Name _____ Period _____ Date _____

# Study Guide and Intervention

## *Graphing Quadratic Functions*

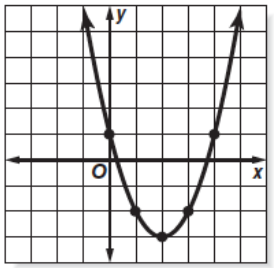
### Graph Quadratic Functions

| | | |
|---|---|---|
| **Quadratic Function** | a function described by an equation of the form $f(x) = ax^2 + bx + c$, where $a \neq 0$ | **Example:** $y = 2x^2 + 3x + 8$ |

The degree of a quadratic function is 2, and the exponents are positive. Graphs of quadratic functions have a general shape called a **parabola**. A parabola opens upward and has a **minimum point** when the value of $a$ is positive, and a parabola opens downward and has a **maximum point** when the value of $a$ is negative.

*Example 1* **Use a table of values to graph $y = x^2 - 4x + 1$.**

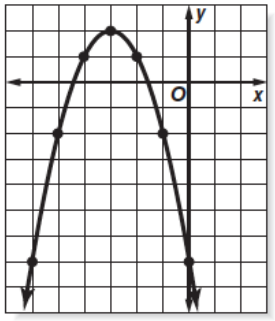
| $x$ | $y$ |
|---|---|
| −1 | 6 |
| 0 | 1 |
| 1 | −2 |
| 2 | −3 |
| 3 | −2 |
| 4 | 1 |




Graph the ordered pairs in the table and connect them with a smooth curve.

*Example 2* **Use a table of values to graph $y = -x^2 - 6x - 7$.**

| $x$ | $y$ |
|---|---|
| −6 | −7 |
| −5 | −2 |
| −4 | 1 |
| −3 | 2 |
| −2 | 1 |
| −1 | −2 |
| 0 | −7 |

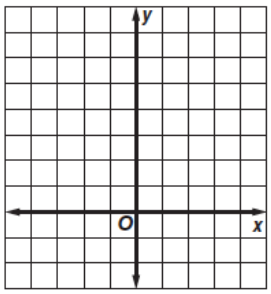



Graph the ordered pairs in the table and connect them with a smooth curve.

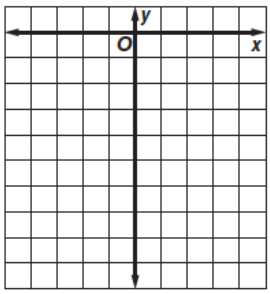
*Exercises*

**Use a table of values to graph each function.**

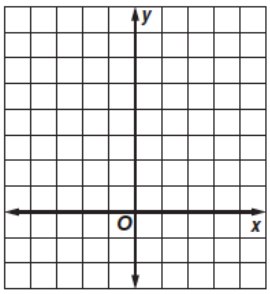
**1.** $y = x^2 + 2$




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




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



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# Study Guide and Intervention *(continued)*

## *Graphing Quadratic Functions*

**Symmetry and Vertices** Parabolas have a geometric property called **symmetry**. That is, if the figure is folded in half, each half will match the other half exactly. The vertical line containing the fold line is called the **axis of symmetry**.

| | | |
|---|---|---|
| **Axis of Symmetry** | For the parabola $y = ax^2 + bx + c$, where $a \neq 0$, the line $x = -\frac{b}{2a}$ is the axis of symmetry. | **Example:** The axis of symmetry of $y = x^2 + 2x + 5$ is the line $x = -1$. |

The axis of symmetry contains the minimum or maximum point of the parabola, the **vertex**.

**Example** **Consider the graph of $y = 2x^2 + 4x + 1$.**

**a. Write the equation of the axis of symmetry.**

In $y = 2x^2 + 4x + 1$, $a = 2$ and $b = 4$. Substitute these values into the equation of the axis of symmetry.

$$x = -\frac{b}{2a}$$

$$x = -\frac{4}{2(2)} = -1$$

The axis of symmetry is $x = -1$.

**b. Find the coordinates of the vertex.**

Since the equation of the axis of symmetry is $x = -1$ and the vertex lies on the axis, the x-coordinate of the vertex is $-1$.

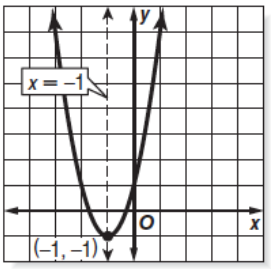
$y = 2x^2 + 4x + 1$ Original equation
$y = 2(-1)^2 + 4(-1) + 1$ Substitute.
$y = 2(1) - 4 + 1$ Simplify.
$y = -1$

The vertex is at $(-1, -1)$.

**c. Identify the vertex as a maximum or a minimum.**

Since the coefficient of the $x^2$-term is positive, the parabola opens upward, and the vertex is a minimum point.

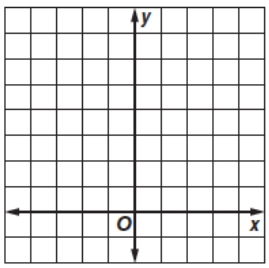
**d. Graph the function.**



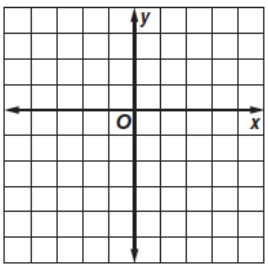

**Exercises**

**Write the equation of the axis of symmetry, and find the coordinates of the vertex of the graph of each function. Identify the vertex as a maximum or a minimum. Then graph the function.**

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




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




**3.** $y = x^2 + 2x + 3$