

8.1 Graphing $f(x) = ax^2$ (pp. 419–424)

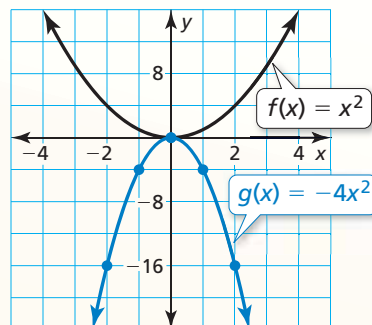
Graph $g(x) = -4x^2$. Compare the graph to the graph of $f(x) = x^2$.

Step 1 Make a table of values.

x	-2	-1	0	1	2
$g(x)$	-16	-4	0	-4	-16

Step 2 Plot the ordered pairs.

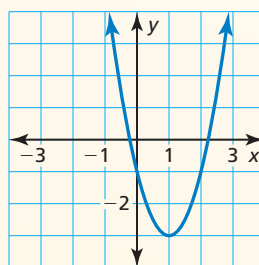
Step 3 Draw a smooth curve through the points.



► The graphs have the same vertex, $(0, 0)$, and the same axis of symmetry, $x = 0$, but the graph of g opens down and is narrower than the graph of f . So, the graph of g is a vertical stretch by a factor of 4 and a reflection in the x -axis of the graph of f .

Graph the function. Compare the graph to the graph of $f(x) = x^2$.

- $p(x) = 7x^2$
 - $q(x) = \frac{1}{2}x^2$
 - $g(x) = -\frac{3}{4}x^2$
 - $h(x) = -6x^2$
5. Identify characteristics of the quadratic function and its graph.

**8.2** Graphing $f(x) = ax^2 + c$ (pp. 425–430)

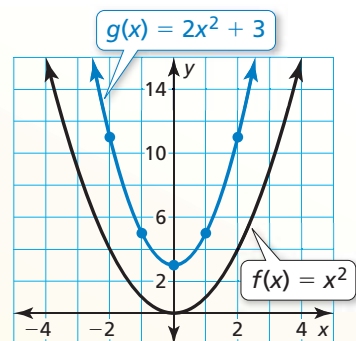
Graph $g(x) = 2x^2 + 3$. Compare the graph to the graph of $f(x) = x^2$.

Step 1 Make a table of values.

x	-2	-1	0	1	2
$g(x)$	11	5	3	5	11

Step 2 Plot the ordered pairs.

Step 3 Draw a smooth curve through the points.



► Both graphs open up and have the same axis of symmetry, $x = 0$. The graph of g is narrower, and its vertex, $(0, 3)$, is above the vertex of the graph of f , $(0, 0)$. So, the graph of g is a vertical stretch by a factor of 2 and a vertical translation 3 units up of the graph of f .

Graph the function. Compare the graph to the graph of $f(x) = x^2$.

- $g(x) = x^2 + 5$
- $h(x) = -x^2 - 4$
- $m(x) = -2x^2 + 6$
- $n(x) = \frac{1}{3}x^2 - 5$

8.3 Graphing $f(x) = ax^2 + bx + c$ (pp. 431–438)

Graph $f(x) = 4x^2 + 8x - 1$. Describe the domain and range.

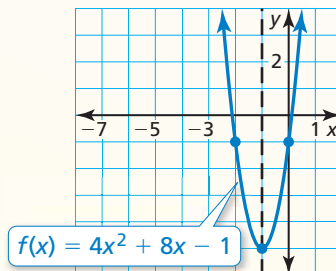
Step 1 Find and graph the axis of symmetry: $x = -\frac{b}{2a} = -\frac{8}{2(4)} = -1$.

Step 2 Find and plot the vertex. The axis of symmetry is $x = -1$. So, the x -coordinate of the vertex is -1 . The y -coordinate of the vertex is $f(-1) = 4(-1)^2 + 8(-1) - 1 = -5$. So, the vertex is $(-1, -5)$.

Step 3 Use the y -intercept to find two more points on the graph. Because $c = -1$, the y -intercept is -1 . So, $(0, -1)$ lies on the graph. Because the axis of symmetry is $x = -1$, the point $(-2, -1)$ also lies on the graph.

Step 4 Draw a smooth curve through the points.

▶ The domain is all real numbers. The range is $y \geq -5$.



Graph the function. Describe the domain and range.

10. $y = x^2 - 2x + 7$ 11. $f(x) = -3x^2 + 3x - 4$ 12. $y = \frac{1}{2}x^2 - 6x + 10$

13. The function $f(t) = -16t^2 + 88t + 12$ represents the height (in feet) of a pumpkin t seconds after it is launched from a catapult. When does the pumpkin reach its maximum height? What is the maximum height of the pumpkin?

8.4 Graphing $f(x) = a(x - h)^2 + k$ (pp. 441–448)

Determine whether $f(x) = 2x^2 + 4$ is *even*, *odd*, or *neither*.

$f(x) = 2x^2 + 4$	Write the original function.
$f(-x) = 2(-x)^2 + 4$	Substitute $-x$ for x .
$= 2x^2 + 4$	Simplify.
$= f(x)$	Substitute $f(x)$ for $2x^2 + 4$.

▶ Because $f(-x) = f(x)$, the function is even.

Determine whether the function is *even*, *odd*, or *neither*.

14. $w(x) = 5^x$ 15. $r(x) = -8x$ 16. $h(x) = 3x^2 - 2x$

Graph the function. Compare the graph to the graph of $f(x) = x^2$.

17. $h(x) = 2(x - 4)^2$ 18. $g(x) = \frac{1}{2}(x - 1)^2 + 1$ 19. $q(x) = -(x + 4)^2 + 7$

20. Consider the function $g(x) = -3(x + 2)^2 - 4$. Graph $h(x) = g(x - 1)$.

21. Write a quadratic function whose graph has a vertex of $(3, 2)$ and passes through the point $(4, 7)$.

8.5 Using Intercept Form (pp. 449–458)

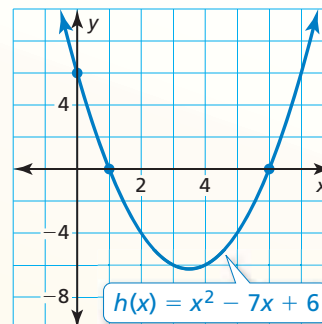
Use zeros to graph $h(x) = x^2 - 7x + 6$.

The function is in standard form. The parabola opens up ($a > 0$), and the y -intercept is 6. So, plot $(0, 6)$.

The polynomial that defines the function is factorable. So, write the function in intercept form and identify the zeros.

$$\begin{aligned} h(x) &= x^2 - 7x + 6 && \text{Write the function.} \\ &= (x - 6)(x - 1) && \text{Factor the trinomial.} \end{aligned}$$

The zeros of the function are 1 and 6. So, plot $(1, 0)$ and $(6, 0)$. Draw a parabola through the points.



Graph the quadratic function. Label the vertex, axis of symmetry, and x -intercepts. Describe the domain and range of the function.

22. $y = (x - 4)(x + 2)$ 23. $f(x) = -3(x + 3)(x + 1)$ 24. $y = x^2 - 8x + 15$

Use zeros to graph the function.

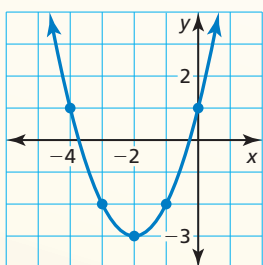
25. $y = -2x^2 + 6x + 8$ 26. $f(x) = x^2 + x - 2$ 27. $f(x) = 2x^3 - 18x$

28. Write a quadratic function in standard form whose graph passes through $(4, 0)$ and $(6, 0)$.

8.6 Comparing Linear, Exponential, and Quadratic Functions (pp. 459–468)

Tell whether the data represent a *linear*, an *exponential*, or a *quadratic* function.

- a. $(-4, 1)$, $(-3, -2)$, $(-2, -3)$
 $(-1, -2)$, $(0, 1)$



► The points appear to represent a quadratic function.

b.

x	-1	0	1	2	3
y	15	8	1	-6	-13

x	-1	0	1	2	3
y	15	8	1	-6	-13

$\overset{+1}{\curvearrowright}$ $\overset{+1}{\curvearrowright}$ $\overset{+1}{\curvearrowright}$ $\overset{+1}{\curvearrowright}$
 $\underset{-7}{\curvearrowleft}$ $\underset{-7}{\curvearrowleft}$ $\underset{-7}{\curvearrowleft}$ $\underset{-7}{\curvearrowleft}$

► The first differences are constant. So, the table represents a linear function.

29. Tell whether the table of values represents a *linear*, an *exponential*, or a *quadratic* function. Then write the function.

x	-1	0	1	2	3
y	512	128	32	8	2

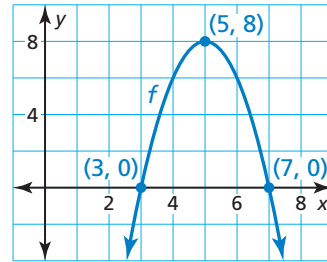
30. The balance y (in dollars) of your savings account after t years is represented by $y = 200(1.1)^t$. The beginning balance of your friend's account is \$250, and the balance increases by \$20 each year.
 (a) Compare the account balances by calculating and interpreting the average rates of change from $t = 2$ to $t = 7$. (b) Predict which account will have a greater balance after 10 years. Explain.

8 Chapter Test

Graph the function. Compare the graph to the graph of $f(x) = x^2$.

1. $h(x) = 2x^2 - 3$ 2. $g(x) = -\frac{1}{2}x^2$ 3. $p(x) = \frac{1}{2}(x + 1)^2 - 1$

4. Consider the graph of the function f .
- Find the domain, range, and zeros of the function.
 - Write the function f in standard form.
 - Compare the graph of f to the graph of $g(x) = x^2$.
 - Graph $h(x) = f(x - 6)$.



Use zeros to graph the function. Describe the domain and range of the function.

5. $f(x) = 2x^2 - 8x + 8$ 6. $y = -(x + 5)(x - 1)$ 7. $h(x) = 16x^2 - 4$

Tell whether the table of values represents a *linear*, an *exponential*, or a *quadratic* function. Explain your reasoning. Then write the function.

8.

x	-1	0	1	2	3
y	4	8	16	32	64

9.

x	-2	-1	0	1	2
y	-8	-2	0	-2	-8

Write a quadratic function in standard form whose graph satisfies the given conditions. Explain the process you used.

10. passes through $(-8, 0)$, $(-2, 0)$, and $(-6, 4)$
 11. passes through $(0, 0)$, $(10, 0)$, and $(9, -27)$
 12. is even and has a range of $y \geq 3$ 13. passes through $(4, 0)$ and $(1, 9)$

14. The table shows the distances d (in miles) that Earth moves in its orbit around the Sun after t seconds. Let the time t be the independent variable. Tell whether the data can be modeled by a *linear*, an *exponential*, or a *quadratic* function. Explain. Then write a function that models the data.

Time, t	1	2	3	4	5
Distance, d	19	38	57	76	95

15. You are playing tennis with a friend. The path of the tennis ball after you return a serve can be modeled by the function $y = -0.005x^2 + 0.17x + 3$, where x is the horizontal distance (in feet) from where you hit the ball and y is the height (in feet) of the ball.
- What is the maximum height of the tennis ball?
 - You are standing 30 feet from the net, which is 3 feet high. Will the ball clear the net? Explain your reasoning.
16. Find values of a , b , and c so that the function $f(x) = ax^2 + bx + c$ is (a) even, (b) odd, and (c) neither even nor odd.
17. Consider the function $f(x) = x^2 + 4$. Find the average rate of change from $x = 0$ to $x = 1$, from $x = 1$ to $x = 2$, and from $x = 2$ to $x = 3$. What do you notice about the average rates of change when the function is increasing?