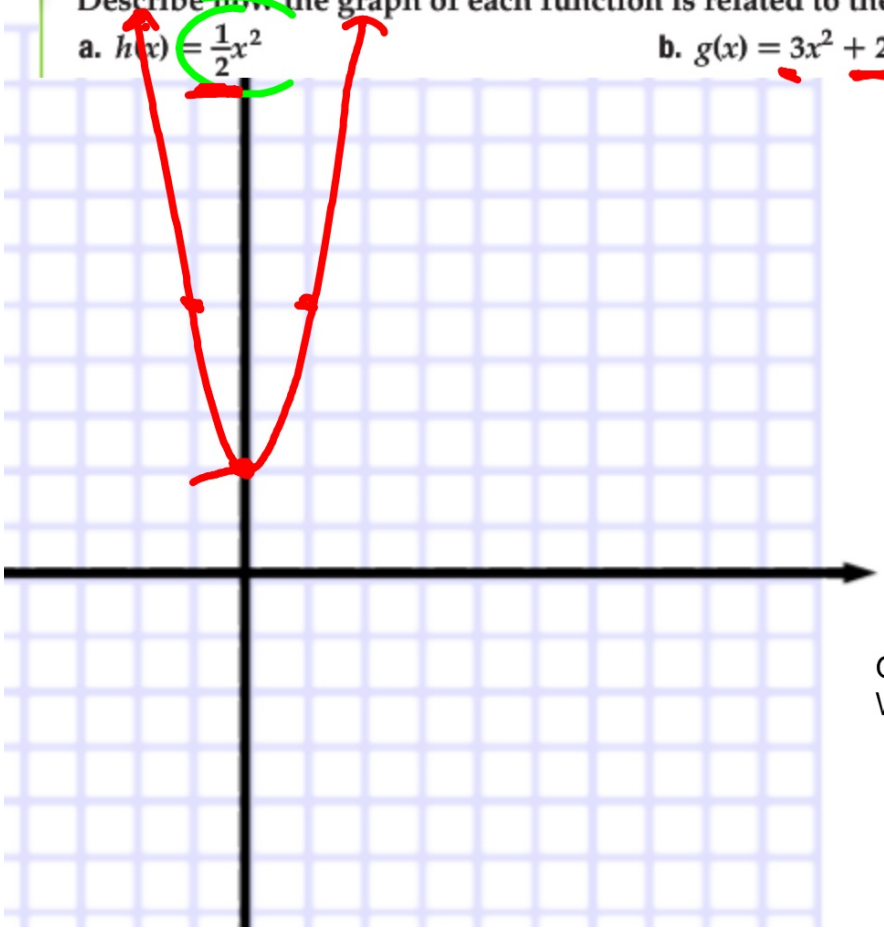
NEW: Twice as steep, half as steep, etc.
Compare to parent graph.

Example 4 Describe and Graph Dilations

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

a. $h(x) = \frac{1}{2}x^2$

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



Graph: move vertex first (parent graph)
What else?

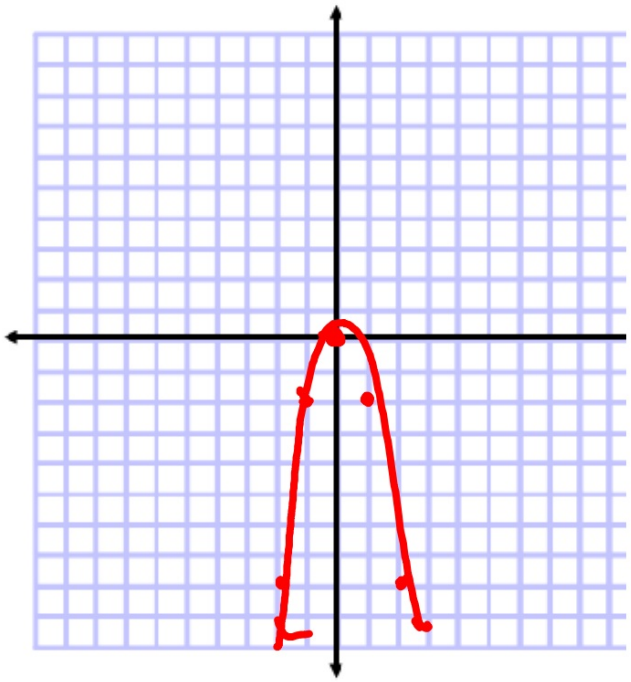
Graph

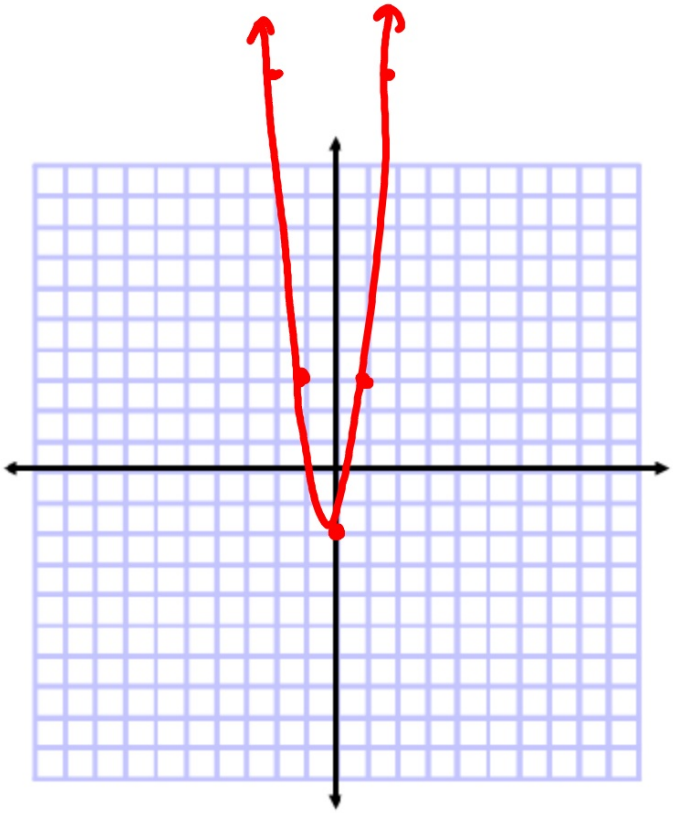
GuidedPractice

4A. $j(x) = 2x^2$

4B. $h(x) = 5x^2 - 2$

4C. $g(x) = \frac{1}{3}x^2 + 2$



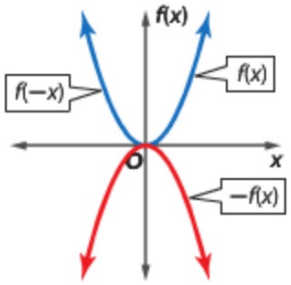


A **reflection** flips a figure across a line.

KeyConcept Reflections

The graph of $-f(x)$ is the reflection of the graph of $f(x) = x^2$ across the x-axis.

The graph of $f(-x)$ is the reflection of the graph of $f(x) = x^2$ across the y-axis.



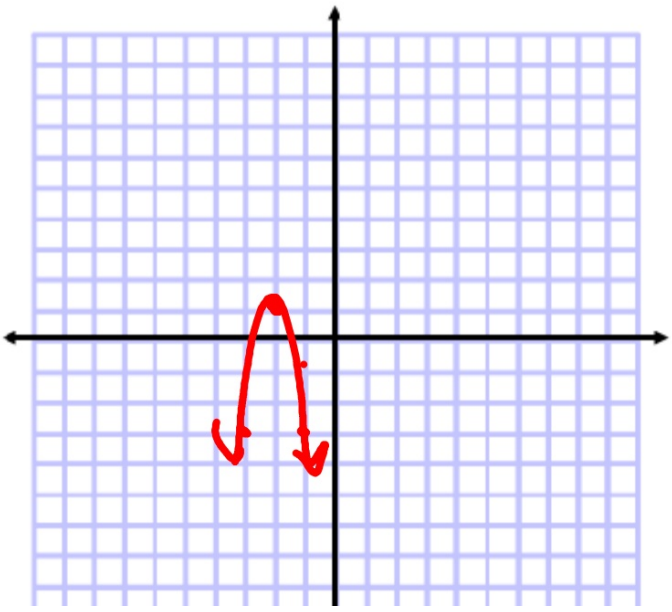
We already knew this...

Example 5 Describe and Graph Reflections

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

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

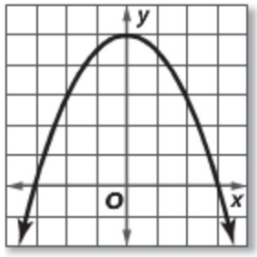
b. $h(x) = -4(x + 2)^2 + 1$



Graph
parent graph (change vertex first)

Standardized Test Example 6 Identify an Equation for a Graph

Which is an equation for the function shown in the graph?



A $y = \frac{1}{2}x^2 - 5$

C $y = -\frac{1}{2}x^2 + 5$

B $y = -2x^2 - 5$

D $y = 2x^2 + 5$

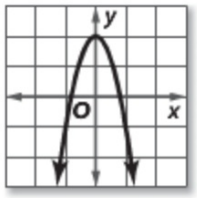
Read the Test Item

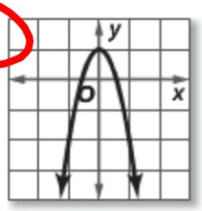
You are given a graph. You need to find its equation.

GuidedPractice

6. Which is the graph of $y = -3x^2 + 1$?

F 

G 

H 

J