

8 Graphing Quadratic Functions

- 8.1 Graphing $f(x) = ax^2$
- 8.2 Graphing $f(x) = ax^2 + c$
- 8.3 Graphing $f(x) = ax^2 + bx + c$
- 8.4 Graphing $f(x) = a(x - h)^2 + k$
- 8.5 Using Intercept Form
- 8.6 Comparing Linear, Exponential, and Quadratic Functions



Town Population (p. 464)



Satellite Dish (p. 457)



Roller Coaster (p. 448)



Firework Explosion (p. 437)



Garden Waterfalls (p. 430)

Maintaining Mathematical Proficiency

Graphing Linear Equations

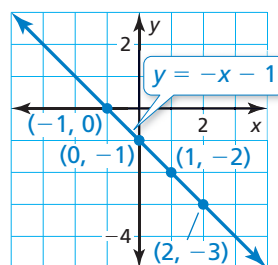
Example 1 Graph $y = -x - 1$.

Step 1 Make a table of values.

x	$y = -x - 1$	y	(x, y)
-1	$y = -(-1) - 1$	0	$(-1, 0)$
0	$y = -(0) - 1$	-1	$(0, -1)$
1	$y = -(1) - 1$	-2	$(1, -2)$
2	$y = -(2) - 1$	-3	$(2, -3)$

Step 2 Plot the ordered pairs.

Step 3 Draw a line through the points.



Graph the linear equation.

- $y = 2x - 3$
- $y = -3x + 4$
- $y = -\frac{1}{2}x - 2$
- $y = x + 5$

Evaluating Expressions

Example 2 Evaluate $2x^2 + 3x - 5$ when $x = -1$.

$$\begin{aligned}
 2x^2 + 3x - 5 &= 2(-1)^2 + 3(-1) - 5 && \text{Substitute } -1 \text{ for } x. \\
 &= 2(1) + 3(-1) - 5 && \text{Evaluate the power.} \\
 &= 2 - 3 - 5 && \text{Multiply.} \\
 &= -6 && \text{Subtract.}
 \end{aligned}$$

Evaluate the expression when $x = -2$.

- $5x^2 - 9$
- $-x^2 + 4x + 1$
- $-2x^2 - 4x + 3$
- $3x^2 + x - 2$
- $x^2 + 8x + 5$
- $-4x^2 + 2x - 6$

11. ABSTRACT REASONING Complete the table. Find a pattern in the differences of consecutive y -values. Use the pattern to write an expression for y when $x = 6$.

x	1	2	3	4	5
$y = ax^2$					

Mathematical Practices

Mathematically proficient students try special cases of the original problem to gain insight into its solution.

Problem-Solving Strategies

Core Concept

Trying Special Cases

When solving a problem in mathematics, it can be helpful to try special cases of the original problem. For instance, in this chapter, you will learn to graph a quadratic function of the form $f(x) = ax^2 + bx + c$. The problem-solving strategy used is to first graph quadratic functions of the form $f(x) = ax^2$. From there, you progress to other forms of quadratic functions.

$$f(x) = ax^2 \quad \text{Section 8.1}$$

$$f(x) = ax^2 + c \quad \text{Section 8.2}$$

$$f(x) = ax^2 + bx + c \quad \text{Section 8.3}$$

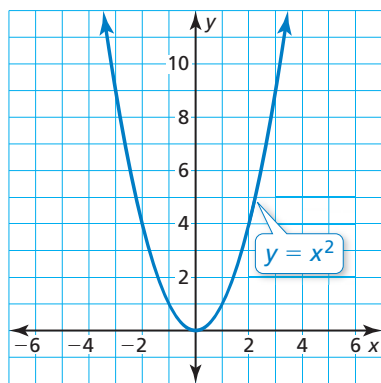
$$f(x) = a(x - h)^2 + k \quad \text{Section 8.4}$$

EXAMPLE 1 Graphing the Parent Quadratic Function

Graph the parent quadratic function $y = x^2$. Then describe its graph.

SOLUTION

The function is of the form $y = ax^2$, where $a = 1$. By plotting several points, you can see that the graph is U-shaped, as shown.



► The graph opens up, and the lowest point is at the origin.

Monitoring Progress

Graph the quadratic function. Then describe its graph.

- $y = -x^2$
- $y = 2x^2$
- $f(x) = 2x^2 + 1$
- $f(x) = 2x^2 - 1$
- $f(x) = \frac{1}{2}x^2 + 4x + 3$
- $f(x) = \frac{1}{2}x^2 - 4x + 3$
- $y = -2(x + 1)^2 + 1$
- $y = -2(x - 1)^2 + 1$
- How are the graphs in Monitoring Progress Questions 1–8 similar? How are they different?