## 8.1 Start Thinking

Use a graphing calculator to graph the functions in the table. Then complete the table.

| Quadratic equation | Shape | Relationship to $y = x^2$ |
|---|---|---|
| $y = 2x^2$ | | |
| $y = \frac{1}{2}x^2$ | | |
| $y = -x^2$ | | |
| $y = (2x)^2$ | | |

How does the value of the coefficient of $x^2$ change the graph of the quadratic equation? Which graph looks the most different from the others? Explain.

## 8.1 Warm Up

**Graph the equation.**

**1.** $y = -x - 1$

**2.** $y = \frac{3}{2}x + 2$

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

**4.** $y = 3x + 3$

**5.** $y = x$

**6.** $y = \frac{3}{4}x - 3$

## 8.1 Cumulative Review Warm Up

**Use the Distributive Property to find the product.**

**1.** $(x - 2)(x - 2)$

**2.** $(z + 6)(z - 2)$

**3.** $(g + 8)(g + 1)$

**4.** $(y - 7)(y - 3)$

**5.** $(4m)(m - 10)$

**6.** $(x - 4)(x - 1)$

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## 8.1 Practice A

**In Exercises 1–6, graph the function. Compare the graph to the graph of $f(x) = x^2$.**

**1.** $g(x) = 4x^2$

**2.** $h(x) = 1.5x^2$

**3.** $j(x) = \dfrac{1}{3}x^2$

**4.** $g(x) = -3x^2$

**5.** $k(x) = -\dfrac{5}{2}x^2$

**6.** $n(x) = -0.5x^2$

**In Exercises 7–9, use a graphing calculator to graph the function. Compare the graph to the graph of $y = -5x^2$.**

**7.** $y = 5x^2$

**8.** $y = -0.5x^2$

**9.** $y = -0.05x^2$

**10.** The arch support of a bridge can be modeled by $y = -0.00125x^2$, where $x$ and $y$ are measured in feet.

    **a.** The width of the arch is 800 feet. Describe the domain of the function. Explain.

    **b.** Use a graphing calculator to graph the function, using the domain in part (a). Find the height of the arch.

**11.** Is the $y$-intercept of the graph of $y = ax^2$ always 0? Explain.

**In Exercises 12–15, determine whether the statement is *always*, *sometimes*, or *never* true. Explain your reasoning.**

**12.** The graph of $f(x) = ax^2$ is narrower than the graph of $g(x) = dx^2$ when $d = -a$.

**13.** The graph of $f(x) = ax^2$ opens in the same direction as the graph of $g(x) = dx^2$ when $d = |a|$.

**14.** The graph of $f(x) = ax^2$ opens in the same direction as the graph of $g(x) = dx^2$ when $g(x) = f(-x)$.

**15.** The graph of $f(x) = ax^2$ opens in the same direction as the graph of $g(x) = dx^2$ when $g(x) = -f(x)$.

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## 8.1 Practice B

**In Exercises 1–6, graph the function. Compare the graph to the graph of $f(x) = x^2$.**

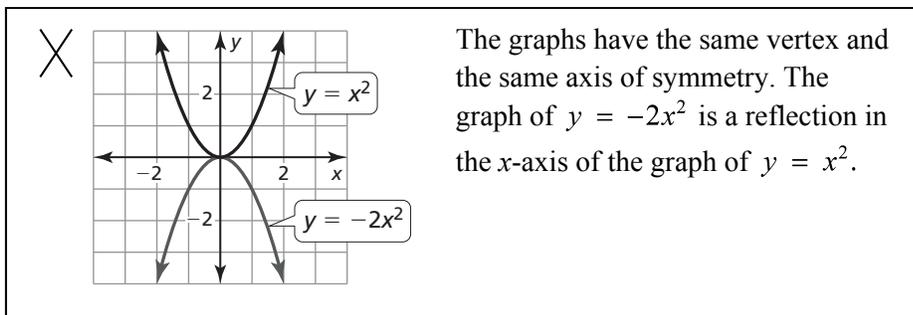**1.** $g(x) = 7x^2$

**2.** $h(x) = 0.25x^2$

**3.** $j(x) = \dfrac{7}{2}x^2$

**4.** $g(x) = -\dfrac{5}{3}x^2$

**5.** $k(x) = -\dfrac{3}{4}x^2$

**6.** $n(x) = -0.4x^2$

**7.** Describe and correct the error in graphing and comparing $y = x^2$ and $y = -2x^2$.



The graphs have the same vertex and the same axis of symmetry. The graph of $y = -2x^2$ is a reflection in the x-axis of the graph of $y = x^2$.

**8.** The arch support of a bridge can be modeled by $y = -\dfrac{1}{300}x^2$, where $x$ and $y$ are measured in feet.

   **a.** The width of the arch is 900 feet. Describe the domain of the function. Explain.

   **b.** Use a graphing calculator to graph the function, using the domain in part (a). Find the height of the arch.

**9.** A parabola opens down and passes through the points $(-3, 4)$ and $(1, -2)$. How do you know that $(-3, 4)$ could be the vertex?

**10.** Given the parabola $f(x) = ax^2$.

   **a.** Find the value of $a$ when the graph passes through $(3, -1)$ and $a < 0$.

   **b.** Find the value of $a$ when the graph passes through $(3, -1)$ and $a > 0$. Explain.

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## **8.1** **Enrichment and Extension**

## **Working with Quadratic Functions**

**In Exercises 1–14, use your knowledge of quadratic functions.**

**1.** Write the equation of any quadratic function $\left(\text{except } y = x^2\right)$.

**2.** Graph the function.

**3.** Determine the maximum (or minimum) point of the equation.

**4.** Determine the domain and range for the function.

**5.** What is the solution to the equation $x^2 = 25$?

**6.** Graph the function $y = x^2 - 25$.

**7.** How does the graph of the function in Exercise 6 help in determining the solution to the equation?

**8.** What is the solution to the equation $x^2 = 16$?

**9.** Graph the function $y = x^2 - 16$.

**10.** How does the graph of the function in Exercise 9 help in determining the solution to the equation?

**11.** What is the solution to the equation $x^2 = -4$?

**12.** Graph the function $y = x^2 + 4$.

**13.** Why is the graph of this function different from the graphs of the functions in Exercises 6 and 9?

**14.** Make a conjecture of the possible reasons for your answer to Exercise 13.

## 8.1 Puzzle Time

## Where Does A Squirrel Keep Its Winter Clothes?

Write the letter of each answer in the box containing the exercise number.

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

**1.** $b(x) = -x^2$

**2.** $p(x) = 5x^2$

**3.** $q(x) = \dfrac{1}{3}x^2$

**4.** $t(x) = -4x^2$

**5.** $c(x) = -0.2x^2$

**6.** $h(x) = 6.4x^2$

**7.** $r(x) = 0.12x^2$

**8.** $d(x) = -\dfrac{8}{5}x^2$

**9.** $s(x) = \dfrac{2}{3}x^2$

**10.** $k(x) = \dfrac{1}{9}x^2$

**11.** The graph of a parabolic bowl can be represented by $g(x) = \dfrac{2}{5}x^2$. Compare the graph to the graph of $f(x) = x^2$.

**12.** The decorated archway at the entrance to a craft fair can be represented by $h(x) = -7x^2$. Compare the graph to the graph of $f(x) = x^2$.

**Answers**

**E.** vertical shrink by a factor of $\dfrac{1}{3}$

**T.** vertical shrink by a factor of $\dfrac{1}{9}$

**K.** reflection in the $x$-axis; vertical shrink by a factor of $0.2$

**N.** reflection in the $x$-axis

**A.** vertical shrink by a factor of $\dfrac{2}{5}$

**T.** vertical shrink by a factor of $0.12$

**R.** reflection in the $x$-axis; vertical stretch by a factor of $4$

**N.** vertical stretch by a factor of $5$

**R.** reflection in the $x$-axis; vertical stretch by a factor of $\dfrac{8}{5}$

**I.** vertical stretch by a factor of $6.4$

**E.** vertical shrink by a factor of $\dfrac{2}{3}$

**U.** reflection in the $x$-axis; vertical stretch by a factor of $7$

| 6 | 2 | | 11 | | 7 | 4 | 9 | 3 | | 10 | 8 | 12 | 1 | 5 |
|---|---|---|----|---|---|---|---|---|---|----|---|----|---|---|
| | | | | | | | | | | | | | | |