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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 from by completing the square.

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

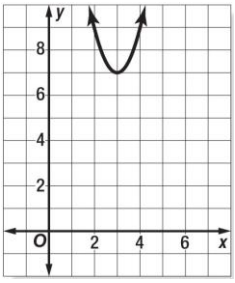
$y = 2x^2 - 12x + 25$

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

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

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

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



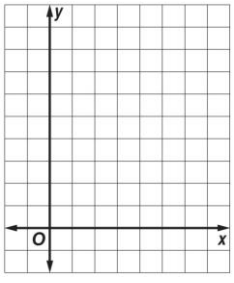
Exercises

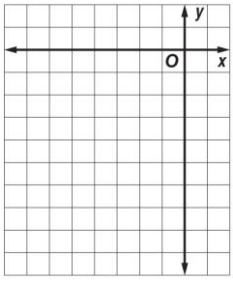
Write each equation in vertex form. Then graph the function.

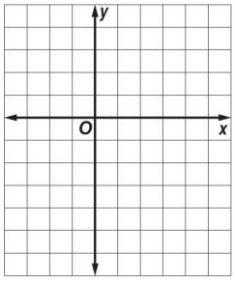
1. $y = x^2 - 10x + 32$

2. $y = x^2 + 6x$

3. $y = x^2 - 8x + 6$







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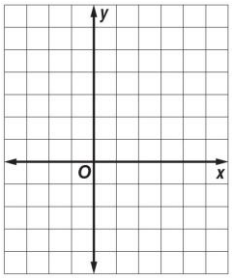
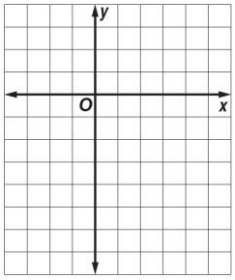
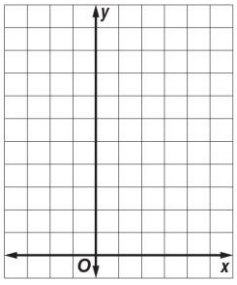
4. $y = -4x^2 + 16x - 11$ **5.** $y = 3x^2 - 12x + 5$ **6.** $y = 5x^2 - 10x + 9$







4-7 Study Guide and Intervention *(continued)*

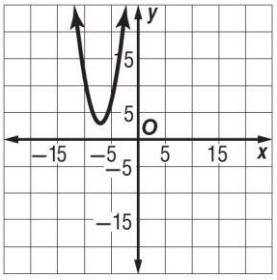
Transformations of Quadratic Graphs

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.



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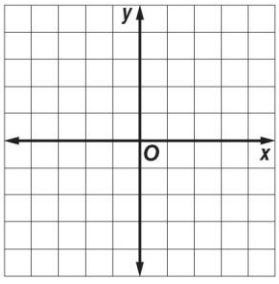
Exercises

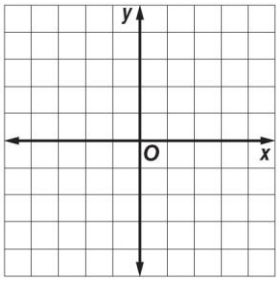
Graph each function.

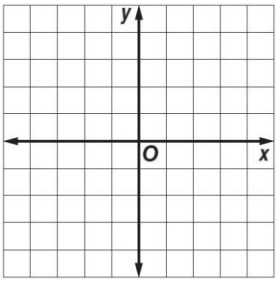
1. $y = -2x^2 + 2$

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

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







4-7 Skills Practice

Transformations of Quadratic Graphs

Write each quadratic function in vertex form. Then identify the vertex, axis of symmetry, and direction of opening.

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

2. $y = -x^2 + 4$

3. $y = x^2 - 6$

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

5. $y = -5x^2 + 9$

6. $y = (x - 2)^2 - 18$

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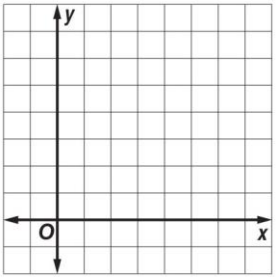
7. $y = x^2 - 2x - 5$

8. $y = x^2 + 6x + 2$

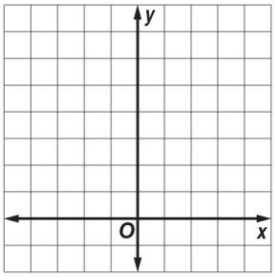
9. $y = -3x^2 + 24x$

Graph each function.

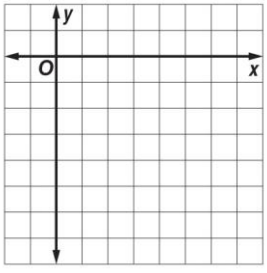
10. $y = (x - 3)^2 - 1$



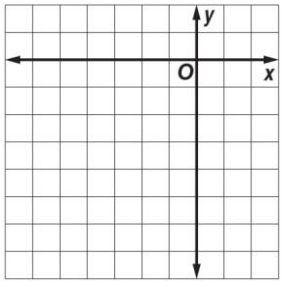
11. $y = (x + 1)^2 + 2$



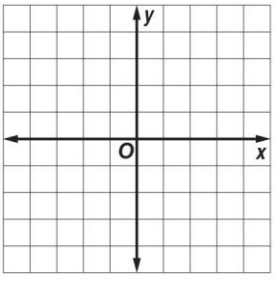
12. $y = -(x - 4)^2 - 4$



13. $y = -\frac{1}{2}(x + 2)^2$



14. $y = -3x^2 + 4$



15. $y = x^2 + 6x + 4$