

Practice 9-5**Factoring Trinomials of the Type $x^2 + bx + c$**

Factor each expression.

- | | | |
|----------------------|----------------------|----------------------|
| 1. $x^2 + 8x + 16$ | 2. $d^2 + 8d + 7$ | 3. $y^2 + 6y + 8$ |
| 4. $b^2 - 2b - 3$ | 5. $s^2 - 4s - 5$ | 6. $x^2 + 12x + 32$ |
| 7. $x^2 - 9x + 20$ | 8. $x^2 - 5x + 6$ | 9. $a^2 + 3a + 2$ |
| 10. $p^2 - 8p + 7$ | 11. $d^2 + 6d + 5$ | 12. $n^2 + n - 6$ |
| 13. $x^2 + 5x - 14$ | 14. $b^2 + 9b + 14$ | 15. $x^2 + 14x + 45$ |
| 16. $a^2 + 7a + 12$ | 17. $x^2 + 13x + 22$ | 18. $x^2 + 3x - 4$ |
| 19. $x^2 - 8x + 12$ | 20. $x^2 + 7x - 18$ | 21. $n^2 - 7n + 10$ |
| 22. $s^2 - 5s - 14$ | 23. $x^2 - 9x + 8$ | 24. $x^2 - 2x - 24$ |
| 25. $x^2 - 6x - 27$ | 26. $x^2 - 16x - 36$ | 27. $x^2 + 7x + 10$ |
| 28. $x^2 - 3x - 28$ | 29. $m^2 - 4m - 21$ | 30. $x^2 - 2x - 15$ |
| 31. $x^2 - 5x - 24$ | 32. $b^2 - 4b - 60$ | 33. $x^2 - 3x - 18$ |
| 34. $m^2 + 7m + 10$ | 35. $n^2 - n - 72$ | 36. $k^2 - 6k + 5$ |
| 37. $x^2 + 9x + 20$ | 38. $x^2 - 10x + 9$ | 39. $x^2 - 8x + 16$ |
| 40. $d^2 - 4d + 3$ | 41. $b^2 - 26b + 48$ | 42. $n^2 - 15n + 26$ |
| 43. $n^2 - n - 6$ | 44. $z^2 - 14z + 49$ | 45. $x^2 + 7x + 12$ |
| 46. $x^2 - 18x + 17$ | 47. $x^2 + 16x + 28$ | 48. $t^2 - 6t - 27$ |
| 49. $b^2 + 4b - 12$ | 50. $d^2 + 11d + 18$ | 51. $x^2 + x - 20$ |
| 52. $x^2 - 13x + 42$ | 53. $x^2 + x - 6$ | 54. $x^2 + 4x - 21$ |
| 55. $a^2 + 2a - 35$ | 56. $h^2 + 7h - 18$ | 57. $x^2 + 3x - 10$ |
| 58. $p^2 - 12p - 28$ | 59. $y^2 + 6y - 55$ | 60. $b^2 + 3b - 4$ |
| 61. $x^2 + 2x - 63$ | 62. $x^2 - 2x - 8$ | 63. $x^2 - 11x - 60$ |
| 64. $r^2 + 2r - 35$ | 65. $c^2 - 3c - 10$ | 66. $x^2 + 8x + 15$ |
| 67. $x^2 - 8x + 15$ | 68. $n^2 - 23n + 60$ | 69. $c^2 + 3c - 10$ |
| 70. $x^2 - 9x + 14$ | 71. $x^2 - 10x + 24$ | 72. $x^2 + 6x - 27$ |
| 73. $y^2 - 16y + 64$ | 74. $n^2 + 10n + 25$ | 75. $r^2 - 14r - 51$ |
| 76. $x^2 + 3x - 40$ | 77. $x^2 - x - 42$ | 78. $n^2 - 2n - 63$ |
| 79. $a^2 + 7a + 6$ | 80. $x^2 - 14x + 48$ | 81. $x^2 - 11x + 28$ |
| 82. $n^2 + 16n - 36$ | 83. $n^2 - 4n - 21$ | 84. $y^2 + 16y - 17$ |

Practice 9-7**Factoring Special Cases**

Factor each expression.

- | | | |
|------------------------|------------------------|---------------------------|
| 1. $x^2 - 9$ | 2. $4m^2 - 1$ | 3. $a^2 + 2a + 1$ |
| 4. $4x^2 + 12x + 9$ | 5. $x^2 - 22x + 121$ | 6. $n^2 - 4$ |
| 7. $9x^2 - 4$ | 8. $16c^2 - 49$ | 9. $9x^2 - 30x + 25$ |
| 10. $4x^2 - 20x + 25$ | 11. $2a^2 - 18$ | 12. $x^2 - 24x + 144$ |
| 13. $3n^2 - 3$ | 14. $9h^2 + 60h + 100$ | 15. $9d^2 - 49$ |
| 16. $81a^2 - 400$ | 17. $r^2 - 36$ | 18. $3a^2 - 48$ |
| 19. $b^2 + 4b + 4$ | 20. $10x^2 - 90$ | 21. $25x^2 - 64$ |
| 22. $12w^2 - 27$ | 23. $g^3 - 25g$ | 24. $x^2 + 6x + 9$ |
| 25. $a^2 - 25$ | 26. $36s^2 - 225$ | 27. $4b^2 + 44b + 121$ |
| 28. $x^2 - 16x + 64$ | 29. $x^2 - 2x + 1$ | 30. $d^2 - 49$ |
| 31. $x^3 - 36x$ | 32. $9y^2 - 289$ | 33. $x^2 - 30x + 225$ |
| 34. $100a^2 - 9$ | 35. $2x^2 + 4x + 2$ | 36. $5n^3 - 20n$ |
| 37. $9n^2 + 12n + 4$ | 38. $d^2 - 169$ | 39. $4a^2 - 81$ |
| 40. $x^2 - 121$ | 41. $5x^2 + 40x + 80$ | 42. $16n^2 + 56n + 49$ |
| 43. $3n^2 - 30n + 75$ | 44. $a^2 + 26a + 169$ | 45. $25x^2 - 144$ |
| 46. $9d^2 - 64$ | 47. $n^2 - 28n + 196$ | 48. $49a^2 - 14a + 1$ |
| 49. $y^2 + 8y + 16$ | 50. $y^2 - 400$ | 51. $x^2 - 10x + 25$ |
| 52. $4x^2 - 60x + 225$ | 53. $3x^2 - 363$ | 54. $y^2 - 81$ |
| 55. $a^2 - 100$ | 56. $256a^2 - 1$ | 57. $n^2 + 34n + 289$ |
| 58. $2d^3 - 50d$ | 59. $y^2 + 22y + 121$ | 60. $144x^2 - 25$ |
| 61. $4x^2 - 169$ | 62. $x^2 - 12x + 36$ | 63. $64r^2 + 80r + 25$ |
| 64. $50m^3 - 32m$ | 65. $b^2 - 225$ | 66. $x^2 - 18x + 81$ |
| 67. $b^2 - 64$ | 68. $16x^2 - 72x + 81$ | 69. $b^2 - 256$ |
| 70. $x^2 + 24x + 144$ | 71. $225x^2 - 16$ | 72. $2x^3 + 40x^2 + 200x$ |
| 73. $4r^2 - 25$ | 74. $16x^2 + 8x + 1$ | 75. $b^2 - 14b + 49$ |
| 76. $x^2 + 30x + 225$ | 77. $m^2 - 28m + 196$ | 78. $9r^2 - 256$ |
| 79. $b^2 + 20b + 100$ | 80. $m^2 - 16$ | 81. $4x^2 - 32x + 64$ |
| 82. $x^2 - 196$ | 83. $8x^3 - 32x$ | 84. $25x^2 - 30x + 9$ |
| 85. $8m^2 - 16m + 8$ | 86. $9x^2 - 400$ | 87. $m^2 - 144$ |

Practice 9-8

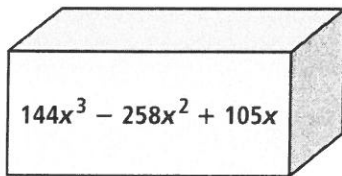
Factoring by Grouping

Factor each expression.

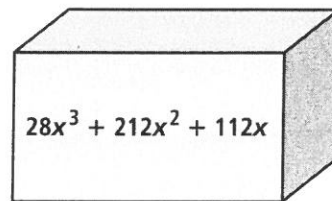
- | | | |
|-----------------------------|-------------------------------|------------------------------|
| 1. $x(a + 2) - 2(a + 2)$ | 2. $3(x + y) + a(x + y)$ | 3. $m(x - 3) + k(x - 3)$ |
| 4. $a(y + 1) - b(y + 1)$ | 5. $x^2 + 3x + 2xy + 6y$ | 6. $y^2 - 5wy + 4y - 20w$ |
| 7. $xy + 4y - 2x - 8$ | 8. $ab + 7b - 3a - 21$ | 9. $ax + bx + ay + by$ |
| 10. $ax + bx - ay - by$ | 11. $2x^2 - 6xy + 5x - 15y$ | 12. $3x^2 - 6xy + 2x - 4y$ |
| 13. $2ax + 6xc + ba + 3bc$ | 14. $x^2y - 3x^2 - 2y + 6$ | 15. $6 + 2y + 3x^2 + x^2y$ |
| 16. $2x^2 - 3x + 1$ | 17. $2x^2 - 7x + 3$ | 18. $6x^2 + 7x + 2$ |
| 19. $4x^2 + 8x + 3$ | 20. $6x^2 - 7x + 2$ | 21. $4x^2 - 9x + 2$ |
| 22. $2x^2 - 3x - 2$ | 23. $12x^2 - x - 1$ | 24. $6x^2 + 19x + 3$ |
| 25. $12y^2 - 5y - 2$ | 26. $10y^2 + 21y - 10$ | 27. $5y^2 + 13y + 6$ |
| 28. $16y^2 + 10y + 1$ | 29. $16x^2 - 14x + 3$ | 30. $16x^2 + 16x + 3$ |
| 31. $10x^2 - 3x - 1$ | 32. $9x^2 + 25x - 6$ | 33. $14x^2 + 15x - 9$ |
| 34. $2x^3 + 8x^2 + x + 4$ | 35. $8x^4 + 6x - 28x^3 - 21$ | 36. $5x^3 - x^2 + 15x - 3$ |
| 37. $x^3 + 3x^2 + 4x + 12$ | 38. $6x^3 + 3x^2 + 2x + 1$ | 39. $3x^3 + 9x^2 + 2x + 6$ |
| 40. $9x^3 - 12x^2 + 3x - 4$ | 41. $10x^3 - 25x^2 + 4x - 10$ | 42. $4x^3 - 20x^2 + 3x - 15$ |

Find expressions for the possible dimensions of each rectangular prism.

43. The volume of the prism is given.



44. The volume of the prism is given.



Practice 9-6Factoring Trinomials of the Type $ax^2 + bx + c$

Factor each expression.

1. $2x^2 + 3x + 1$
2. $2x^2 + 5x + 3$
3. $2n^2 + n - 6$
4. $3x^2 - x - 4$
5. $2y^2 - 9y - 5$
6. $5x^2 - 2x - 7$
7. $7n^2 + 9n + 2$
8. $3c^2 - 17c - 6$
9. $3x^2 + 8x + 4$
10. $6x^2 - 7x - 10$
11. $3x^2 - 10x + 8$
12. $3y^2 - 16y - 12$
13. $5x^2 + 2x - 3$
14. $3x^2 + 7x + 2$
15. $7x^2 - 10x + 3$
16. $3x^2 + 8x + 5$
17. $2x^2 + 9x + 4$
18. $5x^2 - 7x + 2$
19. $5x^2 - 22x + 8$
20. $4x^2 + 17x - 15$
21. $5x^2 - 33x - 14$
22. $3x^2 - 2x - 8$
23. $3y^2 + 7y - 6$
24. $2x^2 + 13x - 24$
25. $4y^2 - 11y - 3$
26. $2y^2 + 9y + 7$
27. $5y^2 - 3y - 2$
28. $7y^2 + 19y + 10$
29. $7x^2 - 30x + 8$
30. $3x^2 + 17x + 10$
31. $2x^2 + 5x - 3$
32. $2x^2 - 5x + 3$
33. $3x^2 + 10x + 3$
34. $2x^2 - x - 21$
35. $5x^2 - 11x + 2$
36. $4x^2 + 4x - 15$
37. $6x^2 - 19x + 15$
38. $2x^2 - x - 15$
39. $3x^2 - 7x - 6$
40. $2x^2 - 5x - 12$
41. $6x^2 - 7x - 5$
42. $4x^2 + 7x + 3$
43. $12y^2 - 7y + 1$
44. $6y^2 - 5y + 1$
45. $6x^2 - 11x + 4$
46. $12x^2 + 19x + 5$
47. $7y^2 + 47y - 14$
48. $11x^2 - 54x - 5$
49. $15x^2 - 19x + 6$
50. $8x^2 - 30x + 25$
51. $14y^2 + 15y - 9$
52. $22x^2 + 51x - 10$
53. $14x^2 - 41x + 15$
54. $8y^2 + 17y + 9$
55. $8x^2 + 65x + 8$
56. $20x^2 + 37x + 15$
57. $24y^2 + 41y + 12$
58. $18x^2 - 27x + 4$
59. $10x^2 + 3x - 4$
60. $10y^2 - 29y + 10$

Practice 11-1

Simplifying Radicals

Simplify each radical expression. Assume that all variables under radicals represent positive numbers.

- | | | | | |
|--------------------------------------|-------------------------------------|--|------------------------------------|-----------------------------------|
| 1. $\sqrt{32}$ | 2. $\sqrt{22} \cdot \sqrt{8}$ | 3. $\sqrt{147}$ | 4. $\sqrt{\frac{17}{144}}$ | 5. $\sqrt{a^2b^5}$ |
| 6. $\frac{2}{\sqrt{6}}$ | 7. $\sqrt{80}$ | 8. $\sqrt{27}$ | 9. $\frac{\sqrt{256}}{\sqrt{32}}$ | 10. $\frac{8}{\sqrt{7}}$ |
| 11. $\sqrt{12x^4}$ | 12. $\frac{\sqrt{96}}{\sqrt{12}}$ | 13. $\sqrt{200}$ | 14. $\sqrt{\frac{12}{225}}$ | 15. $\sqrt{15} \cdot \sqrt{6}$ |
| 16. $\sqrt{120}$ | 17. $\frac{4}{\sqrt{2a}}$ | 18. $(3\sqrt{2})^3$ | 19. $\sqrt{250}$ | 20. $\frac{\sqrt{65}}{\sqrt{13}}$ |
| 21. $\sqrt{84}$ | 22. $\sqrt{\frac{18}{225}}$ | 23. $\sqrt{48s^3}$ | 24. $3\sqrt{24}$ | 25. $\sqrt{15} \cdot \sqrt{35}$ |
| 26. $\sqrt{160}$ | 27. $\frac{6}{\sqrt{3}}$ | 28. $\frac{\sqrt{48n^6}}{\sqrt{6n^3}}$ | 29. $\sqrt{136}$ | 30. $\sqrt{\frac{27x^2}{256}}$ |
| 31. $\sqrt{m^3n^2}$ | 32. $\frac{\sqrt{180}}{\sqrt{9}}$ | 33. $\sqrt{18} \cdot \sqrt{8}$ | 34. $(10\sqrt{3})^2$ | 35. $\sqrt{\frac{17}{64}}$ |
| 36. $\sqrt{50}$ | 37. $\sqrt{48}$ | 38. $\sqrt{20}$ | 39. $\sqrt{8}$ | 40. $\sqrt{25x^2}$ |
| 41. $\sqrt{\frac{7}{9}}$ | 42. $\sqrt{\frac{17}{64}}$ | 43. $\frac{\sqrt{48}}{\sqrt{8}}$ | 44. $\frac{\sqrt{120}}{\sqrt{10}}$ | 45. $\frac{5}{\sqrt{2}}$ |
| 46. $\sqrt{75}$ | 47. $\sqrt{300}$ | 48. $\sqrt{49a^3}$ | 49. $\sqrt{125}$ | 50. $\sqrt{28x^4}$ |
| 51. $\frac{7}{\sqrt{3}}$ | 52. $\sqrt{\frac{15}{49}}$ | 53. $\frac{\sqrt{60}}{\sqrt{12}}$ | 54. $\frac{3}{\sqrt{3}}$ | 55. $\frac{4}{\sqrt{8}}$ |
| 56. $\sqrt{72x^3}$ | 57. $\sqrt{50y^3}$ | 58. $\sqrt{45x^2y^3}$ | 59. $\sqrt{\frac{44x^3}{9x}}$ | 60. $\frac{\sqrt{4}}{\sqrt{3x}}$ |
| 61. $6\sqrt{20}$ | 62. $\sqrt{ab^3}$ | 63. $\sqrt{a^5b^6}$ | 64. $12\sqrt{60x^2}$ | 65. $(2\sqrt{3})^2$ |
| 66. $\sqrt{12} \cdot \sqrt{27}$ | 67. $(7\sqrt{5})^2$ | 68. $\sqrt{14} \cdot \sqrt{8}$ | 69. $(5\sqrt{5})^2$ | 70. $\sqrt{8x^6y^7}$ |
| 71. $\sqrt{16a^3} \cdot \sqrt{5a^2}$ | 72. $\sqrt{8} \cdot \sqrt{7}$ | 73. $\sqrt{3x} \cdot \sqrt{5x}$ | 74. $2\sqrt{5} \cdot 2\sqrt{5}$ | |
| 75. $4\sqrt{3} \cdot 2\sqrt{2}$ | 76. $6\sqrt{3} \cdot 7\sqrt{8}$ | 77. $\frac{10}{\sqrt{x}}$ | 78. $\frac{\sqrt{9}}{\sqrt{2x}}$ | |
| 79. $\frac{4}{\sqrt{20}}$ | 80. $\frac{\sqrt{12x}}{\sqrt{27x}}$ | 81. $\frac{3\sqrt{7}}{\sqrt{20x}}$ | 82. $\frac{4\sqrt{5}}{\sqrt{8y}}$ | |

Practice 5-6**Complex Numbers**

Find the first three output values for each function. Use $z = 0$ for the first input value.

1. $f(z) = z^2 + 2i$

2. $f(z) = z^2 + 1 + i$

Find the additive inverse of each of the following.

3. $2 + 3i$

4. $-4 + i$

5. $2i$

6. $-1 - i$

7. $-6i$

8. $5 - 2i$

9. $-2 + 3i$

10. 4

Find each absolute value.

11. $|-2i|$

12. $|5 + 12i|$

13. $|-1 - i|$

14. $|2 + i|$

15. $|4 + 3i|$

16. $|5 - 2i|$

17. $|3 - 2i|$

18. $|-2 + i|$

19. $|3 - 3i|$

20. $|3i|$

21. $|2i|$

22. $|4 + i|$

23. $|6 - 3i|$

24. $|-3 + i|$

25. $|4|$

Simplify each expression.

26. $\sqrt{40}$

27. $\sqrt{-88}$

28. $-\sqrt{-36}$

29. $(1 + 5i) + (1 - 5i)$

30. $(3 + 2i) - (3 + 2i)$

31. $4 - \sqrt{-25}$

32. $(2 + 6i) - (7 + 9i)$

33. $(1 + 5i)(1 - 5i)$

34. $(1 + 5i)(6 - 3i)$

35. $(5 - 6i)(6 - 2i)$

36. $(3 + 4i)(3 + 4i)$

37. $(2 + 3i)(2 - 3i)$

38. $(2 + 2i)(2 - 2i)$

39. $(-3 - 2i)(1 - 3i)$

40. $(3 + 3i) - (4 - 3i)$

41. $\sqrt{-48}$

42. $\sqrt{-300}$

43. $\sqrt{-75}$

44. $\sqrt{-16} + 2$

45. $(4 - i)(4 - i)$

46. $(4 + 2i)(1 - 7i)$

47. $(1 + 3i)(1 - 7i)$

48. $(2 + 4i)(-3 - 2i)$

49. $(11 - 12i)(11 + 12i)$

50. $(2 + 3i) + (-4 + 5i)$

51. $(5 + 14i) - (10 - 2i)$

52. $(5 + 12i)(5 - 12i)$

53. $(3 + 4i)(1 - 2i)$

54. $(6 + 2i)(1 - 2i)$

55. $(5 - 13i)(5 - 13i)$

56. $\sqrt{-44}$

57. $-\sqrt{-63}$

58. $\sqrt{-8}$

59. $(2 + 3i)(4 + 5i)$

60. $(5 + 4i) - (-1 - 2i)$

61. $(1 + 2i)(-1 - 2i)$

62. $(-1 + 4i)(1 - 2i)$

63. $(6 + 2i) + (1 - 2i)$

64. $(3 + 2i)(3 + 2i)$

65. $(-2 + 3i) + (4 + 5i)$

66. $(5 + 4i)(1 + 2i)$

67. $(-1 - 5i)(-1 + 5i)$

Solve each equation.

68. $x^2 + 80 = 0$

69. $5x^2 + 500 = 0$

70. $2x^2 + 40 = 0$

71. $3x^2 + 36 = 0$

72. $3x^2 + 75 = 0$

73. $2x^2 + 144 = 0$

74. $4x^2 + 1600 = 0$

75. $4x^2 + 1 = 0$

76. $2x^2 + 10 = 0$

77. $4x^2 + 100 = 0$

78. $x^2 + 9 = 0$

79. $9x^2 + 90 = 0$

Practice 9-1

Adding and Subtracting Polynomials

Write each polynomial in standard form. Then name each polynomial based on its degree and number of terms.

- | | | |
|--------------------------|----------------------|--------------------------|
| 1. $4y^3 - 4y^2 + 3 - y$ | 2. $x^2 + x^4 - 6$ | 3. $x + 2$ |
| 4. $2m^2 - 7m^3 + 3m$ | 5. $4 - x + 2x^2$ | 6. $7x^3 + 2x^2$ |
| 7. $n^2 - 5n$ | 8. $6 + 7x^2$ | 9. $3a^2 + a^3 - 4a + 3$ |
| 10. $5 + 3x$ | 11. $7 - 8a^2 + 6a$ | 12. $5x + 4 - x^2$ |
| 13. $2 + 4x^2 - x^3$ | 14. $4x^3 - 2x^2$ | 15. $y^2 - 7 - 3y$ |
| 16. $x - 6x^2 - 3$ | 17. $v^3 - v + 2v^2$ | 18. $8d + 3d^2$ |

Simplify. Write each answer in standard form.

- | | |
|---|--|
| 19. $(3x^2 - 5x) - (x^2 + 4x + 3)$ | 20. $(2x^3 - 4x^2 + 3) + (x^3 - 3x^2 + 1)$ |
| 21. $(3y^3 - 11y + 3) - (5y^3 + y^2 + 2)$ | 22. $(3x^2 + 2x^3) - (3x^2 + 7x - 1)$ |
| 23. $(2a^3 + 3a^2 + 7a) + (a^3 + a^2 - 2a)$ | 24. $(8y^3 - y + 7) - (6y^3 + 3y - 3)$ |
| 25. $(x^2 - 6) + (5x^2 + x - 3)$ | 26. $(5n^2 - 7) - (2n^2 + n - 3)$ |
| 27. $(5n^3 + 2n^2 + 2) - (n^3 + 3n^2 - 2)$ | 28. $(3y^2 - 7y + 3) - (5y + 3 - 4y^2)$ |
| 29. $(2x^2 + 9x - 17) + (x^2 - 6x - 3)$ | 30. $(3 - x^3 - 5x^2) + (x + 2x^3 - 3)$ |
| 31. $(3x + x^2 - x^3) - (x^3 + 2x^2 + 5x)$ | 32. $(d^2 + 8 - 5d) - (5d^2 + d - 2d^3 + 3)$ |
| 33. $(3x^3 + 7x^2) + (x^2 - 2x^3)$ | 34. $(6c^2 + 5c - 3) - (3c^2 + 8c)$ |
| 35. $(3y^2 - 5y - 7) + (y^2 - 6y + 7)$ | 36. $(3c^2 - 8c + 4) - (7 + c^2 - 8c)$ |
| 37. $(4x^2 + 13x + 9) + (12x^2 + x + 6)$ | 38. $(2x - 13x^2 + 3) - (2x^2 + 8x)$ |
| 39. $(7x - 4x^2 + 11) + (7x^2 + 5)$ | 40. $(4x + 7x^3 - 9x^2) + (3 - 2x^2 - 5x)$ |
| 41. $(y^3 + y^2 - 2) + (y - 6y^2)$ | 42. $(x^2 - 8x - 3) - (x^3 + 8x^2 - 8)$ |
| 43. $(3x^2 - 2x + 9) - (x^2 - x + 7)$ | 44. $(2x^2 - 6x + 3) - (2x + 4x^2 + 2)$ |
| 45. $(2x^2 - 2x^3 - 7) + (9x^2 + 2 + x)$ | 46. $(3a^2 + a^3 - 1) + (2a^2 + 3a + 1)$ |
| 47. $(2x^2 + 3 - x) - (2 + 2x^2 - 5x)$ | 48. $(n^4 - 2n - 1) + (5n - n^4 + 5)$ |
| 49. $(x^3 + 3x) - (x^2 + 6 - 4x)$ | 50. $(7s^2 + 4s + 2) + (3s + 2 - s^2)$ |
| 51. $(6x^2 - 3x + 9) - (x^2 + 3x - 5)$ | 52. $(3x^3 - x^2 + 4) + (2x^3 - 3x + 9)$ |
| 53. $(y^3 + 3y - 1) - (y^3 + 3y + 5)$ | 54. $(3 + 5x^3 + 2x) - (x + 2x^2 + 4x^3)$ |
| 55. $(x^2 + 15x + 13) + (3x^2 - 15x + 7)$ | 56. $(7 - 8x^2) + (x^3 - x + 5)$ |
| 57. $(2x + 3) - (x - 4) + (x + 2)$ | 58. $(x^2 + 4) - (x - 4) + (x^2 - 2x)$ |

All rights reserved.

© Pearson Education, Inc., publishing as Pearson Prentice Hall.

Practice 10-4**Solving Quadratic Equations**

Solve each equation by finding square roots. If the equation has no real solution, write *no solution*. If the value is irrational, round to the nearest hundredth.

- | | | |
|-----------------------|--------------------------|-----------------------|
| 1. $x^2 = 16$ | 2. $x^2 - 144 = 0$ | 3. $3x^2 - 27 = 0$ |
| 4. $x^2 + 16 = 0$ | 5. $x^2 = 12$ | 6. $x^2 = 49$ |
| 7. $x^2 + 8 = -10$ | 8. $3x^2 = 300$ | 9. $2x^2 - 6 = 26$ |
| 10. $x^2 = 80$ | 11. $81x^2 - 10 = 15$ | 12. $2x^2 = 90$ |
| 13. $x^2 = 300$ | 14. $4x^2 + 9 = 41$ | 15. $2x^2 + 8 = 4$ |
| 16. $x^2 + 8 = 72$ | 17. $4x^2 + 6 = 7$ | 18. $x^2 = 121$ |
| 19. $5x^2 + 20 = 30$ | 20. $x^2 + 6 = 17$ | 21. $3x^2 + 1 = 54$ |
| 22. $2x^2 - 7 = 74$ | 23. $x^2 + 1 = 0$ | 24. $4x^2 - 8 = -20$ |
| 25. $9x^2 = 1$ | 26. $x^2 + 4 = 4$ | 27. $3x^2 = 1875$ |
| 28. $x^2 = 9$ | 29. $5x^2 - 980 = 0$ | 30. $x^2 - 10 = 100$ |
| 31. $4x^2 - 2 = 1$ | 32. $3x^2 - 75 = 0$ | 33. $x^2 + 25 = 0$ |
| 34. $2x^2 - 10 = -4$ | 35. $4x^2 + 3 = 3$ | 36. $4x^2 - 8 = 32$ |
| 37. $7x^2 + 8 = 15$ | 38. $x^2 + 1 = 26$ | 39. $6x^2 = -3$ |
| 40. $x^2 - 400 = 0$ | 41. $7x^2 - 8 = 20$ | 42. $2x^2 - 1400 = 0$ |
| 43. $5x^2 + 25 = 90$ | 44. $x^2 + 4x^2 = 20$ | 45. $5x^2 - 18 = -23$ |
| 46. $3x^2 - x^2 = 10$ | 47. $2x^2 + 6 - x^2 = 9$ | 48. $x^2 - 225 = 0$ |
| 49. $-3 + 4x^2 = 2$ | 50. $7x^2 - 1008 = 0$ | 51. $6x^2 - 6 = 12$ |

Solve each problem. If necessary, round to the nearest tenth.

52. You want to build a fence around a square garden that covers 506.25 ft^2 . How many feet of fence will you need to complete the job?
53. The formula $A = 6s^2$ will calculate the surface area of a cube. Suppose you have a cube that has a surface area of 216 in.^2 . What is the length of each side?
54. You drop a pencil out of a window that is 20 ft above the ground. Use the formula $V^2 = 64s$, where V is the speed and s is the distance fallen, to calculate the speed the pencil is traveling when it hits the ground.
55. Suppose you are going to construct a circular fish pond in your garden. You want the pond to cover an area of 300 ft^2 . What is the radius of the pond?
56. During the construction of a skyscraper, a bolt fell from 400 ft. What was the speed of the bolt when it hit the ground? Use $V^2 = 64s$.

Practice 10-5**Factoring to Solve Quadratic Equations**

Use the Zero-Product Property to solve each equation.

- | | | |
|---------------------------|---------------------------|---------------------------|
| 1. $(x + 5)(x - 3) = 0$ | 2. $(x - 2)(x + 9) = 0$ | 3. $(b - 12)(b + 12) = 0$ |
| 4. $(2n + 3)(n - 4) = 0$ | 5. $(x + 7)(4x - 5) = 0$ | 6. $(2x + 7)(2x - 7) = 0$ |
| 7. $(3x - 7)(2x + 1) = 0$ | 8. $(8y - 3)(4y + 1) = 0$ | 9. $(5x + 6)(4x + 5) = 0$ |

Solve by factoring.

- | | | |
|--------------------------|---------------------------|-------------------------|
| 10. $x^2 + 5x + 6 = 0$ | 11. $b^2 - 7b - 18 = 0$ | 12. $r^2 - 4 = 0$ |
| 13. $x^2 + 8x - 20 = 0$ | 14. $y^2 + 14y + 13 = 0$ | 15. $s^2 - 3s - 10 = 0$ |
| 16. $x^2 + 7x = 8$ | 17. $x^2 = 25$ | 18. $h^2 + 10h = -21$ |
| 19. $2t^2 + 8t - 64 = 0$ | 20. $3a^2 - 36a + 81 = 0$ | 21. $5x^2 - 45 = 0$ |
| 22. $2a^2 - a - 21 = 0$ | 23. $3n^2 - 11n + 10 = 0$ | 24. $2x^2 - 7x - 9 = 0$ |
| 25. $2n^2 - 5n = 12$ | 26. $3m^2 - 5m = -2$ | 27. $5s^2 - 17s = -6$ |
| 28. $6m^2 = 13m + 28$ | 29. $4a^2 - 4a = 15$ | 30. $4r^2 = r + 3$ |
31. Suppose you are building a storage box of volume 4368 in.^3 . The length of the box will be 24 in. The height of the box will be 1 in. more than its width. Find the height and width of the box.
32. A banner is in the shape of a right triangle of area 63 in.^2 . The height of the banner is 4 in. less than twice the width of the banner. Find the height and width of the banner.
33. A rectangular poster has an area of 190 in.^2 . The height of the poster is 1 in. less than twice its width. Find the dimensions of the poster.
34. A diver is standing on a platform 24 ft above the pool. He jumps from the platform with an initial upward velocity of 8 ft/s. Use the formula $h = -16t^2 + vt + s$, where h is his height above the water, t is the time, v is his starting upward velocity, and s is his starting height. How long will it take for him to hit the water?

Solve each equation.

- | | | |
|-----------------------------|-----------------------------|----------------------------|
| 35. $(x - 9)(x + 8) = 0$ | 36. $x^2 - 9x - 10 = 0$ | 37. $(c - 21)(c + 21) = 0$ |
| 38. $(x - 12)(5x - 13) = 0$ | 39. $2a^2 - 21a - 65 = 0$ | 40. $x^2 + 6x - 91 = 0$ |
| 41. $a^2 + 6a - 72 = 0$ | 42. $4x^2 + 8x - 21 = 0$ | 43. $20d^2 - 82d + 80 = 0$ |
| 44. $3n^2 + 12n - 288 = 0$ | 45. $2s^2 - 13s - 24 = 0$ | 46. $x^2 + 5x = 150$ |
| 47. $3c^2 + 8c = 3$ | 48. $30a^2 + 121a - 21 = 0$ | 49. $c^2 - 81 = 0$ |
| 50. $x^2 + 306 = -35x$ | 51. $x^2 = 121$ | 52. $x^2 - 21x + 108 = 0$ |

Practice 10-7

Using the Quadratic Formula

Use the quadratic formula to solve each equation. If the equation has no real solutions write *no real solutions*. If necessary, round your answers to the nearest hundredth.

1. $x^2 + 8x + 5 = 0$
 2. $x^2 - 36 = 0$
 3. $d^2 - 4d - 96 = 0$
 4. $a^2 - 3a - 154 = 0$
 5. $4p^2 - 12p - 91 = 0$
 6. $5m^2 + 9m = 126$
 7. $r^2 - 35r + 70 = 0$
 8. $y^2 + 6y - 247 = 0$
 9. $x^2 + 12x - 40 = 0$
 10. $4n^2 - 81 = 0$
 11. $x^2 + 13x + 30 = 0$
 12. $a^2 - a = 132$
 13. $6w^2 - 23w + 7 = 0$
 14. $4x^2 + 33x = 27$
 15. $7s^2 - 7 = 0$
 16. $x^2 + 5x - 90 = 0$
 17. $5b^2 - 20 = 0$
 18. $4x^2 - 3x + 6 = 0$
 19. $6h^2 + 77h - 13 = 0$
 20. $5y^2 = 17y + 12$
 21. $g^2 - 15g = 54$
 22. $27f^2 = 12$
 23. $4x^2 - 52x + 133 = 0$
 24. $x^2 + 36x + 60 = 0$
 25. $a^2 - 2a - 360 = 0$
 26. $x^2 + 10x + 40 = 0$
 27. $t^2 - 10t = 39$
 28. $4x^2 + 7x - 9 = 0$
 29. $2c^2 - 39c + 135 = 0$
 30. $4x^2 + 33x + 340 = 0$
 31. $m^2 - 40m + 100 = 0$
 32. $8x^2 + 25x + 19 = 0$
 33. $36w^2 - 289 = 0$
 34. $4d^2 + 29d - 60 = 0$
 35. $4z^2 + 43z + 108 = 0$
 36. $3x^2 - 19x + 40 = 0$
 37. $14x^2 = 56$
 38. $32x^2 - 18 = 0$
 39. $r^2 + r - 650 = 0$
 40. $2y^2 = 39y - 17$
 41. $5a^2 - 9a + 5 = 0$
 42. $x^2 = 9x + 120$
 43. $8h^2 - 38h + 9 = 0$
 44. $20x^2 = 245$
 45. $9h^2 - 72h = -119$
 46. $x^2 + 3x + 8 = 0$
 47. $6m^2 - 13m = 19$
 48. $9x^2 - 81 = 0$
 49. $4s^2 + 8s = 221$
 50. $6p^2 + 25p - 119 = 0$
 51. $2s^2 - 59s + 17 = 0$
52. A rectangular painting has dimensions x and $x + 10$. The painting is in a frame 2 in. wide. The total area of the picture and the frame is 900 in.^2 . What are the dimensions of the painting?
 53. A ball is thrown upward from a height of 15 ft with an initial upward velocity of 5 ft/s. Use the formula $h = -16t^2 + vt + s$ to find how long it will take for the ball to hit the ground.
 54. Your community wants to put a square fountain in a park. Around the fountain will be a sidewalk that is 3.5 ft wide. The total area that the fountain and sidewalk can be is 700 ft^2 . What are the dimensions of the fountain?
 55. The Garys have a triangular pennant of area 420 in.^2 flying from the flagpole in their yard. The height of the triangle is 10 in. less than 5 times the base of the triangle. What are the dimensions of the pennant?

Practice 10-8

Using the Discriminant

Find the number of real solutions of each equation.

- | | | |
|-------------------------------|-----------------------------|----------------------------|
| 1. $x^2 + 6x + 10 = 0$ | 2. $x^2 - 4x - 1 = 0$ | 3. $x^2 + 6x + 9 = 0$ |
| 4. $x^2 - 8x + 15 = 0$ | 5. $x^2 - 5x + 7 = 0$ | 6. $x^2 - 4x + 5 = 0$ |
| 7. $3x^2 - 18x + 27 = 0$ | 8. $4x^2 - 8 = 0$ | 9. $-5x^2 - 10x = 0$ |
| 10. $-x^2 = 4x + 6$ | 11. $4x^2 = 9x - 3$ | 12. $8x^2 + 2 = 8x$ |
| 13. $7x^2 + 16x + 11 = 0$ | 14. $12x^2 - 11x - 2 = 0$ | 15. $-9x^2 - 25x + 20 = 0$ |
| 16. $16x^2 + 8x = -1$ | 17. $-16x^2 + 11x = 11$ | 18. $12x^2 - 12x = -3$ |
| 19. $0.2x^2 + 4.5x - 2.8 = 0$ | 20. $-2.8x^2 + 3.1x = -0.5$ | 21. $0.5x^2 + 0.6x = 0$ |
| 22. $1.5x^2 - 15x + 2.5 = 0$ | 23. $-3x^2 + 27x = -40$ | 24. $2.1x^2 + 4.2 = 0$ |
25. One of the games at a carnival involves trying to ring a bell with a ball by hitting a lever that propels the ball into the air. The height of the ball is modeled by the equation $h = -16t^2 + 39t$. If the bell is 25 ft above the ground, will it be hit by the ball?
26. You are placing a rectangular picture on a square poster board. You can enlarge the picture to any size. The area of the poster board not covered by the picture is modeled by the equation $A = -x^2 - 10x + 300$. Is it possible for the area not covered by the picture to be 100 in.²?
27. The equation $h = -16t^2 + 58t + 3$ models the height of a baseball t seconds after it has been hit.
- Was the height of the baseball ever 40 ft?
 - Was the height of the baseball ever 60 ft?
28. A firefighter is on the fifth floor of an office building. She needs to throw a rope into the window above her on the seventh floor. The function $h = -16t^2 + 36t$ models how high above her she is able to throw a rope. If she needs to throw the rope 40 ft above her to reach the seventh-floor window, will the rope get to the window?

Find the number of x -intercepts of each function.

- | | | |
|--------------------------|---------------------------|---------------------------|
| 29. $y = x^2 + 10x + 16$ | 30. $y = x^2 + 3x + 5$ | 31. $y = x^2 - 2x - 7$ |
| 32. $y = 3x^2 - 3$ | 33. $y = 2x^2 + x$ | 34. $y = 3x^2 + 2x + 1$ |
| 35. $y = x^2 - 8x - 4$ | 36. $y = x^2 - 16x + 64$ | 37. $y = -2x^2 - 5x - 6$ |
| 38. $y = -4x^2 - 5x - 2$ | 39. $y = -x^2 + 12x - 36$ | 40. $y = -5x^2 + 11x - 6$ |

Practice 10-6**Completing the Square**

Find the value of c such that each expression is a perfect square trinomial.

1. $x^2 - 14x + c$

2. $x^2 - \frac{2}{9}x + c$

3. $x^2 - \frac{4}{9}x + c$

4. $x^2 - \frac{2}{6}x + c$

Solve each equation by completing the square.

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

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

7. $x^2 - 6x = 10$

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

9. $x^2 - 3x = 18$

10. $x^2 - 8x - 4 = 0$

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

12. $x^2 - 6x = 8$

13. $x^2 - 7x = 0$

14. $x^2 + 4x - 12 = 0$

15. $x^2 + 11x + 10 = 0$

16. $x^2 + 2x = 15$

17. $x^2 - 8x = 9$

18. $x^2 + 5x = -6$

19. $x^2 - 2x = 120$

20. $x^2 - 22x = -105$

21. $2x^2 = 3x + 9$

22. $2x^2 + 8x - 10 = 0$

23. $2x^2 - 3x - 2 = 0$

24. $2x^2 + 12x - 32 = 0$

25. $3x^2 + 17x - 6 = 0$

26. $2x^2 - x - 28 = 0$

27. $3x^2 - 4x + 1 = 0$

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

29. $6x^2 - 2x = 28$

30. $2x^2 - 16x = -30$

31. $4x^2 = -2x + 12$

32. $9x^2 + 6x = 3$

33. $10x^2 + 3x = 4$

34. $12x^2 - 29x + 15 = 0$

Practice 5-7

Completing the Square

Complete the square.

- | | | | |
|-----------------|------------------|------------------|-----------------|
| 1. $x^2 + 6x +$ | 2. $x^2 - 7x +$ | 3. $x^2 + 12x +$ | 4. $x^2 + 3x +$ |
| 5. $x^2 - 8x +$ | 6. $x^2 + 16x +$ | 7. $x^2 + 21x +$ | 8. $x^2 - 2x +$ |

Rewrite each equation in vertex form. Then find the vertex.

- | | | |
|--------------------------|----------------------------------|----------------------------|
| 9. $y = x^2 + 4x - 6$ | 10. $y = x^2 - 6x + 6$ | 11. $y = 4x^2 + 8x - 4$ |
| 12. $y = 4x^2 + 4x + 1$ | 13. $y = 2x^2 + 4x - 5$ | 14. $y = -3x^2 - 4x - 1$ |
| 15. $y = -3x^2 + 3x - 1$ | 16. $y = x^2 + 2x + 1$ | 17. $y = -5x^2 + 10x + 1$ |
| 18. $y = -2x^2 + 4x + 3$ | 19. $y = x^2 + 5x + \frac{5}{4}$ | 20. $y = -2x^2 + 10x - 11$ |
| 21. $y = 6x^2 - 12x + 1$ | 22. $y = -2x^2 + 8x - 9$ | 23. $y = 3x^2 + 9x + 6$ |

Solve each quadratic equation by completing the square.

- | | | |
|-------------------------|-------------------------|-----------------------|
| 24. $x^2 + 12x + 4 = 0$ | 25. $x^2 - x - 5 = 0$ | 26. $3x^2 = -12x - 3$ |
| 27. $x^2 - x - 1 = 0$ | 28. $4x^2 - 8x + 1 = 0$ | 29. $5x^2 = 8x - 6$ |
| 30. $2x^2 - 4x - 3 = 0$ | 31. $x^2 + 11x = 0$ | 32. $x^2 = 5x + 14$ |
| 33. $2x^2 + x - 1 = 0$ | 34. $2x^2 + 6x - 7 = 0$ | 35. $2x^2 = -8x + 45$ |
| 36. $x^2 = -3x - 3$ | 37. $4x^2 = -2x + 1$ | 38. $3x^2 = -6x + 9$ |
| 39. $x^2 = 7x + 12$ | 40. $x^2 = 3x + 7$ | 41. $3x^2 = 6x - 9$ |
| 42. $x^2 = -3x + 2$ | 43. $x^2 = -7x - 1$ | 44. $4x^2 = -3x + 2$ |
| 45. $2x^2 = 4x - 5$ | 46. $2x^2 = 5x + 5$ | 47. $2x^2 = 6x + 5$ |
| 48. $x^2 = 3x$ | 49. $x^2 = 8x$ | 50. $4x^2 = -2x - 3$ |
| 51. $2x^2 = -2x + 5$ | 52. $2x^2 = -5x - 5$ | 53. $3x^2 = -5x + 1$ |
| 54. $2x^2 = 2x + 4$ | 55. $3x^2 = 7x + 8$ | 56. $2x^2 = -6x + 4$ |
| 57. $x^2 = -7x - 9$ | 58. $2x^2 = 5x$ | 59. $3x^2 = -42x$ |
| 60. $2x^2 = -4x + 5$ | 61. $4x^2 = -x + 5$ | 62. $3x^2 = -3x + 1$ |
| 63. $x^2 = 3x + 4$ | 64. $2x^2 = 2x + 8$ | 65. $3x^2 = x + 4$ |

Solve each equation.

- | | | |
|--|--|---|
| 66. $x^2 + 2x + 1 = 9$ | 67. $3x^2 - 18x + 27 = 125$ | 68. $x^2 - 4x + 4 = 5$ |
| 69. $x^2 + 3x + \frac{9}{4} = \frac{13}{4}$ | 70. $x^2 + 3x + \frac{9}{4} = -\frac{15}{4}$ | 71. $x^2 + 3x + \frac{9}{4} = \frac{41}{4}$ |
| 72. $x^2 + 7x + \frac{49}{4} = \frac{53}{4}$ | 73. $x^2 + 3x + \frac{9}{4} = \frac{29}{4}$ | 74. $x^2 - 6x + 9 = 7$ |

Practice 10-1

Exploring Quadratic Graphs

Identify the vertex of each graph. Tell whether it is a minimum or a maximum.

1. $y = -3x^2$

2. $y = -7x^2$

3. $y = 0.5x^2$

4. $y = 5x^2$

5. $y = -4x^2$

6. $y = \frac{3}{2}x^2$

Order each group of quadratic functions from widest to narrowest graph.

7. $y = x^2, y = 5x^2, y = 3x^2$

8. $y = -8x^2, y = \frac{1}{2}x^2, y = -x^2$

9. $y = 5x^2, y = -4x^2, y = 2x^2$

10. $y = -\frac{1}{2}x^2, y = \frac{1}{3}x^2, y = -3x^2$

11. $y = 6x^2, y = -7x^2, y = 4x^2$

12. $y = \frac{3}{4}x^2, y = 2x^2, y = \frac{1}{5}x^2$

Graph each function.

13. $y = x^2$

14. $y = 4x^2$

15. $y = -3x^2$

16. $y = -x^2 - 4$

17. $y = 2x^2 - 2$

18. $y = 2x^2 + 3$

19. $y = \frac{1}{2}x^2 + 2$

20. $y = \frac{1}{2}x^2 - 3$

21. $y = \frac{1}{3}x^2 + 5$

22. $y = \frac{1}{3}x^2 - 4$

23. $y = 2.5x^2 + 3$

24. $y = 2.5x^2 + 5$

25. $y = 5x^2 + 8$

26. $y = 5x^2 - 8$

27. $y = -3.5x^2 - 4$

28. The price of a stock on the NYSE is modeled by the function $y = 0.005x^2 + 10$, where x is the number of months the stock has been available.
- Graph the function.
 - What x -values make sense for the domain? Explain why.
 - What y -values make sense for the range? Explain why.
29. You are designing a poster. The poster is 24 in. wide by 36 in. high. On the poster, you want to place a square photograph and some printing. If each side of the photograph is x in., the function $y = 864 - x^2$ gives the area of the poster available for printing.
- Graph the function.
 - What x -values make sense for the domain? Explain why.
 - What y -values make sense for the range? Explain why.
30. You are placing a circular drawing on a square piece of poster board. The poster board is 15 in. wide. The part of the poster board not covered by the drawing will be painted blue. If the radius of the drawing is r , the function $A = 225 - 3.14r^2$ gives the area to be painted blue.
- Graph the function.
 - What x -values make sense for the domain? Explain why.
 - What y -values make sense for the range? Explain why.

Practice 10-2**Quadratic Functions**

Find the equation of the axis of symmetry and the coordinates of the vertex of the graph of each function.

1. $y = x^2 - 10x + 2$

2. $y = x^2 + 12x - 9$

3. $y = -x^2 + 2x + 1$

4. $y = 3x^2 + 18x + 9$

5. $y = 3x^2 + 3$

6. $y = 16x - 4x^2$

7. $y = 0.5x^2 + 4x - 2$

8. $y = -4x^2 + 24x + 6$

9. $y = -1.5x^2 + 6x$

Graph each function. Label the axis of symmetry, the vertex, and the y -intercept.

10. $y = x^2 - 6x + 4$

11. $y = x^2 + 4x - 1$

12. $y = x^2 + 10x + 14$

13. $y = x^2 + 2x + 1$

14. $y = -x^2 - 4x + 4$

15. $y = -4x^2 + 24x + 13$

16. $y = -2x^2 - 8x + 5$

17. $y = 4x^2 - 16x + 10$

18. $y = -x^2 + 6x + 5$

19. $y = 4x^2 + 8x$

20. $y = -3x^2 + 6$

21. $y = 6x^2 + 48x + 98$

Graph each quadratic inequality.

22. $y > x^2 + 1$

23. $y \geq x^2 - 4$

24. $y < -x^2 + 1$

25. $y > x^2 + 6x + 3$

26. $y < x^2 - 4x + 4$

27. $y < -x^2 + 2x - 3$

28. $y \geq -2x^2 - 8x - 5$

29. $y \leq -3x^2 + 6x + 1$

30. $y \geq 2x^2 - 4x - 3$

Find the vertex of each function. Determine whether the vertex is a maximum or minimum.

31. $y = 2x^2 - 12x + 9$

32. $y = -2x^2 - 16x - 33$

33. $y = -4x^2 + 4x - 1$

34. $y = -3.5x^2 - 14x - 10$

35. $y = 0.05x^2 - 3.2x + 4$

36. $y = -1.8x^2 + 16.2x - 18.2$

37. You and a friend are hiking in the mountains. You want to climb to a ledge that is 20 ft above you. The height the grappling hook can be thrown is given by the function $h = -16t^2 - 32t + 5$. What is the maximum height the grappling hook can reach? Can you throw it high enough to reach the ledge?
38. The total profit made by an engineering firm is given by the function $p = x^2 - 25x + 5000$. Find the minimum profit made by the company.
39. You are trying to dunk a basketball. You need to jump 2.5 ft in the air to dunk the ball. The height that your feet are above the ground is given by the function $h = -16t^2 + 12t$. What is the maximum height your feet will be above the ground? Will you be able to dunk the basketball?

Solving Quadratic Systems

FOR USE WITH LESSON 10-6

In Chapter 3 you solved systems of linear equations algebraically and graphically. You can use the same methods to solve systems that include quadratic equations.

1 EXAMPLE Solving Algebraically

Solve the system algebraically. $\begin{cases} x^2 - y^2 = 9 \\ x^2 + 9y^2 = 169 \end{cases}$

$$x^2 - y^2 = 9$$

$$x^2 + 9y^2 = 169$$

$$-10y^2 = -160$$

$$y = 4 \text{ or } y = -4$$

$$x^2 - (4)^2 = 9$$

$$x^2 = 25$$

$$x = 5 \text{ or } x = -5$$

Subtract like terms to eliminate the x^2 terms.
Solve for y .

Substitute the values of y into one of the original equations.

$$x^2 - (-4)^2 = 9$$

$$x^2 = 25$$

$$x = 5 \text{ or } x = -5$$

- The ordered pairs $(5, 4)$, $(-5, 4)$, $(5, -4)$, and $(-5, -4)$ are solutions to the system.

2 EXAMPLE Solving Graphically

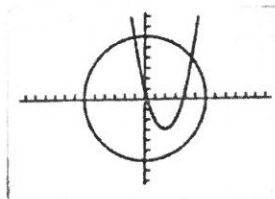
Solve the system by graphing. $\begin{cases} x^2 + y^2 = 36 \\ y = (x - 2)^2 - 3 \end{cases}$

$$x^2 + y^2 = 36$$

$$y = \pm\sqrt{36 - x^2} \quad \text{Solve the first equation for } y.$$

Graph the equations and find the point(s) of intersection.

- The solutions are approximately $(-1, 6)$ and $(4.6, 3.8)$.



EXERCISES

Solve each quadratic system.

1. $\begin{cases} x^2 + 64y^2 = 64 \\ x^2 + y^2 = 64 \end{cases}$

2. $\begin{cases} 2x^2 - y^2 = 2 \\ x^2 + y^2 = 25 \end{cases}$

3. $\begin{cases} 9x^2 + 25y^2 = 225 \\ y = -x^2 + 5 \end{cases}$

4. $\begin{cases} 4x^2 + 4y^2 = 100 \\ 3x^2 + 3y^2 = 27 \end{cases}$

5. a. **Writing** The system that consists of $y = -3x + 6$ and $y = x^2 - 4x$ is a linear-quadratic system. How would you solve the system algebraically? Graphically?

b. Solve the system in part (a).

Identify each system as linear-quadratic or quadratic-quadratic. Then solve.

6. $\begin{cases} y = x - 1 \\ x^2 + y^2 = 25 \end{cases}$

7. $\begin{cases} 9x^2 + 4y^2 = 36 \\ x^2 - y^2 = 4 \end{cases}$

8. $\begin{cases} -x + y = 4 \\ y = x^2 - 4x + 2 \end{cases}$

9. $\begin{cases} 4x^2 + 25y^2 = 100 \\ y = x + 2 \end{cases}$

You can use a graphing calculator to graph quadratic inequalities and to solve systems of quadratic inequalities.

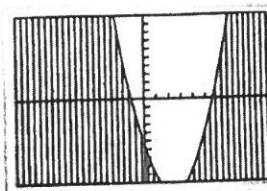
1 EXAMPLE

Graph $y \leq x^2 - 5x - 6$.

Enter the corresponding equation as shown. Place the cursor to the left of Y_1 and press **ENTER** three times to produce shading *below* the graph. The solution is represented by all the points in the shaded region. Solutions to $y = x^2 - 5x - 6$ are also part of the solution.

```

Plot1 Plot2 Plot3
Y1  $\square$   $X^2 - 5X - 6$ 
Y2 =
Y3 =
Y4 =
Y5 =
Y6 =
Y7 =
    
```



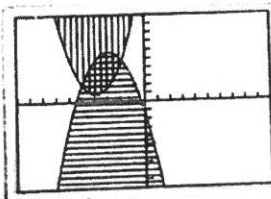
2 EXAMPLE

Solve $y \geq x^2 + 8x + 17$ and $y \leq -x^2 - 6x - 3$.

Enter the corresponding equations. For each equation, choose shading that corresponds to the inequality sign. The solution consists of all points within the double-shaded region.

```

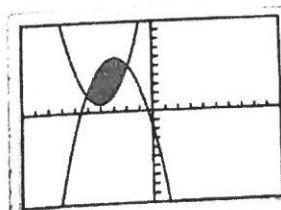
Plot1 Plot2 Plot3
Y1  $\square$   $X^2 + 8X + 17$ 
Y2  $\square$   $-X^2 - 6X - 3$ 
Y3 =
Y4 =
Y5 =
Y6 =
Y7 =
    
```



You can also use the **Shade** command from the **DRAW** menu. This command instructs the calculator to shade only the region of the intersection of the graphs.

```

Shade (Y1, Y2)
    
```



EXERCISES

Graph each quadratic inequality.

1. $y \geq 2x^2 + 7x - 4$

2. $y < -x^2 - 5x - 5$

3. $y > -1.4x^2 + 2x + 7$

Solve each system of quadratic inequalities graphically.

4. $y \geq x^2 - 6x + 5$

$y \leq -x^2 + 6x$

5. $y \geq x^2 - x - 6$
 $y \geq -x^2 - x + 6$

6. $y \geq x^2$
 $y \geq (x - 3)^2$

Chapter Test**Form A****Chapter 9**

Write each polynomial in standard form. Then name each expression based on its degree and number of terms.

1. $2x^3 - x^2 + 4x$

2. $y^2 + 3y + 6 - 4y^2 - 6y$

3. $8 - 6w - 12w - 8w^2 - 7 - 3w^3$

4. $6x^5 + 3x^3 - 7x^5 - 4x^3$

Simplify. Write each answer in standard form.

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

6. $(2x^2 + 6x + 7) + (3x^2 + 3x - 5)$

7. $(3x^2 + 4x - 10) - (2x + 7 - 4x^2)$

8. $(8x - 4x^2 + x^3) - (8x^2 + 4x^3 - 7x)$

9. **Open-Ended** Write a trinomial with degree 5.

Simplify each product. Write in standard form.

10. $8x(3x + 4 - x^2)$

11. $-y(8y^2 + y)$

12. $7x(3 - x + 6x^3)$

13. $5y(y^5 + 8y^3)$

14. $6x(x^2 + 2x + 1)$

15. $(y + 4)(y + 3)$

16. $(a + 3)(a - 1)$

17. $(2y - 8)(y - 4)$

18. $(3x + 4)(5x - 9)$

19. $(x - 1)(x^2 + 6x + 4)$

20. $(2x^2 - 6x - 5)(3 - x)$

21. $(8x - 7)(3x + 2)$

Write the GCF of each polynomial.

22. $12x^3 + 6x^2 - 3x$

23. $18x^2 + 16x - 12x^3$

24. $6y^2 - 12y^3 + 36y^4$

25. $-10y^3 + 8y^2 - 20y$

26. **Writing** A student commented, "Factoring undoes the distributive property." What do you think the student meant? Explain and give an example.

Write an expression for each situation as a product and in standard form.

27. A settling pond at a sewage treatment facility is rectangular. The length of the pond is 15 ft more than 4 times its width w . What is the area of the pond?

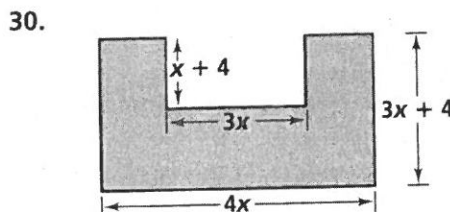
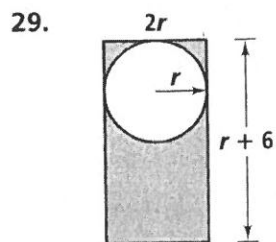
Chapter Test (continued)

Form A

Chapter 9

28. The length of an airplane hangar is 20 ft less than 4 times its height h .
The width of the hangar is 10 ft more than 2 times its height.
What polynomial expression represents the volume of the hangar?

Geometry Write an expression for the area of each shaded region.
Write your answer in simplest form.



Factor each expression.

31. $x^2 - 6x + 5$

32. $y^2 + 18y + 81$

33. $16x^2 + 48x + 36$

34. $y^2 - 144$

35. $y^2 - 10y + 25$

36. $9x^2 - 64$

37. $64x^2 + 40x + 6$

38. $14x^2 - 56$

Write the value missing from each perfect square trinomial.

39. $x^2 + \underline{\hspace{2cm}}x + 64$

40. $\underline{\hspace{2cm}}y^2 + 16y + 16$

41. $25x^2 - 60x + \underline{\hspace{2cm}}$

42. $36y^2 - \underline{\hspace{2cm}}y + 100$

Identify the factor common to the first two terms and the factor common to the last two terms of the polynomial.

43. $9x^5 + 6x^4 - 12x + 8$

44. $20x^4 + 16x^3 - 5x - 4$

Factor completely.

45. $15y^3 + 12y^2 + 5y + 4$

46. $6x^2 - 2x - 20$

47. $x^4 - 6x^3 + 6x - 36$

48. $12x^3 - 18x^2 - 8x + 12$

49. $24y^3 + 56y^2 - 6y - 14$

50. $-4y^3 + 3y^2 + 8y - 6$

51. **Open-Ended** Writing $(x + y)^2$ as $x^2 + y^2$ illustrates a common error.
Explain.

Chapter Test

Form A

Chapter 10

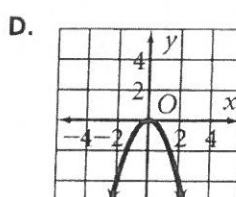
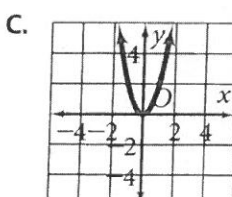
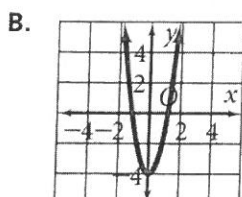
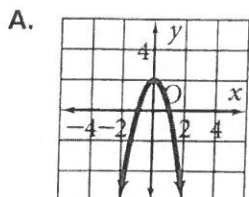
Match each graph with its function.

1. $y = -2x^2 + 2$

2. $y = -x^2$

3. $y = 2x^2$

4. $y = 3x^2 - 4$



Find the equation of the axis of symmetry and the coordinates of the vertex of the graph of each function. Is the vertex a maximum or a minimum?

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

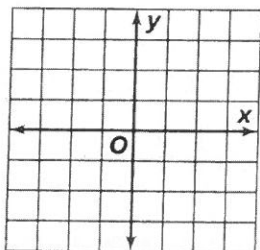
6. $y = x^2 + 5x - 12$

7. $y = \frac{3}{2}x^2 - 6x + 5$

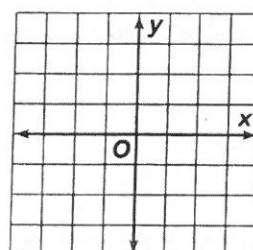
8. $y = \frac{1}{4}x^2 + 8x$

Graph each function.

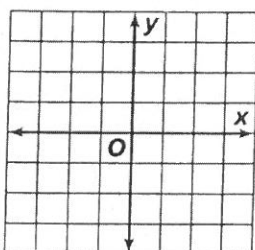
9. $y = \frac{2}{3}x^2$



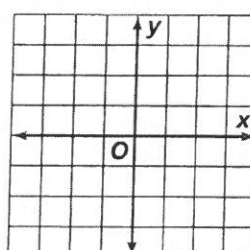
10. $y = -x^2 + 3$



11. $y = 2x^2 + 5x - 7$



12. $y = x^2 - 5$



13. **Open-Ended** Write an equation of a parabola that has two x -intercepts and a minimum vertex. Include a graph of the parabola.

Find the number of x -intercepts of each function.

14. $y = 8x^2$

15. $y = 4x^2 + 9$

16. $y = -3x^2 + x - 4$

17. $y = x^2 - 5x$

Find the principal and the negative square root of each number. If necessary, round to the nearest hundredth.

18. 900

19. 1.21

20. $\frac{16}{25}$

21. 0.64

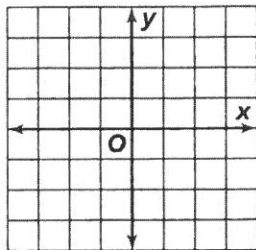
Chapter Test (continued)

Form A

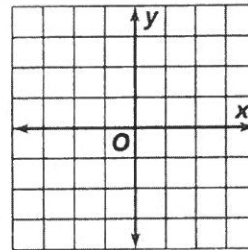
Chapter 10

Graph each inequality.

22. $y > x^2 + 2$



23. $y \leq -x^2 + 3$



Between what two consecutive integers is each square root?

24. $\sqrt{18}$

25. $\sqrt{156}$

26. $\sqrt{432}$

27. $-\sqrt{7.99}$

Find the number of solutions of each equation.

28. $x^2 + 3x = 4$

29. $-2x^2 - 5x = 0$

30. $4x^2 - 3x = -2$

31. $x^2 + 12 = 0$

Solve each equation. If necessary, round to the nearest hundredth.

32. $3x^2 = 48$

33. $2x^2 - 5x = 12$

34. $-x^2 + 6x - 4 = 0$

35. $6x^2 - 8x - 30 = 0$

36. $x^2 - 81 = 0$

37. $2x^2 + 5x - 63 = 0$

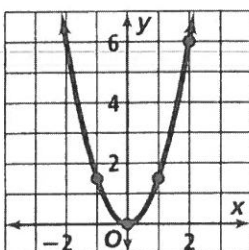
Model each problem with a quadratic equation. Then solve.

38. The volume of a square pyramid is given by the formula $V = \frac{1}{3}hx^2$, where h is the height of the pyramid and x is the length of one side of the base. A pyramid with a height of 15 ft has a volume of 2880 ft³. What is the length of one side of the base?

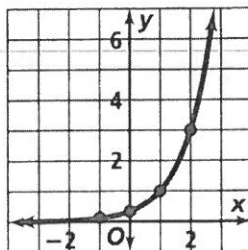
39. The area of a soccer field is 5000 yd². The length of the field is twice the width. Find the dimensions of the field.

Identify each graph as linear, quadratic, or exponential. Write an equation that models the data shown in each graph.

40.



41.



42.

