**9-1 Study Guide and Intervention**

***Graphing Quadratic Functions***

**Characteristics of Quadratic Functions**

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

The parent graph of the family of quadratic functions is *y* = $x^{2}$*.* 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:**

**a. Use a table of values to graph *y* =** $x^{2}$ **– 4*x* + 1.**

|  |  |
| --- | --- |
| x | 5-m-1.jpgy |
| –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.

**b. What are the domain and range of this function?**

 The domain is all real numbers. The range is all real numbers greater than or equal to –3, which is the minimum.

**Example 2:**

**a. Use a table of values to graph *y* = –**$x^{2}$**– 6*x* – 7.**

|  |  |
| --- | --- |
| x | 5-m-2.jpgy |
| –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.

**b. What are the domain and range of this function?**

 The domain is all real numbers. The range is all
real numbers less than or equal to 2, which is the maximum.

**Exercises**

**Use a table of values to graph each function. Determine the domain and range.**

 **1.** *y* = $x^{2}$ + 2 **2.** *y* = –$x^{2}$ – 4 **3.** *y* = $x^{2}$ – 3*x* + 2



**9-1 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**. The axis of symmetry contains the minimum or maximum point of the parabola, the **vertex**.

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

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

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

In *y* = 2$x^{2}$ + 4*x* + 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* = 2$x^{2}$ + 4*x* + 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.**

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**Exercises**

**Consider each equation. Determine whether the function has *maximum* or *minimum* value. State the maximum or minimum value and the domain and range of the function. Find the equation of the axis of symmetry. Graph the function.**

** 1.** *y* = $x^{2}$ + 3 **2.** *y* = –$x^{2}$ – 4*x* – 4 **3.** *y* = $x^{2}$ + 2*x* + 3

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