

4-7 Study Guide and Intervention

Transformations of Quadratic Graphs

Write Quadratic Equations in Vertex Form A quadratic function is easier to graph when it is in vertex form. You can write a quadratic function of the form $y = ax^2 + bx + c$ in vertex form by completing the square.

Example Write $y = 2x^2 - 12x + 25$ in vertex form. Then graph the function.

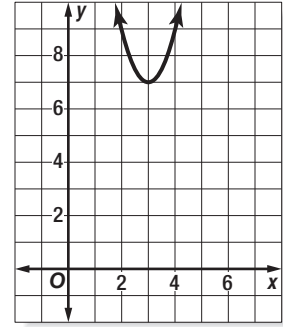
$$y = 2x^2 - 12x + 25$$

$$y = 2(x^2 - 6x) + 25$$

$$y = 2(x^2 - 6x + 9) + 25 - 18$$

$$y = 2(x - 3)^2 + 7$$

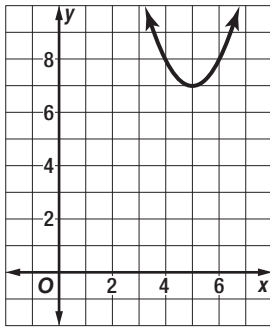
The vertex form of the equation is $y = 2(x - 3)^2 + 7$.



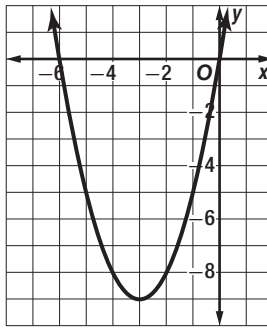
Exercises

Write each equation in vertex form. Then graph the function.

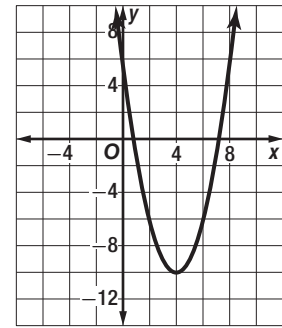
1. $y = x^2 - 10x + 32$
 $y = (x - 5)^2 + 7$



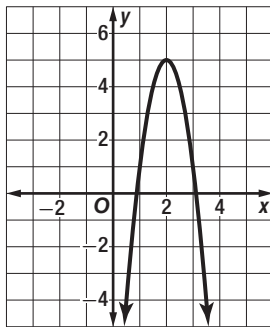
2. $y = x^2 + 6x$
 $y = (x + 3)^2 - 9$



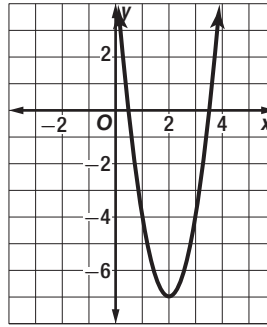
3. $y = x^2 - 8x + 6$
 $y = (x - 4)^2 - 10$



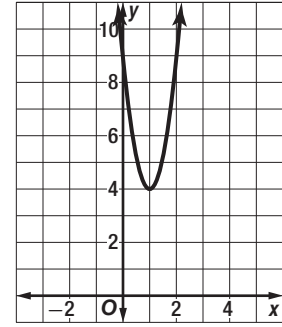
4. $y = -4x^2 + 16x - 11$
 $y = -4(x - 2)^2 + 5$



5. $y = 3x^2 - 12x + 5$
 $y = 3(x - 2)^2 - 7$



6. $y = 5x^2 - 10x + 9$
 $y = 5(x - 1)^2 + 4$



4-7 Study Guide and Intervention (continued)

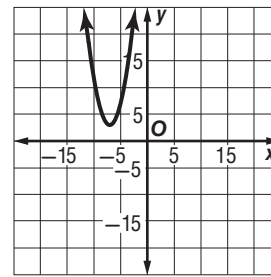
Transformations of Quadratic Graphs

Transformations of Quadratic Graphs Parabolas can be transformed by changing the values of the constants a , h , and k in the vertex form of a quadratic equation: $y = a(x - h)^2 + k$.

- The sign of a determines whether the graph opens upward ($a > 0$) or downward ($a < 0$).
- The absolute value of a also causes a dilation (enlargement or reduction) of the parabola. The parabola becomes narrower if $|a| > 1$ and wider if $|a| < 1$.
- The value of h translates the parabola horizontally. Positive values of h slide the graph to the right and negative values slide the graph to the left.
- The value of k translates the graph vertically. Positive values of k slide the graph upward and negative values slide the graph downward.

Example Graph $y = (x + 7)^2 + 3$.

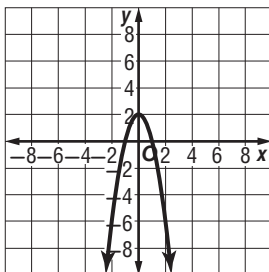
- Rewrite the equation as $y = [x - (-7)]^2 + 3$.
- Because $h = -7$ and $k = 3$, the vertex is at $(-7, 3)$. The axis of symmetry is $x = -7$. Because $a = 1$, we know that the graph opens up, and the graph is the same width as the graph of $y = x^2$.
- Translate the graph of $y = x^2$ seven units to the left and three units up.



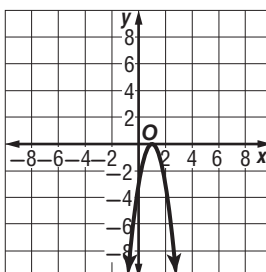
Exercises

Graph each function.

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



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



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

