

Section 0.3

21. Evaluate each of the following without a calculator.

(a) $\left(\frac{3}{8}\right)^0$ (b) $2^3 \cdot 2^{-5}$

(c) $\frac{4^9}{4^3}$ (d) $\left(\frac{1}{7}\right)^3 \left(\frac{1}{7}\right)^{-4}$

22. Use the rules of exponents to simplify each of the following with positive exponents. Assume all variables are nonzero.

(a) $x^5 \cdot x^{-7}$ (b) x^8/x^{-2} (c) $(x^3)^3$

(d) $(y^4)^{-2}$ (e) $(-y^{-3})^{-2}$

For Problems 23–28, rewrite each expression so that only positive exponents remain. Assume all variables are nonzero.

23. $\frac{-(2xy^2)^{-2}}{(3x^{-2}y^{-3})^2}$

24. $\left(\frac{2}{3}x^2y^{-4}\right)^{-2}$

25. $\left(\frac{x^{-2}}{2y^{-1}}\right)^2$

26. $\frac{(-x^4y^{-2}z^2)^0}{-(x^4y^{-2}z^2)^{-2}}$

27. $\left(\frac{x^{-3}y^4z^{-2}}{3x^{-2}y^{-3}z^{-3}}\right)^{-1}$

28. $\left(\frac{x}{2y}\right)\left(\frac{y}{x^2}\right)^{-2}$

Section 0.4

29. Find the following roots.

(a) $-\sqrt[3]{-64}$ (b) $\sqrt{4/49}$ (c) $\sqrt[3]{1.9487171}$

30. Write each of the following with an exponent and with the variable in the numerator.

(a) \sqrt{x} (b) $\sqrt[3]{x^2}$ (c) $1/\sqrt[4]{x}$

31. Write each of the following in radical form.

(a) $x^{2/3}$ (b) $x^{-1/2}$ (c) $-x^{3/2}$

32. Rationalize each of the following denominators and simplify.

(a) $\frac{5xy}{\sqrt{2x}}$ (b) $\frac{y}{x\sqrt[3]{xy^2}}$

In Problems 33–38, use the properties of exponents to simplify so that only positive exponents remain. Assume all variables are positive.

33. $x^{1/2} \cdot x^{1/3}$ 34. $y^{-3/4}/y^{-7/4}$ 35. $x^4 \cdot x^{1/4}$

36. $1/(x^{-4/3} \cdot x^{-7/3})$ 37. $(x^{4/5})^{1/2}$ 38. $(x^{1/2}y^2)^4$

In Problems 39–44, simplify each expression. Assume all variables are positive.

39. $\sqrt{12x^3y^5}$ 40. $\sqrt{1250x^6y^9}$

41. $\sqrt[3]{24x^4y^4} \cdot \sqrt[3]{45x^4y^{10}}$ 42. $\sqrt{16a^2b^3} \cdot \sqrt{8a^3b^5}$

43. $\frac{\sqrt{52x^3y^6}}{\sqrt{13xy^4}}$ 44. $\frac{\sqrt{32x^4y^3}}{\sqrt{6xy^{10}}}$

Section 0.5

In Problems 45–62, perform the indicated operations and simplify.

45. $(3x + 5) - (4x + 7)$

46. $x(1 - x) + x[x - (2 + x)]$

47. $(3x^3 - 4xy - 3) + (5xy + x^3 + 4y - 1)$

48. $(4xy^3)(6x^4y^2)$

49. $(3x - 4)(x - 1)$

50. $(3x - 1)(x + 2)$

51. $(4x + 1)(x - 2)$

52. $(3x - 7)(2x + 1)$

53. $(2x - 3)^2$

54. $(4x + 3)(4x - 3)$

55. $(2x^2 + 1)(x^2 + x - 3)$

56. $(2x - 1)^3$

57. $(x - y)(x^2 + xy + y^2)$ 58. $\frac{4x^2y - 3x^3y^3 - 6x^4y^2}{2x^2y^2}$

59. $(3x^4 + 2x^3 - x + 4) \div (x^2 + 1)$

60. $(x^4 - 4x^3 + 5x^2 + x) \div (x - 3)$

61. $x^{4/3}(x^{2/3} - x^{-1/3})$

62. $(\sqrt{x} + \sqrt{a - x})(\sqrt{x} - \sqrt{a - x})$

Section 0.6

In Problems 63–73, factor each expression completely.

63. $2x^4 - x^3$

64. $4(x^2 + 1)^2 - 2(x^2 + 1)^3$

65. $4x^2 - 4x + 1$

66. $16 - 9x^2$

67. $2x^4 - 8x^2$

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

69. $3x^2 - x - 2$

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

71. $x^2 - 10x - 24$

72. $12x^2 - 23x - 24$

73. $16x^4 - 72x^2 + 81$

74. Factor as indicated: $x^{-2/3} + x^{-4/3} = x^{-4/3}(\quad?)$

Section 0.7

75. Reduce each of the following to lowest terms.

(a) $\frac{2x}{2x + 4}$ (b) $\frac{4x^2y^3 - 6x^3y^4}{2x^2y^2 - 3xy^3}$

In Problems 76–82, perform the indicated operations and simplify.

76. $\frac{x^2 - 4x}{x^2 + 4} \cdot \frac{x^4 - 16}{x^4 - 16x^2}$

77. $\frac{x^2 + 6x + 9}{x^2 - 7x + 12} \div \frac{x^2 + 4x + 3}{x^2 - 3x - 4}$

78. $\frac{x^4 - 2x^3}{3x^2 - x - 2} \div \frac{x^3 - 4x}{9x^2 - 4}$ 79. $1 + \frac{3}{2x} - \frac{1}{6x^2}$

80. $\frac{1}{x - 2} - \frac{x - 2}{4}$ 81. $\frac{x + 2}{x^2 - x} - \frac{x^2 + 4}{x^2 - 2x + 1} + 1$

82. $\frac{x - 1}{x^2 - x - 2} - \frac{x}{x^2 - 2x - 3} + \frac{1}{x - 2}$

Exercise Set 0.6

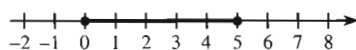
1. $3b(3a - 4a^2 + 6b)$
2. $2x(2x + 4y^2 + y^3)$
3. $(7x^2 + 2)(x - 2)$
4. $(6 + y)(x - m)$
5. $(x + 2)(x + 6)$
6. $(x - 3)(x + 2)$
7. $(7x + 4)(x - 2)$
8. $(x - 5)^2$
9. $(7a + 12b)(7a - 12b)$
10. (a) $(3x - 1)(3x + 8)$
11. (b) $(9x + 4)(x + 2)$
12. $x(4x - 1)$
13. $(x^2 - 5)(x + 4)$
14. $2(x - 7)(x + 3)$
15. $2x(x - 2)^2$
16. $(2x - 3)(x + 2)$
17. $3(x + 4)(x - 3)$
18. $2x(x + 2)(x - 2)$
19. $(5x + 2)(2x + 3)$
20. $(5x - 1)(2x - 9)$
21. $(y^2 + 4x^2)(y + 2x)(y - 2x)$
22. $(x + 2)^2(x - 2)^2$
23. $(2x + 1)(2x - 1)(x + 1)(x - 1)$
24. $(x + 1)^3$
25. $(x - 4)^3$
26. $(x - 4)(x^2 + 4x + 16)$
27. $(3 + 2x)(9 - 6x + 4x^2)$
28. $x + 1$
29. $1 + x$
30. $7x - 3x^3$
31. $P(1 + r)$
32. $m(c - m)$
33. (a) $p(10,000 - 100p)$; $x = 10,000 - 100p$
34. (b) 6200
35. (a) $R = x(300 - x)$
36. (b) $300 - x$

Exercise Set 0.7

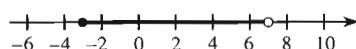
1. $2y^3/z$
2. $\frac{1}{3}$
3. $(x - 1)/(x - 3)$
4. $(2xy^2 - 5)/(y + 3)$
5. $20x/y$
6. $\frac{32}{3}$
7. $3x + 9$
8. $\frac{-(x + 1)(x + 3)}{(x - 1)(x - 3)}$
9. $15bc^2/2$
10. $5y/(y - 3)$
11. $\frac{-x(x - 3)(x + 2)}{x + 3}$
12. $\frac{1}{x + 1}$
13. $\frac{4a - 4}{a(a - 2)}$
14. $\frac{-x^2 + x + 1}{x + 1}$
15. $\frac{16a + 15a^2}{12(x + 2)}$
16. $\frac{79x + 9}{30(x - 2)}$
17. $\frac{9x + 4}{(x - 2)(x + 2)(x + 1)}$
18. $(7x - 3x^3)/\sqrt{3 - x^2}$
19. $\frac{1}{6}$
20. $39. xy$
21. $\frac{x + 1}{x^2}$
22. $\frac{1}{\sqrt{a}} = \frac{\sqrt{a}}{a}$
23. $\frac{x - 2}{(x - 3)\sqrt{x^2 + 9}}$
24. (a) -12
25. (b) $\frac{25}{36}$
26. (c) $2b^2 - a$
27. $(1 - 2\sqrt{x} + x)/(1 - x)$
28. $1/(\sqrt{x + h} + \sqrt{x})$
29. $(bc + ac + ab)/abc$
30. (a) $\frac{0.1x^2 + 55x + 4000}{x}$
31. (b) $0.1x^2 + 55x + 4000$
32. $\frac{t^2 + 9t}{(t + 3)^2}$

Chapter 0 Review Exercises

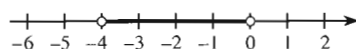
1. yes
2. no
3. no
4. $\{1, 2, 3, 4, 9\}$
5. $\{5, 6, 7, 8, 10\}$
6. $\{1, 2, 3, 4, 9\}$
7. yes, $(A' \cup B') = \{1, 3\} = A \cap B$
8. (a) Commutative Property of Addition
9. (b) Associative Property of Multiplication
10. (c) Distributive Law
11. (a) irrational
12. (b) rational, integer
13. (c) meaningless
14. (a) $>$
15. (b) $<$
16. (c) $>$
17. 11. 6
18. 12. 142
19. 13. 10
20. 14. $5/4$
21. 15. 9
22. 16. -29
23. 17. $13/4$
24. 18. -10.62857888
25. 19. (a) $[0, 5]$, closed



- (b) $[-3, 7)$, half-open

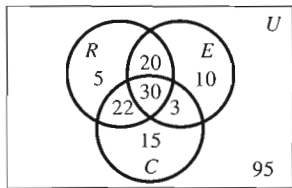


- (c) $(-4, 0)$, open



26. 20. (a) $-1 < x < 16$
27. (b) $-12 \leq x \leq 8$
28. (c) $x < -1$
29. 21. (a) 1
30. (b) $2^{-2} = 1/4$
31. (c) 4^6
32. (d) 7
33. 22. (a) $1/x^2$
34. (b) x^{10}
35. (c) x^9
36. (d) $1/y^8$
37. (e) y^6
38. 23. $-x^2y^2/36$
39. 24. $9y^8/(4x^4)$
40. 25. $y^2/(4x^4)$
41. 26. $-x^8z^4/y^4$
42. 27. $3x/(y^7z)$
43. 28. $x^5/(2y^3)$
44. 29. (a) 4
45. (b) $2/7$
46. (c) 1.1
47. 30. (a) $x^{1/2}$
48. (b) $x^{2/3}$
49. (c) $x^{-1/4}$
50. 31. (a) $\sqrt[3]{x^2}$
51. (b) $1/\sqrt{x} = \sqrt{x}/x$
52. (c) $-x\sqrt{x}$
53. 32. (a) $5y\sqrt{2x}/2$
54. (b) $\sqrt[3]{x^2y}/x^2$
55. 33. $x^{5/6}$
56. 34. y
57. 35. $x^{17/4}$
58. 36. $x^{11/3}$
59. 37. $x^{2/5}$
60. 38. x^2y^8
61. 39. $2xy^2\sqrt{3xy}$
62. 40. $25x^3y^4\sqrt{2y}$
63. 41. $6x^2y^4\sqrt[3]{5x^2y^2}$
64. 42. $8a^2b^4\sqrt{2a}$
65. 43. $2xy$
66. 44. $4x\sqrt{3xy}/(3y^4)$
67. 45. $-x - 2$
68. 46. $-x^2 - x$
69. 47. $4x^3 + xy + 4y - 4$
70. 48. $24x^5y^5$
71. 49. $3x^2 - 7x + 4$
72. 50. $3x^2 + 5x - 2$
73. 51. $4x^2 - 7x - 2$
74. 52. $6x^2 - 11x - 7$
75. 53. $4x^2 - 12x + 9$
76. 54. $16x^2 - 9$
77. 55. $2x^4 + 2x^3 - 5x^2 + x - 3$
78. 56. $8x^3 - 12x^2 + 6x - 1$
79. 57. $x^3 - y^3$
80. 58. $(2/y) - (3xy/2) - 3x^2$
81. 59. $3x^2 + 2x - 3 + (-3x + 7)/(x^2 + 1)$
82. 60. $x^3 - x^2 + 2x + 7 + 21/(x - 3)$
83. 61. $x^2 - x$
84. 62. $2x - a$
85. 63. $x^3(2x - 1)$
86. 64. $2(x^2 + 1)^2(1 + x)(1 - x)$
87. 65. $(2x - 1)^2$
88. 66. $(4 + 3x)(4 - 3x)$
89. 67. $2x^2(x + 2)(x - 2)$
90. 68. $(x - 7)(x + 3)$
91. 69. $(3x + 2)(x - 1)$
92. 70. $(x - 3)(x - 2)$
93. 71. $(x - 12)(x + 2)$

72. $(4x + 3)(3x - 8)$ 73. $(2x + 3)^2(2x - 3)^2$
 74. $x^{2/3} + 1$ 75. (a) $\frac{x}{(x + 2)}$ (b) $\frac{2xy(2 - 3xy)}{2x - 3y}$
 76. $\frac{x^2 - 4}{x(x + 4)}$ 77. $\frac{(x + 3)}{(x - 3)}$ 78. $\frac{x^2(3x - 2)}{(x - 1)(x + 2)}$
 79. $(6x^2 + 9x - 1)/(6x^2)$ 80. $\frac{4x - x^2}{4(x - 2)}$
 81. $-\frac{x^2 + 2x + 2}{x(x - 1)^2}$ 82. $\frac{x(x - 4)}{(x - 2)(x + 1)(x - 3)}$
 83. $\frac{(x - 1)^3}{x^2}$ 84. $\frac{1 - x}{1 + x}$ 85. $3(\sqrt{x} + 1)$
 86. $2/(\sqrt{x} + \sqrt{x - 4})$
 87. (a)



R: recognized
 E: exercise
 C: community involvement

- (b) 10 (c) 100
 88. \$72.96 billion 89. 16
 90. (a) \$4115.27 (b) \$66,788.69
 91. \$400 million; \$5078.676 million
 92. (a) $10,000 \left[\frac{(0.0065)(1.0065)^n}{(1.0056)^n - 1} \right]$
 (b) \$243.19 (for both)
 93. (a) $S = k\sqrt[3]{A}$ (b) $\sqrt[3]{2.25} \approx 1.31$
 94. $26x - 300 - 0.001x^2$
 95. $450,000 - 1125x$
 96. $(50 + x)(12 - 0.5x)$
 97. (a) $\frac{5400p}{100 - p}$
 (b) \$0. It costs nothing if no effort is made to remove pollution.
 (c) \$264,600
 (d) Undefined. Removing 100% would be impossible, and the cost of getting close would be enormous.
 98. $\frac{56x^2 + 1200x + 8000}{x}$

Chapter 0 Test

1. (a) {3, 4, 6, 8} (b) {3, 4}; {3, 6}; or {4, 6}
 (c) {6} or {8}
 2. 21
 3. (a) 8 (b) 1 (c) $\frac{1}{2}$ (d) -10 (e) 30
 (f) $\frac{5}{6}$ (g) $\frac{2}{3}$ (h) -3
 4. (a) $\sqrt[5]{x}$ (b) $\frac{1}{\sqrt[4]{x^3}}$ 5. (a) $\frac{1}{x^5}$ (b) $\frac{x^{21}}{y^6}$
 6. (a) $\frac{\sqrt{5x}}{5}$ (b) $2a^2b^2\sqrt{6ab}$ (c) $\frac{1 - 2\sqrt{x} + x}{1 - x}$

7. (a) 5 (b) -8 (c) -5
 8. $(-2, 3]$
 9. (a) $2x^2(4x - 1)$ (b) $(x - 4)(x - 6)$
 (c) $(3x - 2)(2x - 3)$ (d) $2x^3(1 + 4x)(1 - 4x)$
 10. (c); -2 11. $2x + 1 + \frac{2x - 6}{x^2 - 1}$
 12. (a) $19y - 45$ (b) $-6t^6 + 9t^9$
 (c) $4x^3 - 21x^2 + 13x - 2$ (d) $-18x^2 + 15x - 2$
 (e) $4m^2 - 28m + 49$ (f) $\frac{x^4}{3x + 9}$ (g) $\frac{x^7}{81}$
 (h) $\frac{6 - x}{x - 8}$ (i) $\frac{x^2 - 4x - 3}{x(x - 3)(x + 1)}$
 13. $\frac{y - x}{y + xy^2}$ 14. (a) 0 (b) 175
 15. \$4875.44 (nearest cent)

Exercise Set 1.1

1. $x = -9/4$ 3. $x = 0$ 5. $x = -32$
 7. $x = -29/2$ 9. $x = 17/13$
 11. $x = -1/3$ 13. $x = 3$ 15. $x = 5/4$
 17. no solution 19. $x \approx -0.279$
 21. $x \approx -1147.362$ 23. $y = \frac{3}{4}x - \frac{15}{4}$
 25. $y = -6x + \frac{22}{3}$ 27. $t = \frac{S - P}{Pr}$
 29. $x < 2$ 31. $x < -4$ 33. $x \leq -1$
 35. $x < -3$
 37. $x < -6$
 39. $x < 2$
 41. 145 months
 43. \$3356.50 45. 440 packs, or 220,000 CDs
 47. \$29,600 49. 78.68% 51. 96
 53. \$90,000 at 9%; \$30,000 at 13%
 55. \$2160/month; 8% increase
 57. $x > 80$
 59. $695 + 5.75x \leq 900$; 35 or fewer
 61. (a) $t = 10$ (b) $t > 12.80$ (c) in 2008
 63. (a) $0.479 \leq h \leq 1$; $h = 1$ means 100% humidity
 (b) $0 \leq h \leq 0.237$

Exercise Set 1.2

1. (a) To each x -value there corresponds exactly one y -value.
 (b) domain: $\{-7, -1, 0, 3, 4.2, 9, 11, 14, 18, 22\}$
 range: $\{0, 1, 5, 9, 11, 22, 35, 60\}$
 3. $f(0) = 1, f(11) = 35$
 5. yes; to each x -value there corresponds exactly one y -value; domain = $\{1, 2, 3, 8, 9\}$, range = $\{-4, 5, 16\}$