

# SKILL PRACTICE

1. **VOCABULARY** Copy and complete: A quadratic function in the form  $y = a(x - h)^2 + k$  is in   ? form.

2. **★ WRITING** Explain how to find a quadratic function's maximum value or minimum value when the function is given in intercept form.

**GRAPHING WITH VERTEX FORM** Graph the function. Label the vertex and axis of symmetry.

3.  $y = (x - 3)^2$

4.  $y = (x + 4)^2$

5.  $f(x) = -(x + 3)^2 + 5$

6.  $y = 3(x - 7)^2 - 1$

7.  $g(x) = -4(x - 2)^2 + 4$

8.  $y = 2(x + 1)^2 - 3$

9.  $f(x) = -2(x - 1)^2 - 5$

10.  $y = -\frac{1}{4}(x + 2)^2 + 1$

11.  $y = \frac{1}{2}(x - 3)^2 + 2$

12. **★ MULTIPLE CHOICE** What is the vertex of the graph of the function  $y = 3(x + 2)^2 - 5$ ?

(A) (2, -5)

(B) (-2, -5)

(C) (-5, 2)

(D) (5, -2)

**GRAPHING WITH INTERCEPT FORM** Graph the function. Label the vertex, axis of symmetry, and  $x$ -intercepts.

13.  $y = (x + 3)(x - 3)$

14.  $y = (x + 1)(x - 3)$

15.  $y = 3(x + 2)(x + 6)$

16.  $f(x) = 2(x - 5)(x - 1)$

17.  $y = -(x - 4)(x + 6)$

18.  $g(x) = -4(x + 3)(x + 7)$

19.  $y = (x + 1)(x + 2)$

20.  $f(x) = -2(x - 3)(x + 4)$

21.  $y = 4(x - 7)(x + 2)$

22. **★ MULTIPLE CHOICE** What is the vertex of the graph of the function  $y = -(x - 6)(x + 4)$ ?

(A) (1, 25)

(B) (-1, 21)

(C) (-6, 4)

(D) (6, -4)

23. **ERROR ANALYSIS** Describe and correct the error in analyzing the graph of the function  $y = 5(x - 2)(x + 3)$ .

The  $x$ -intercepts of the graph are -2 and 3.



**WRITING IN STANDARD FORM** Write the quadratic function in standard form.

24.  $y = (x + 4)(x + 3)$

25.  $y = (x - 5)(x + 3)$

26.  $h(x) = 4(x + 1)(x - 6)$

27.  $y = -3(x - 2)(x - 4)$

28.  $f(x) = (x + 5)^2 - 2$

29.  $y = (x - 3)^2 + 6$

30.  $g(x) = -(x + 6)^2 + 10$

31.  $y = 5(x + 3)^2 - 4$

32.  $f(x) = 12(x - 1)^2 + 4$

**MINIMUM OR MAXIMUM VALUES** Find the minimum value or the maximum value of the function.

33.  $y = 3(x - 3)^2 - 4$

34.  $g(x) = -4(x + 6)^2 - 12$

35.  $y = 15(x - 25)^2 + 130$

36.  $f(x) = 3(x + 10)(x - 8)$

37.  $y = -(x - 36)(x + 18)$

38.  $y = -12x(x - 9)$

39.  $y = 8x(x + 15)$

40.  $y = 2(x - 3)(x - 6)$

41.  $g(x) = -5(x + 9)(x - 4)$

42. **GRAPHING CALCULATOR** Consider the function  $y = a(x - h)^2 + k$  where  $a = 1$ ,  $h = 3$ , and  $k = -2$ . Predict the effect of each change in  $a$ ,  $h$ , or  $k$  described in parts (a)–(c). Use a graphing calculator to check your prediction by graphing the original and revised functions in the same coordinate plane.
- a.  $a$  changes to  $-3$       b.  $h$  changes to  $-1$       c.  $k$  changes to  $2$

**MAKING A GRAPH** Graph the function. Label the vertex and axis of symmetry.

43.  $y = 5(x - 2.25)^2 - 2.75$       44.  $g(x) = -8(x + 3.2)^2 + 6.4$       45.  $y = -0.25(x - 5.2)^2 + 8.5$   
 46.  $y = -\frac{2}{3}\left(x - \frac{1}{2}\right)^2 + \frac{4}{5}$       47.  $f(x) = -\frac{3}{4}(x + 5)(x + 8)$       48.  $g(x) = \frac{5}{2}\left(x - \frac{4}{3}\right)\left(x - \frac{2}{5}\right)$

49. **★ OPEN-ENDED MATH** Write two different quadratic functions in intercept form whose graphs have axis of symmetry  $x = 3$ .

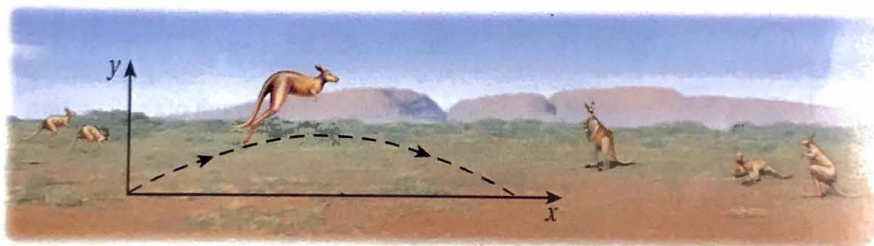
50. **CHALLENGE** Write  $y = a(x - h)^2 + k$  and  $y = a(x - p)(x - q)$  in standard form. Knowing the vertex of the graph of  $y = ax^2 + bx + c$  occurs at  $x = -\frac{b}{2a}$ , show that the vertex of the graph of  $y = a(x - h)^2 + k$  occurs at  $x = h$  and that the vertex of the graph of  $y = a(x - p)(x - q)$  occurs at  $x = \frac{p + q}{2}$ .

## PROBLEM SOLVING

### EXAMPLES 2 and 4

on pp. 246–247  
for Exs. 51–54

51. **BIOLOGY** The function  $y = -0.03(x - 14)^2 + 6$  models the jump of a red kangaroo where  $x$  is the horizontal distance (in feet) and  $y$  is the corresponding height (in feet). What is the kangaroo's maximum height? How long is the kangaroo's jump?



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52. **CIVIL ENGINEERING** The arch of the Gateshead Millennium Bridge forms a parabola with equation  $y = -0.016(x - 52.5)^2 + 45$  where  $x$  is the horizontal distance (in meters) from the arch's left end and  $y$  is the distance (in meters) from the base of the arch. What is the width of the arch?

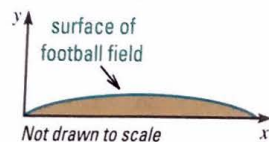
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53. **MULTI-STEP PROBLEM** Although a football field appears to be flat, its surface is actually shaped like a parabola so that rain runs off to both sides. The cross section of a field with synthetic turf can be modeled by

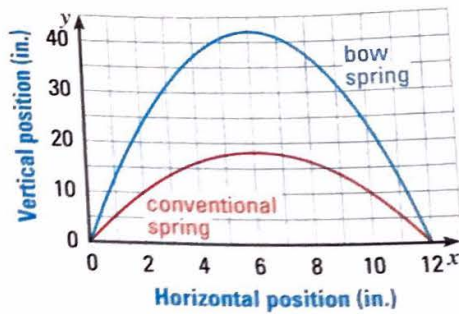
$$y = -0.000234x(x - 160)$$

where  $x$  and  $y$  are measured in feet.

- a. What is the field's width?  
 b. What is the maximum height of the field's surface?



54. ★ **SHORT RESPONSE** A jump on a pogo stick with a conventional spring can be modeled by  $y = -0.5(x - 6)^2 + 18$ , and a jump on a pogo stick with a bow spring can be modeled by  $y = -1.17(x - 6)^2 + 42$ , where  $x$  and  $y$  are measured in inches. Compare the maximum heights of the jumps on the two pogo sticks. Which constants in the functions affect the maximum heights of the jumps? Which do not?



55. ★ **EXTENDED RESPONSE** A kernel of popcorn contains water that expands when the kernel is heated, causing it to pop. The equations below give the "popping volume"  $y$  (in cubic centimeters per gram) of popcorn with moisture content  $x$  (as a percent of the popcorn's weight).

**Hot-air popping:**  $y = -0.761(x - 5.52)(x - 22.6)$

**Hot-oil popping:**  $y = -0.652(x - 5.35)(x - 21.8)$

- a. **Interpret** For hot-air popping, what moisture content maximizes popping volume? What is the maximum volume?
- b. **Interpret** For hot-oil popping, what moisture content maximizes popping volume? What is the maximum volume?
- c. **Graphing Calculator** Graph the functions in the same coordinate plane. What are the domain and range of each function in this situation? *Explain* how you determined the domain and range.
56. **CHALLENGE** Flying fish use their pectoral fins like airplane wings to glide through the air. Suppose a flying fish reaches a maximum height of 5 feet after flying a horizontal distance of 33 feet. Write a quadratic function  $y = a(x - h)^2 + k$  that models the flight path, assuming the fish leaves the water at  $(0, 0)$ . Describe how changing the value of  $a$ ,  $h$ , or  $k$  affects the flight path.



## MISSOURI MIXED REVIEW

TEST PRACTICE at [classzone.com](http://classzone.com)

57. A salesperson wants to analyze the time he spends driving to visit clients. In a typical week, the salesperson drives 870 miles during a period of 22 hours. His average speed is 65 miles per hour on the highway and 30 miles per hour in the city. About how many hours a week does the salesperson spend driving in the city?

(A) 6 h                      (B) 8.2 h                      (C) 13.9 h                      (D) 16 h

58. What is the approximate area of the shaded region?

(A)  $21.5 \text{ cm}^2$   
 (B)  $42.9 \text{ cm}^2$   
 (C)  $121.4 \text{ cm}^2$   
 (D)  $150 \text{ cm}^2$

