Study Guide and Review - Chapter 4

State whether each sentence is *true* or *false*. If *false*, replace the underlined term to make a true sentence.

1. The factored form of a quadratic equation is $ax^2 + bx + c = 0$ where $a \neq 0$ and a, b, and c are integers.

ANSWER:
false, standard form

2. The graph of a quadratic function is called a parabola.

ANSWER:
true

3. The vertex form of a quadratic function is $y = a(x - p)(x - q)$.

ANSWER:
false, factored form

4. The axis of symmetry will intersect a parabola in one point called the vertex.

ANSWER:
true

5. A method called FOIL method is used to make a quadratic expression a perfect square in order to solve the related equation.

ANSWER:
false, completing the square

6. The equation $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ is known as the discriminant.

ANSWER:
false, Quadratic Formula

7. The number 6i is called a pure imaginary number.

ANSWER:
true

8. The two numbers $2 + 3i$ and $2 - 3i$ are called complex conjugates.

ANSWER:
true

Complete parts a–c for each quadratic function.

a. Find the *y*-intercept, the equation of the axis of symmetry, and the *x*-coordinate of the vertex.

b. Make a table of values that includes the vertex.

c. Use this information to graph the function.

9. $f(x) = x^2 + 5x + 12$

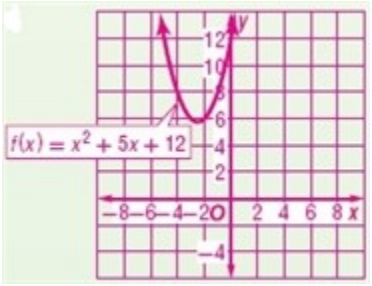
ANSWER:

a. *y*-int: 12; $x = \frac{-5}{2}; \frac{-5}{2}$

b.

x	f(x)
−3	6
$\frac{-5}{2}$	$\frac{23}{4}$
−2	6
−1	8
0	12

c.



10. $f(x) = x^2 - 7x + 15$

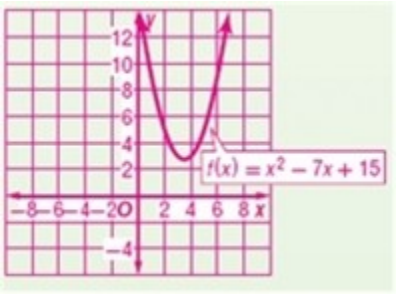
ANSWER:

a. *y*-int: 15; $x = \frac{7}{2}; \frac{7}{2}$

b.

x	f(x)
2	5
3	3
$\frac{7}{2}$	$\frac{11}{4}$
4	3
5	5

c.



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

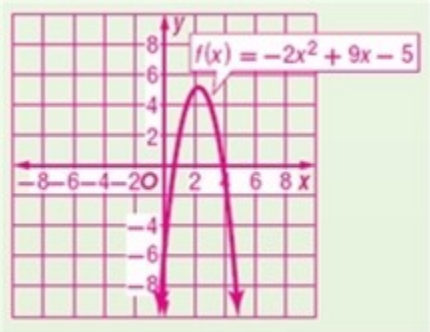
ANSWER:

a. y-int: -5; $x = \frac{9}{4}; \frac{9}{4}$

b.

x	$f(x)$
1	2
2	5
$\frac{9}{4}$	$\frac{41}{8}$
3	4
4	−1

c.



12. $f(x) = -3x^2 + 12x - 1$

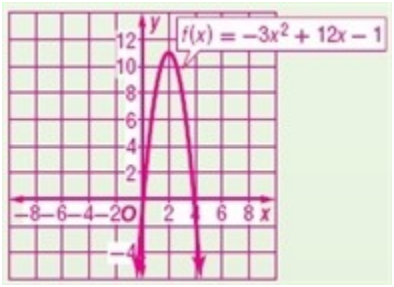
ANSWER:

a. y-int: -1; x = 2; 2

b.

x	$f(x)$
0	−1
1	8
2	11
3	8
4	−1

c.



Determine whether each function has a maximum or minimum value and find the maximum or minimum value. Then state the domain and range of the function.

13. $f(x) = -x^2 + 3x - 1$

ANSWER:

max; 1.25; D = {all real numbers};

$R = \{f(x) | f(x) \leq 1.25\}$

14. $f(x) = -3x^2 - 4x + 5$

ANSWER:
max; $\frac{19}{3}$; D = {all real numbers};

$R = \left\{ f(x) \middle| f(x) \leq \frac{19}{3} \right\}$

15. **BUSINESS** Sal's Shirt Store sells 100 T-shirts per week at a rate of $10 per shirt. Sal estimates that he will sell 5 less shirts for each $1 increase in price. What price will maximize Sal's T-shirt income?

ANSWER:
75 T-shirts at $15 each

Solve each equation by graphing. If exact roots cannot be found, state the consecutive integers between which the roots are located.

16. $x^2 - x - 20 = 0$

ANSWER:
{–4, 5}

17. $2x^2 - x - 3 = 0$

ANSWER:
$\left\{-1, \frac{3}{2}\right\}$

18. $4x^2 - 6x - 15 = 0$

ANSWER:
between –1 and –2; between 2 and 3

19. **BASEBALL** A baseball is hit upward at 120 feet per second. Use the formula $h(t) = v_0 t - 16t^2$, where $h(t)$ is the height of an object in feet, v_0 is the object's initial velocity in feet per second, and t is the time in seconds. Ignoring the height of the ball when it was hit, how long does it take for the ball to hit the ground?

ANSWER:
7.5 seconds

Write a quadratic equation in standard form with the given roots.

20. 5, 6

ANSWER:
$x^2 - 11x + 30 = 0$

21. –3, –7

ANSWER:
$x^2 + 10x + 21 = 0$

22. –4, 2

ANSWER:
$x^2 + 2x - 8 = 0$

23. $-\frac{2}{3}, 1$

ANSWER:
$3x^2 - x - 2 = 0$

24. $\frac{1}{6}, 5$

ANSWER:
$6x^2 - 31x + 5 = 0$

25. $-\frac{1}{4}, -1$

ANSWER:
$4x^2 + 5x + 1 = 0$

Solve each equation by factoring.

26. $2x^2 - 2x - 24 = 0$

ANSWER:
{–3, 4}

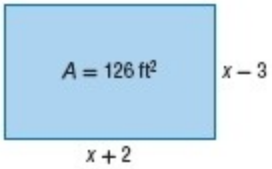
27. $2x^2 - 5x - 3 = 0$

ANSWER:
$\left\{-\frac{1}{2}, 3\right\}$

28. $3x^2 - 16x + 5 = 0$

ANSWER:
$\left\{\frac{1}{3}, 5\right\}$

29. Find x and the dimensions of the rectangle below.



ANSWER:
$x = 12$; 9 feet by 14 feet

Simplify.

30. $\sqrt{-8}$

ANSWER:
$2i\sqrt{2}$

31. $(2 - i) + (13 + 4i)$

ANSWER:
$15 + 3i$

32. $(6 + 2i) - (4 - 3i)$

ANSWER:
$2 + 5i$

33. $(6 + 5i)(3 - 2i)$

ANSWER:
$28 + 3i$

34. **ELECTRICITY** The impedance in one part of a series circuit is $3 + 2j$ ohms, and the impedance in the other part of the circuit is $4 - 3j$ ohms. Add these complex numbers to find the total impedance in the circuit.

ANSWER:
$7 - j$ ohms

Solve each equation.

35. $2x^2 + 50 = 0$

ANSWER:
$\pm 5i$

36. $4x^2 + 16 = 0$

ANSWER:
$\pm 2i$

37. $3x^2 + 15 = 0$

ANSWER:
$\pm i\sqrt{5}$

38. $8x^2 + 16 = 0$

ANSWER:
$\pm i\sqrt{2}$

39. $4x^2 + 1 = 0$

ANSWER:
$\pm \frac{1}{2}i$

Find the value of *c* that makes each trinomial a perfect square. Then write the trinomial as a perfect square.

40. $x^2 + 18x + c$

ANSWER:
81; $(x + 9)^2$

41. $x^2 - 4x + c$

ANSWER:
4; $(x - 2)^2$

42. $x^2 - 7x + c$

ANSWER:
$\frac{49}{4}; \left(x - \frac{7}{2}\right)^2$

43. $x^2 + 2.4x + c$

ANSWER:
1.44; $(x + 1.2)^2$

44. $x^2 - \frac{1}{2}x + c$

ANSWER:
$\frac{1}{16}; \left(x - \frac{1}{4}\right)^2$

45. $x^2 + \frac{6}{5}x + c$

ANSWER:

$\frac{9}{25}; \left(x + \frac{3}{5}\right)^2$

Solve each equation by completing the square.

46. $x^2 - 6x - 7 = 0$

ANSWER:

{–1, 7}

47. $x^2 - 2x + 8 = 0$

ANSWER:

$\{1 \pm i\sqrt{7}\}$

48. $2x^2 + 4x - 3 = 0$

ANSWER:

$\left\{\frac{-2 \pm \sqrt{10}}{2}\right\}$

49. $2x^2 + 3x - 5 = 0$

ANSWER:

$\left\{1, -\frac{5}{2}\right\}$

50. **FLOOR PLAN** Mario's living room has a length 6 feet wider than the width. The area of the living room is 280 square feet. What are the dimensions of his living room?

ANSWER:

20 feet by 14 feet

Complete parts a–c for each quadratic equation.

a. Find the value of the discriminant.

b. Describe the number and type of roots.

c. Find the exact solutions by using the Quadratic Formula.

51. $x^2 - 10x + 25 = 0$

ANSWER:

a. 0

b. 1 real rational root

c. {5}

52. $x^2 + 4x - 32 = 0$

ANSWER:

a. 144

b. 2 rational real roots

c. {–8, 4}

53. $2x^2 + 3x - 18 = 0$

ANSWER:

a. 153

b. 2 irrational real roots

c. $\left\{\frac{-3 \pm 3\sqrt{17}}{4}\right\}$

54. $2x^2 + 19x - 33 = 0$

ANSWER:

a. 625

b. 2 real rational roots

c. $\left\{-11, \frac{3}{2}\right\}$

55. $x^2 - 2x + 9 = 0$

ANSWER:

a. –32

b. 2 complex roots

c. $\left\{1 \pm 2i\sqrt{2}\right\}$

56. $4x^2 - 4x + 1 = 0$

ANSWER:

a. 0

b. 1 real rational root

c. $\left\{\frac{1}{2}\right\}$

57. $2x^2 + 5x + 9 = 0$

ANSWER:

a. –47

b. 2 complex roots

c. $\left\{\frac{-5 \pm i\sqrt{47}}{4}\right\}$

58. **PHYSICAL SCIENCE** Lauren throws a ball with an initial velocity of 40 feet per second. The equation for the height of the ball is $h = -16t^2 + 40t + 5$, where h represents the height in feet and t represents the time in seconds. When will the ball hit the ground?

ANSWER:

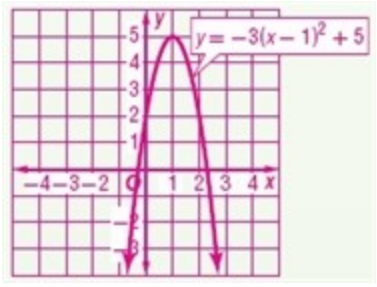
about 2.62 seconds

Write each quadratic function in vertex form, if not already in that form. Then identify the vertex, axis of symmetry, and direction of opening. Then graph the function.

59. $y = -3(x-1)^2 + 5$

ANSWER:

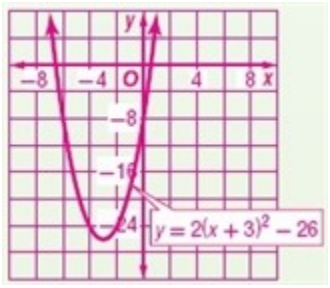
$y = -3(x - 1)^2 + 5$; (1, 5); $x = 1$; opens down



60. $y = 2x^2 + 12x - 8$

ANSWER:

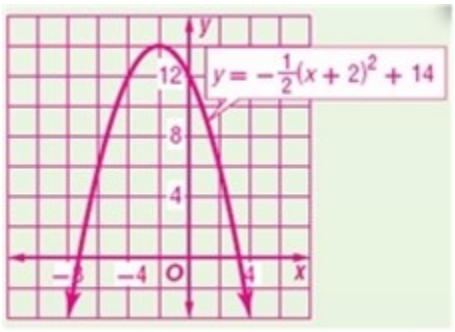
$y = 2(x + 3)^2 - 26$; (–3, –26); $x = –3$; opens up



61. $y = -\frac{1}{2}x^2 - 2x + 12$

ANSWER:

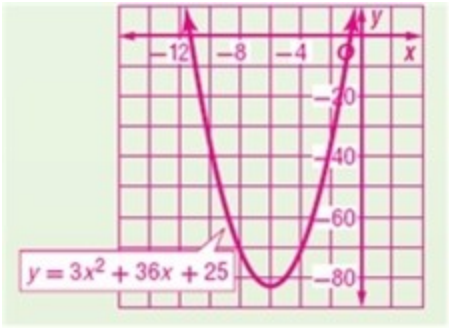
$y = -\frac{1}{2}(x + 2)^2 + 14$; (–2, 14); $x = –2$; opens down



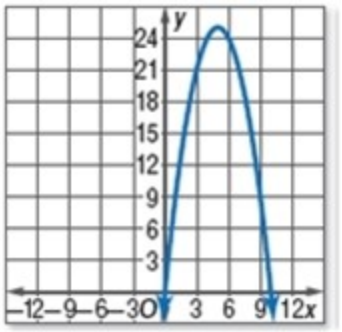
62. $y = 3x^2 + 36x + 25$

ANSWER:

$y = 3(x + 6)^2 - 83$; (–6, –83); $x = 6$; opens up



63. The graph at the right shows a product of 2 numbers with a sum of 10. Find a function that models this product and use it to determine the two numbers that would give a maximum product.



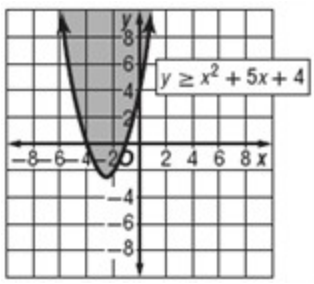
ANSWER:

$f(x) = –x^2 + 10x$; 5 and 5

Graph each quadratic inequality.

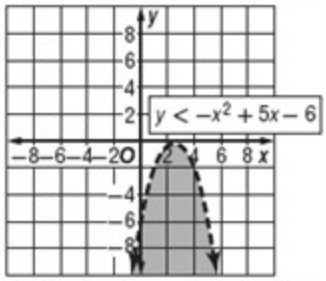
64. $y \geq x^2 + 5x + 4$

ANSWER:



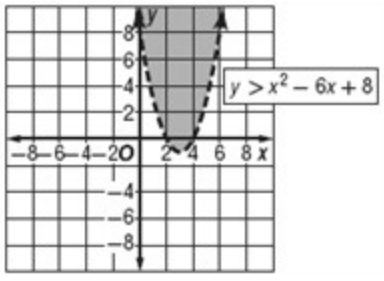
65. $y < -x^2 + 5x - 6$

ANSWER:



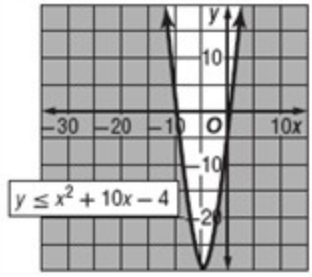
66. $y > x^2 - 6x + 8$

ANSWER:

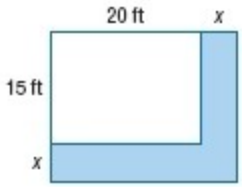


67. $y \leq x^2 + 10x - 4$

ANSWER:



68. Solomon wants to put a deck along two sides of his garden. The deck width will be the same on both sides and the total area of the garden and deck cannot exceed 500 square feet. How wide can the deck be?



ANSWER:
between 0 and 5 ft

Solve each inequality using a graph or algebraically.

69. $x^2 + 8x + 12 > 0$

ANSWER:
$\{x \mid x < -6 \text{ or } x > -2\}$

70. $6x + x^2 \geq -9$

ANSWER:
all real numbers

71. $2x^2 + 3x - 20 > 0$

ANSWER:

$\left\{x \mid x < -4 \text{ or } x > \frac{5}{2}\right\}$

72. $4x^2 - 3 < -5x$

ANSWER:

$\{x \mid -1.69 < x < 0.44\}$

73. $3x^2 + 4 > 8x$

ANSWER:

$\left\{x \mid x < \frac{2}{3} \text{ or } x > 2\right\}$