

Algebra 1 9.3

Apply transformations to quadratic functions
Apply dilations and reflections to quadratic functions

parent graph

transformation

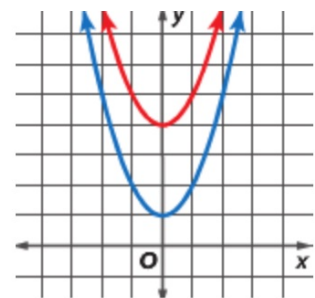
translation

reflection

dilation

activity: whiteboards

$$y = x^2$$



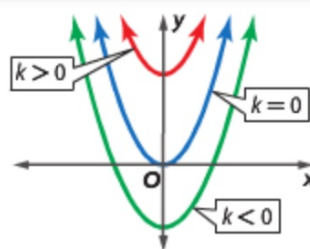
Quiz 9.1-9.2

Key Concept 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**.



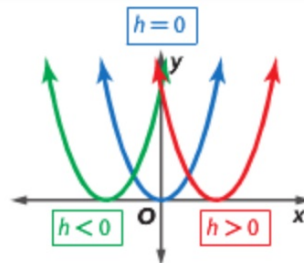
A quadratic graph can be translated horizontally by subtracting an h term from x .

Key Concept 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**.

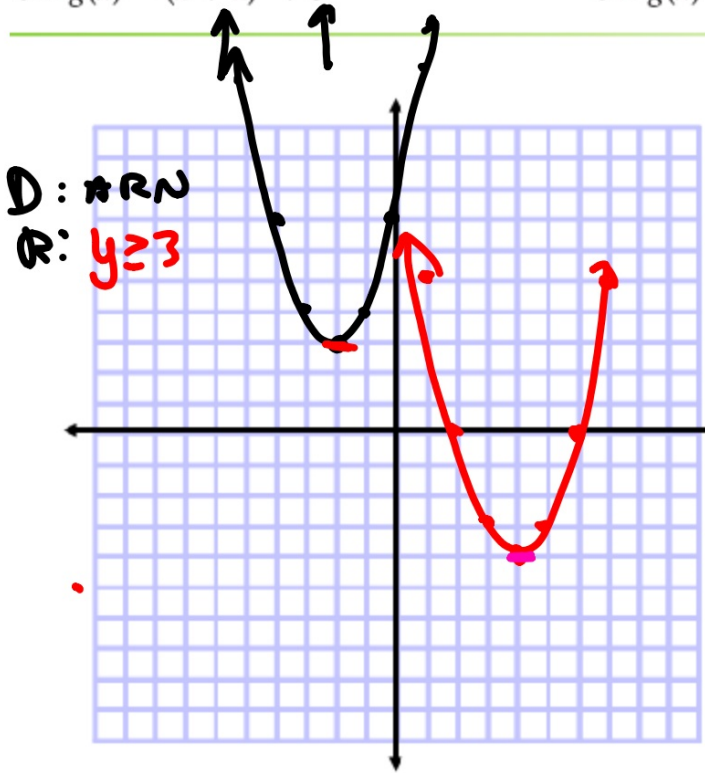
If $h < 0$, the graph of $f(x) = x^2$ is translated $|h|$ units to the **left**.



Guided Practice

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

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



D: \mathbb{R}
R: $y \geq 3$

D: \mathbb{R}
R: $y \geq -4$

$$2x^2$$

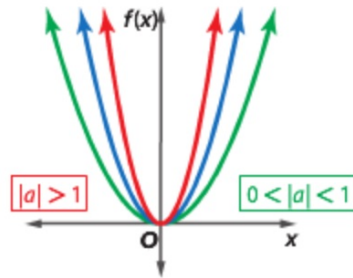
$$\frac{1}{2}x^2$$

Key Concept 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.

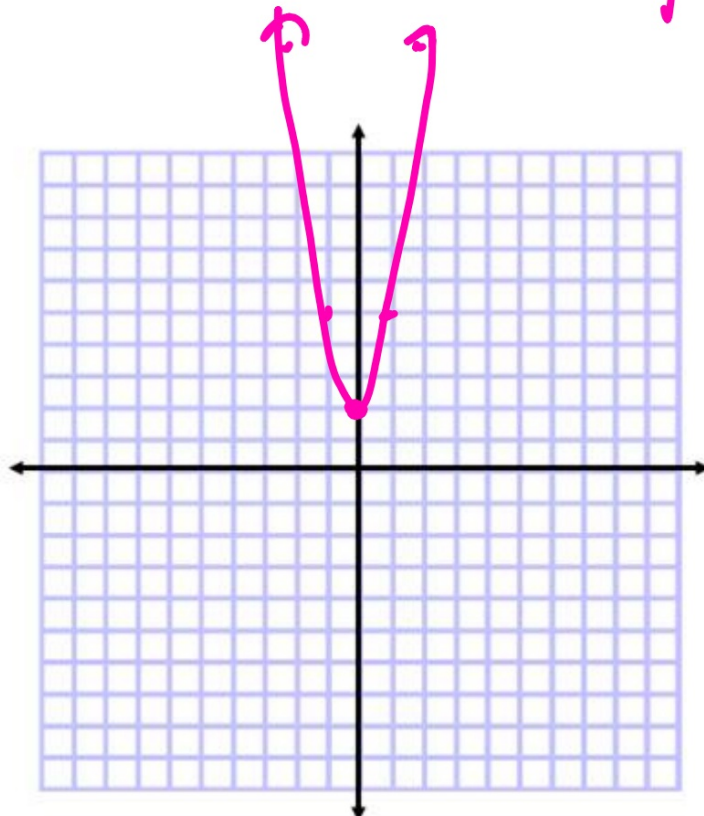
Example 4 Describe and Graph Dilations



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



ph: move vertex first (parent graph)
at else?

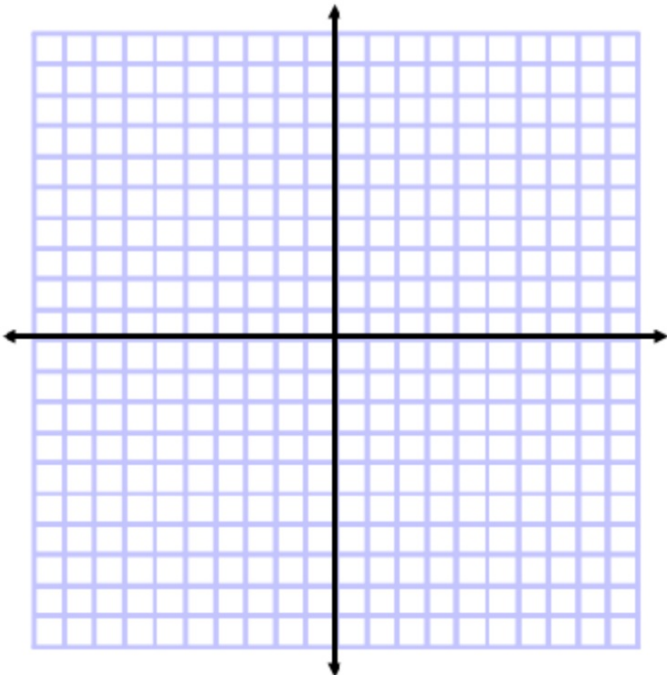
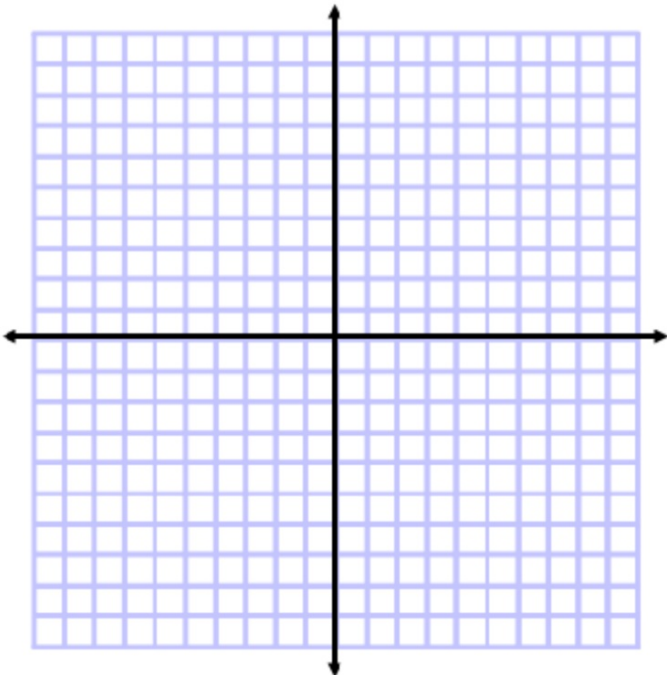
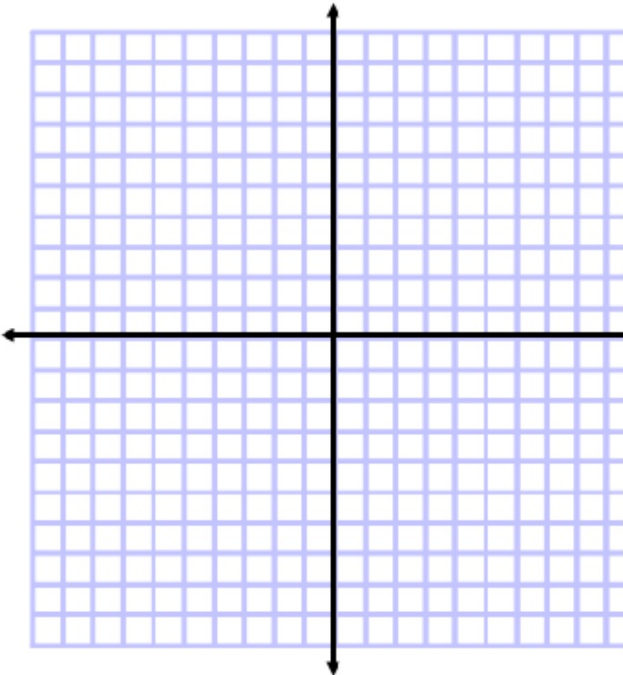
Graph

Guided Practice

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

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

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

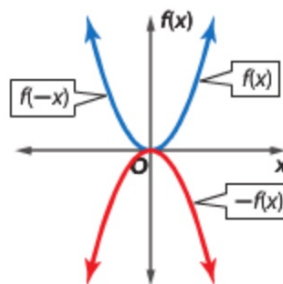


A **reflection** flips a figure across a line.

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.



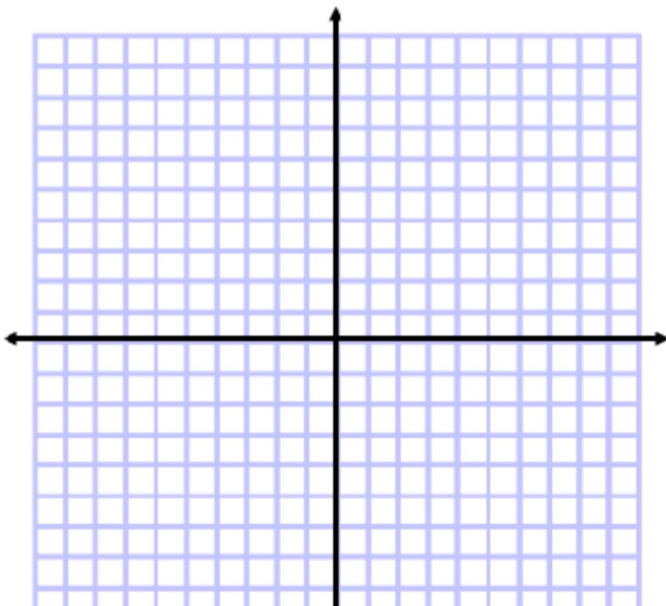
We already knew this...

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

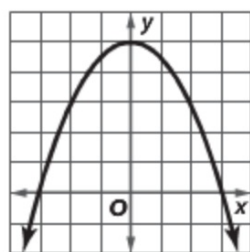
Which is an equation for the function shown in the graph?

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

~~B $y = -2x^2 - 5$~~ ~~D $y = -2x^2 + 5$~~

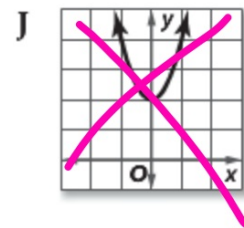
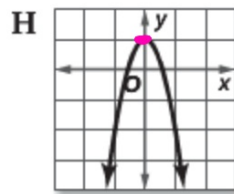
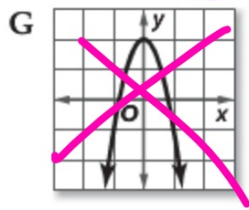
Read the Test Item

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



Guided Practice

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



1. graph (opt.)

5. skip.

WB 9.3 (prac) \rightarrow 1) $y = 10 + x^2$
1-12