Write a quadratic equation in standard form with the given root(s).

1. $-8, 5$

ANSWER:

$x^2 + 3x - 40 = 0$

2. $\dfrac{3}{2}, \dfrac{1}{4}$

ANSWER:

$8x^2 - 14x + 3 = 0$

3. $-\dfrac{2}{3}, \dfrac{5}{2}$

ANSWER:

$6x^2 - 11x - 10 = 0$

Factor each polynomial.

4. $35x^2 - 15x$

ANSWER:

$5x(7x - 3)$

5. $18x^2 - 3x + 24x - 4$

ANSWER:

$(6x - 1)(3x + 4)$

6. $x^2 - 12x + 32$

ANSWER:

$(x - 8)(x - 4)$

7. $x^2 - 4x - 21$

ANSWER:

$(x - 7)(x + 3)$

8. $2x^2 + 7x - 30$

ANSWER:

$(2x - 5)(x + 6)$

9. $16x^2 - 16x + 3$

ANSWER:

$(4x - 3)(4x - 1)$

Solve each equation.

10. $x^2 - 36 = 0$

ANSWER:

$-6, 6$

11. $12x^2 - 18x = 0$

ANSWER:

$0, \dfrac{3}{2}$

12. $12x^2 - 2x - 2 = 0$

ANSWER:

$-\dfrac{1}{3}, \dfrac{1}{2}$

13. $x^2 - 9x = 0$

ANSWER:

$0, 9$

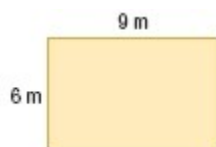14. $x^2 - 3x - 28 = 0$

ANSWER:

$-4, 7$

15. $2x^2 - 24x = -72$

ANSWER:
6

16. **CCSS SENSE-MAKING** Tamika wants to double the area of her garden by increasing the length and width by the same amount. What will be the dimensions of her garden then?

ANSWER:
9 m by 12 m

Write a quadratic equation in standard form with the given root(s).

17. 7

ANSWER:
$x^2 - 14x + 49 = 0$

18. $-5, \dfrac{1}{2}$

ANSWER:
$2x^2 + 9x - 5 = 0$

19. $\dfrac{1}{5}, 6$

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

Factor each polynomial.

20. $40a^2 - 32a$

ANSWER:
$8a(5a - 4)$

21. $51c^3 - 34c$

ANSWER:
$17c(3c^2 - 2)$

22. $32xy + 40bx - 12ay - 15ab$

ANSWER:
$(8x - 3a)(4y + 5b)$

23. $3x^2 - 12$

ANSWER:
$3(x + 2)(x - 2)$

24. $15y^2 - 240$

ANSWER:
$15(y + 4)(y - 4)$

25. $48cg + 36cf - 4dg - 3df$

ANSWER:
$(12c - d)(4g + 3f)$

26. $x^2 + 13x + 40$

ANSWER:
$(x + 8)(x + 5)$

27. $x^2 - 9x - 22$

ANSWER:
$(x - 11)(x + 2)$

28. $3x^2 + 12x - 36$

ANSWER:
$3(x + 6)(x - 2)$

29. $15x^2 + 7x - 2$

ANSWER:
$(5x - 1)(3x + 2)$

30. $4x^2 + 29x + 30$

ANSWER:
$(4x + 5)(x + 6)$

31. $18x^2 + 15x - 12$

ANSWER:
$3(2x - 1)(3x + 4)$

32. $8x^2z^2 - 4xz^2 - 12z^2$

ANSWER:
$4z^2(2x - 3)(x + 1)$

33. $9x^2 - 25$

ANSWER:
$(3x + 5)(3x - 5)$

34. $18x^2y^2 - 24xy^2 + 36y^2$

ANSWER:
$6y^2(3x^2 - 4x + 6)$

35. $15x^2 - 84x - 36$

ANSWER:
$3(5x + 2)(x - 6)$

36. $12x^2 + 13x - 14$

ANSWER:
$(4x + 7)(3x - 2)$

37. $12xy^2 - 108x$

ANSWER:
$12x(y + 3)(y - 3)$

Solve each equation by factoring.

38. $x^2 + 4x - 45 = 0$

ANSWER:
$5, -9$

39. $x^2 - 5x - 24 = 0$

ANSWER:
$8, -3$

40. $x^2 = 121$

ANSWER:
$11, -11$

41. $x^2 + 13 = 17$

    ANSWER:
    2, –2

42. $-3x^2 - 10x + 8 = 0$

    ANSWER:
    $-4, \dfrac{2}{3}$

43. $-8x^2 + 46x - 30 = 0$

    ANSWER:
    $5, \dfrac{3}{4}$

44. **GEOMETRY** The hypotenuse of a right triangle is 1 centimeter longer than one side and 4 centimeters longer than three times the other side. Find the dimensions of the triangle.
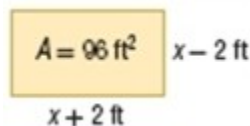
    ANSWER:
    7 cm, 24 cm, 25 cm

45. **NUMBER THEORY** Find two consecutive even integers with a product of 624.
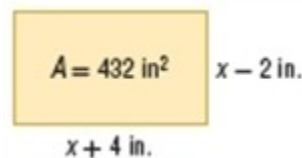
    ANSWER:
    24 and 26 or -24 and -26

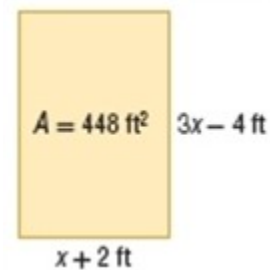**GEOMETRY Find x and the dimensions of each rectangle.**

46.
$A = 96\ ft^2$ $x - 2\ ft$
$x + 2\ ft$

    ANSWER:
    $x = 10$; 8 ft by 12 ft

47.
$A = 432\ in^2$ $x - 2\ in.$
$x + 4\ in.$

    ANSWER:
    $x = 20$; 24 in. by 18 in.

48.
$A = 448\ ft^2$ $3x - 4\ ft$
$x + 2\ ft$

    ANSWER:
    $x = 12$; 14 ft by 32 ft

Solve each equation by factoring.

49. $12x^2 - 4x = 5$

    ANSWER:
    $-\dfrac{1}{2}, \dfrac{5}{6}$

50. $5x^2 = 15x$

ANSWER:
0, 3

51. $16x^2 + 36 = -48x$

ANSWER:
$-\dfrac{3}{2}$

52. $75x^2 - 60x = -12$

ANSWER:
$\dfrac{2}{5}$

53. $4x^2 - 144 = 0$

ANSWER:
6, −6

54. $-7x + 6 = 20x^2$

ANSWER:
$\dfrac{2}{5}, -\dfrac{3}{4}$

55. **MOVIE THEATER** A company plans to build a large multiplex theater. The financial analyst told her manager that the profit function for their theater was $P(x) = -x^2 + 48x - 512$, where x is the number of movie screens, and $P(x)$ is the profit earned in thousands of dollars. Determine the range of production of movie screens that will guarantee that the company will not lose money.

ANSWER:
16 to 32 screens

Write a quadratic equation in standard form with the given root(s).

56. $-\dfrac{4}{7}, \dfrac{3}{8}$

ANSWER:
$56x^2 + 11x - 12 = 0$

57. 3.4, 0.6

ANSWER:
$25x^2 - 100x + 51 = 0$

58. $\dfrac{2}{11}, \dfrac{5}{9}$

ANSWER:
$99x^2 - 73x + 10 = 0$

Solve each equation by factoring.

59. $10x^2 + 25x = 15$

ANSWER:
$-3, \dfrac{1}{2}$

60. $27x^2 + 5 = 48x$

ANSWER:

$\dfrac{5}{3}, \dfrac{1}{9}$

61. $x^2 + 0.25x = 1.25$

ANSWER:

$1, -\dfrac{5}{4}$

62. $48x^2 - 15 = -22x$

ANSWER:

$\dfrac{3}{8}, -\dfrac{5}{6}$
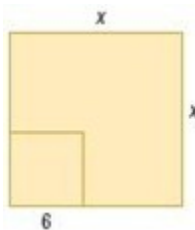
63. $3x^2 + 2x = 3.75$

ANSWER:

$-\dfrac{3}{2}, \dfrac{5}{6}$

64. $-32x^2 + 56x = 12$

ANSWER:

$\dfrac{1}{4}, \dfrac{3}{2}$

65. **DESIGN** A square is cut out of the figure at the right. Write an expression for the area of the figure that remains, and then factor the expression.
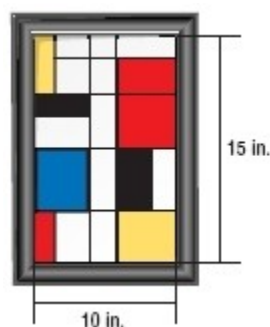

ANSWER:

$x^2 - 6^2$; $(x + 6)(x - 6)$

66. **CCSS PERSEVERANCE** After analyzing the market, a company that sells Web sites determined the profitability of their product was modeled by $P(x) = -16x^2 + 368x - 2035$, where x is the price of each Web site and $P(x)$ is the company's profit. Determine the price range of the Web sites that will be profitable for the company.

ANSWER:
$9.25 to $13.75

67. **PAINTINGS** Enola wants to add a border to her painting, distributed evenly, that has the same area as the painting itself. What are the dimensions of the painting with the border included?

ANSWER:
20 in. by 15 in.

68. **MULTIPLE REPRESENTATIONS** In this problem, you will consider $a(x - p)(x - q) = 0$.

a. GRAPHICAL Graph the related function for $a = 1, p = 2,$ and $q = -3.$

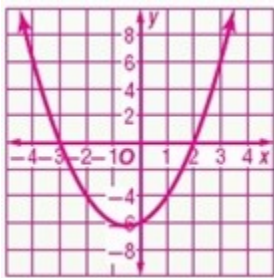**b. ANALYTICAL** What are the solutions of the equation?

c. GRAPHICAL Graph the related functions for $a = 4, -3,$ and $\dfrac{1}{2}$ on the same graph.

d. VERBAL What are the similarities and differences between the graphs?

e. VERBAL What conclusion can you make about the relationship between the factored form of a quadratic equation and its solutions?
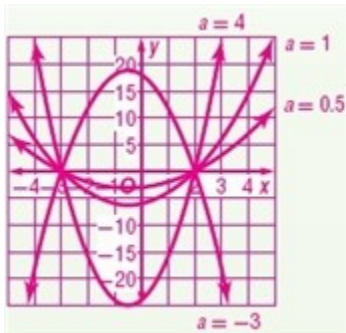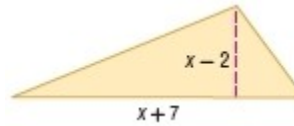
ANSWER:
a.

b. 2 and −3

c.

d. Sample answer: They all have the same roots, p and q. Therefore, they all have the same solutions. The graphs are shaped differently due to the value of a. The graph with $a = -3$ is flipped due to the negative.

e. When quadratic equations have the same factors, they will have the same solutions, regardless of the value of a, which only affects the shape of the graphs.

69. **GEOMETRY** The area of the triangle is 26 square centimeters. Find the length of the base.

ANSWER:
13 cm

70. **SOCCER** When a ball is kicked in the air, its height in meters above the ground can be modeled by $h(t) = -4.9t^2 + 14.7t$ and the distance it travels can be modeled by $d(t) = 16t$, where t is the time in seconds.

a. How long was the ball in the air?

b. How far did it travel before it hit the ground? (Hint: Ignore air resistance.)

c. What was the maximum height of the ball?

ANSWER:
a. 3 seconds
b. 48 m
c. 11.025 m

Factor each polynomial.

71. $18a - 24ay + 48b - 64by$

ANSWER:
$2(3 - 4y)(3a + 8b)$

72. $3x^2 + 2xy + 10y + 15x$

ANSWER:
$(3x + 2y)(x + 5)$

73. $6a^2b^2 - 12ab^2 - 18b^3$

ANSWER:
$6b^2(a^2 - 2a - 3b)$

74. $12a^2 - 18ab + 30ab^3$

ANSWER:
$6a(2a - 3b + 5b^3)$

75. $32ax + 12bx - 48ay - 18by$

ANSWER:
$2(2x - 3y)(8a + 3b)$

76. $30ac + 80bd + 40ad + 60bc$

ANSWER:
$10(a + 2b)(3c + 4d)$

77. $5ax^2 - 2by^2 - 5ay^2 + 2bx^2$

ANSWER:
$(x + y)(x - y)(5a + 2b)$

78. $12c^2x + 4d^2y - 3d^2x - 16c^2y$

ANSWER:
$(2c + d)(2c - d)(3x - 4y)$

79. **ERROR ANALYSIS** Gwen and Morgan are solving $-12x^2 + 5x + 2 = 0$. Is either of them correct? Explain your reasoning.

Gwen
$-12x^2 + 5x + 2 = 0$
$-12x^2 + 8x - 3x + 2 = 0$
$4x(-3x + 2) - (3x + 2) = 0$
$(4x - 1)(3x + 2) = 0$
$x = \dfrac{1}{4}$ or $-\dfrac{2}{3}$

Morgan
$-12x^2 + 5x + 2 = 0$
$-12x^2 + 8x - 3x + 2 = 0$
$4x(-3x + 2) + (-3x + 2) = 0$
$(4x + 1)(-3x + 2) = 0$
$x = -\dfrac{1}{4}$ or $\dfrac{2}{3}$

ANSWER:
Sample answer: Morgan; Gwen did not have like terms in the parentheses in the third line.

80. **CHALLENGE** Solve $3x^6 - 39x^4 + 108x^2 = 0$ by factoring.

ANSWER:
0, 3, –3, 2, or –2

81. **CHALLENGE** The rule for factoring a difference of cubes is shown below. Use this rule to factor $40x^5 - 135x^2y^3$.][

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

ANSWER:
$5x^2(2x - 3y)(4x^2 + 6xy + 9y^2)$

82. **OPEN ENDED** Choose two integers. Then write an equation in standard form with those roots. How would the equation change if the signs of the two roots were switched?

    ANSWER:

    Sample answer: 3 and 6 → $x^2 - 9x + 18 = 0$. -3 and -6 → $x^2 + 9x + 18 = 0$. The linear term changes sign.

83. **CHALLENGE** For a quadratic equation of the form $(x - p)(x - q) = 0$, show that the axis of symmetry of the related quadratic function is located halfway between the x-intercepts p and q.

    ANSWER:
    Sample answer:

$(x - p)(x - q) = 0$	Original equation
$x^2 - px - qx + pq = 0$	Multiply
$x^2 - (p + q)x + pq = 0$	Simplify.
$x = -\dfrac{b}{2a}$	Formula for axis of symmetry
$x = -\dfrac{-(p + q)}{2(1)}$	$a = 1$ and $b = -(p + q)$
$x = \dfrac{p + q}{2}$	Simplify.
x is midway between p and q.	Definition of midpoint

84. **WRITE A QUESTION** A classmate is using the guess and check strategy to factor trinomials of the form $x^2 + bx + c$. Write a question to help him think of a way to use that strategy for $ax^2 + bx + c$.

    ANSWER:

    Sample answer: What do you know about $a \cdot c$ to use guess and check to factor trinomials of the form $ax^2 + bx + c$?

85. **CCSS ARGUMENTS** Determine whether the following statement is *sometimes, always,* or *never* true. Explain your reasoning.
    In a quadratic equation in standard form where a, b, and c are integers, if b is odd, then the quadratic cannot be a perfect square trinomial.

    ANSWER:

    Sample answer: Always; in order to factor using perfect square trinomials, the coefficient of the linear term, bx, must be a multiple of 2, or even.

86. **WRITING IN MATH** Explain how to factor a trinomial in standard form with $a > 1$.

    ANSWER:

    Sample answer: In standard form, we have $ax^2 + bx + c$. Multiply a and c.
    Then find a pair of integers, g and h, that multiply to equal ac and add to equal b.
    Then write out the quadratic, turning the middle term, bx, into $gx + hx$.
    We now have $ax^2 + gx + hx + c$.
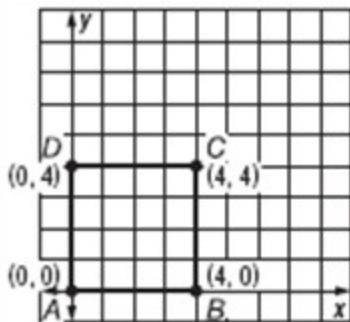   Now factor the GCF from the first two terms and then factor the GCF from the second two terms.
    So we now have GCF$(x - q)$ + GCF$_2(x - q)$.
    Simplifying, we get (GCF + GCF$_2$)$(x - q)$ or $(x - p)(x - q)$.

87. **SHORT RESPONSE** If $ABCD$ is transformed by $(x, y) \rightarrow (3x, 4y)$, determine the area of $A'B'C'D'$.

ANSWER:
192 square units

88. For $y = 2|6 - 3x| + 4$, which set describes x when $y < 6$?

A $\left\{ x \left| \dfrac{5}{3} < x < \dfrac{7}{3} \right. \right\}$

B $\left\{ x \left| x < \dfrac{5}{3} \text{ or } x > \dfrac{7}{3} \right. \right\}$

C $\left\{ x \left| x < \dfrac{5}{3} \right. \right\}$

D $\left\{ x \left| x > \dfrac{7}{3} \right. \right\}$

ANSWER:
A

89. **PROBABILITY** A 5-character password can contain the numbers 0 through 9 and 26 letters of the alphabet. None of the characters can be repeated. What is the probability that the password begins with a consonant?

F $\dfrac{21}{26}$

G $\dfrac{21}{35}$

H $\dfrac{21}{36}$

J $\dfrac{5}{36}$

ANSWER:
H

90. **SAT/ACT** If $c = \dfrac{8a^3}{b}$, what happens to the value of c when both a and b are doubled?

A c is unchanged.

B c is halved.

C c is doubled.

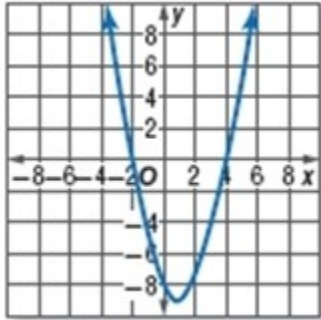D c is multiplied by 4.

E c is multiplied by 8.

ANSWER:
D

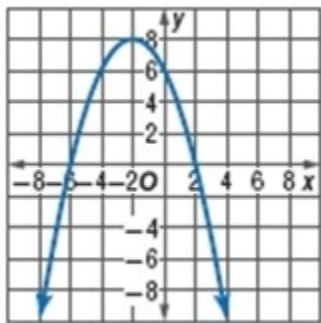**Use the related graph of each equation to determine its solutions.**

91. $x^2 - 2x - 8 = 0$
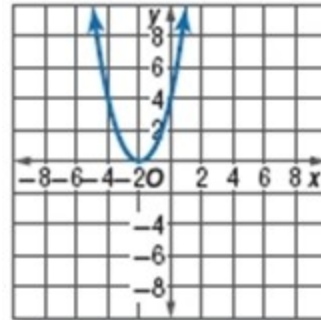

ANSWER:
$-2, 4$

92. $x^2 + 4x = 12$

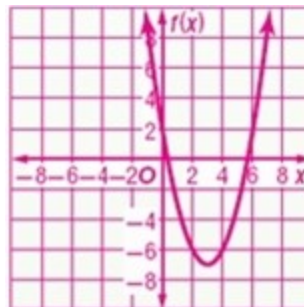*ANSWER:*
$-6, 2$

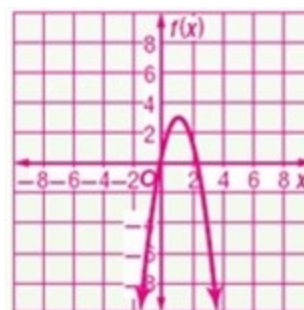93. $x^2 + 4x + 4 = 0$

ANSWER:
-2

Graph each function.

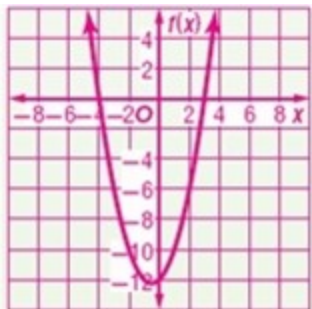94. $f(x) = x^2 - 6x + 2$

ANSWER:

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

ANSWER:

$96. f(x) = (x − 3)(x + 4)$

ANSWER:

97. **FUNDRAISING** Lawrence High School sold wrapping paper and boxed cards for their fundraising event. The school gets $1.00 for each roll of wrapping paper sold and $0.50 for each box of cards sold.

Total Amounts for Each Class		
Class	Wrapping Paper	Cards
Freshmen	72	49
Sophomores	68	63
Juniors	90	56
Seniors	86	62

a. Write a matrix that represents the amounts sold for each class and a matrix that represents the amount of money the school earns for each item sold.

b. Write a matrix that shows how much each class earned.

c. Which class earned the most money?

d. What is the total amount of money the school made from the fundraiser?

ANSWER:

a. $\begin{bmatrix} 72 & 49 \\ 68 & 63 \\ 90 & 56 \\ 86 & 62 \end{bmatrix}, \begin{bmatrix} 1.00 \\ 0.50 \end{bmatrix}$

b. $\begin{bmatrix} 96.50 \\ 99.50 \\ 118 \\ 117 \end{bmatrix}$

c. juniors

d. $431

Simplify.

98. $\sqrt{5} \cdot \sqrt{15}$

ANSWER:
$5\sqrt{3}$

99. $\sqrt{8} \cdot \sqrt{32}$

ANSWER:
16

100. $2\sqrt{3} \cdot \sqrt{27}$

ANSWER:
18