Name _____ Class _____ Date _____

# 4-2 Reteaching

## Standard Form of a Quadratic Function

- The graph of a quadratic function, $y = ax^2 + bx + c$, where $a \neq 0$, is a parabola.
- The axis of symmetry is the line $x = -\frac{b}{2a}$.
- The $x$-coordinate of the vertex is $-\frac{b}{2a}$. The $y$-coordinate of the vertex is $y = f\left(-\frac{b}{2a}\right)$, or the $y$-value when $x = -\frac{b}{2a}$.
- The $y$-intercept is $(0, c)$.

### Problem

What is the graph of $y = 2x^2 - 8x + 5$?

$x = -\frac{b}{2a} = \frac{-(-8)}{2(2)} = \frac{8}{4} = 2$ Find the equation of the axis of symmetry.

$x$-coordinate of vertex: 2 $-\frac{b}{2a}$

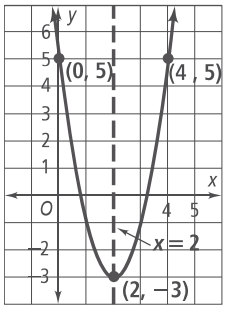
$f\left(-\frac{b}{2a}\right) = f(2) = 2(2)^2 - 8(2) + 5$ Find the $y$-value when $x = 2$.

$= 8 - 16 + 5$

$= -3$

$y$-coordinate of vertex: $-3$ The vertex is $(2, -3)$.

$y$-intercept: $(0, 5)$ The $y$-intercept is at $(0, c) = (0, 5)$.

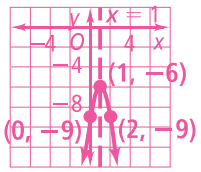



Because $a$ is positive, the graph opens upward, and the vertex is at the bottom of the graph. Plot the vertex and draw the axis of symmetry. Plot (0, 5) and its corresponding point on the other side of the axis of symmetry.

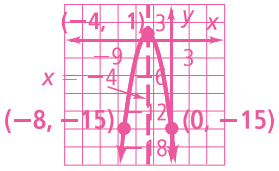
## Exercises

**Graph each parabola. Label the vertex and the axis of symmetry.**

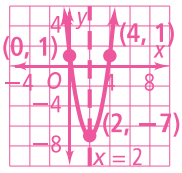
**1.** $y = -3x^2 + 6x - 9$



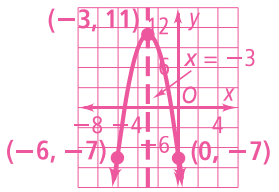

**2.** $y = -x^2 - 8x - 15$




**3.** $y = 2x^2 - 8x + 1$




**4.** $y = -2x^2 - 12x - 7$



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# 4-2 Reteaching (continued)

## Standard Form of a Quadratic Function

- Standard form of a quadratic function is $y = ax^2 + bx + c$. Vertex form of a quadratic function is $y = a(x - h)^2 + k$.
- For a parabola in vertex form, the coordinates of the vertex are $(h, k)$.

**Problem**

What is the vertex form of $y = 3x^2 - 24x + 50$?

| | |
|---|---|
| $y = ax^2 + bx + c$ | |
| $y = 3x^2 - 24x + 50$ | Verify that the equation is in standard form. |
| $b = -24, a = 3$ | Find $b$ and $a$. |
| $x\text{-coordinate} = -\frac{b}{2a}$ | For an equation in standard form, the $x$-coordinate of the vertex can be found by using $x = -\frac{b}{2a}$. |
| $= -\frac{-24}{2(3)}$ | Substitute. |
| $= 4$ | Simplify. |
| $y\text{-coordinate} = 3(4)^2 - 24(4) + 50$ | Substitute 4 into the standard form to find the $y$-coordinate. |
| $= 2$ | Simplify. |
| $y = 3(x - 4)^2 + 2$ | Substitute 4 for $h$ and 2 for $k$ into the vertex form. |

Once the conversion to vertex form is complete, check by multiplying.

$y = 3(x^2 - 8x + 16) + 2$

$y = 3x^2 - 24x + 50$

The result is the standard form of the equation.

## Exercises

**Write each function in vertex form. Check your answers.**

**5.** $y = x^2 - 2x - 3$
$y = (x - 1)^2 - 4$

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

**7.** $y = x^2 + 3x - 10$
$y = \left(x + \frac{3}{2}\right)^2 - \frac{49}{4}$

**8.** $y = x^2 - 9x$
$y = \left(x - \frac{9}{2}\right)^2 - \frac{81}{4}$

**9.** $y = x^2 + x$
$y = \left(x + \frac{1}{2}\right)^2 - \frac{1}{4}$

**10.** $y = x^2 + 5x + 4$
$y = \left(x + \frac{5}{2}\right)^2 - \frac{9}{4}$

**11.** $y = 4x^2 + 8x - 3$
$y = 4(x + 1)^2 - 7$

**12.** $y = \frac{3}{4}x^2 + 9x$
$y = \frac{3}{4}(x + 6)^2 - 27$

**13.** $y = -2x^2 + 2x + 1$
$y = -2\left(x - \frac{1}{2}\right)^2 + \frac{3}{2}$

**Write each function in standard form.**

**14.** $y = (x - 3)^2 + 1$
$y = x^2 - 6x + 10$

**15.** $y = 2(x - 1)^2 - 3$
$y = 2x^2 - 4x - 1$

**16.** $y = -3(x + 4)^2 + 1$
$y = -3x^2 - 24x - 47$