Definitions and Concepts	Examples
Section 10.7 Complex Numbers (continued)	
To divide complex numbers, multiply the numerator and the denominator by the conjugate of the denominator in order to obtain a real number in the denominator. This real number becomes the denominator of a and b in the quotient $a + bi$.	$\frac{5+2i}{4-i} = \frac{5+2i}{4-i}\cdot\frac{4+i}{4+i} = \frac{20+5i+8i+2i^2}{16-i^2}$ $= \frac{20+13i+2(-1)}{16-(-1)}$ $= \frac{20+13i-2}{16+1}$ $= \frac{18+13i}{17} = \frac{18}{17}+\frac{13}{17}i$
To simplify powers of i, rewrite the expression in terms of i^2. Then replace i^2 with -1 and simplify.	Simplify: i^{27}. $i^{27} = i^{26}\cdot i = (i^2)^{13}i = (-1)^{13}i = (-1)i = -i$

CHAPTER 10 REVIEW EXERCISES

10.1 *In Exercises 1–5, find the indicated root, or state that the expression is not a real number.*

1. $\sqrt{81}$
2. $-\sqrt{\frac{1}{100}}$
3. $\sqrt[3]{-27}$
4. $\sqrt[4]{-16}$
5. $\sqrt[5]{-32}$

In Exercises 6–7, find the indicated function values for each function. If necessary, round to two decimal places. If the function value is not a real number and does not exist, so state.

6. $f(x) = \sqrt{2x-5};\quad f(15), f(4), f\left(\frac{5}{2}\right), f(1)$

7. $g(x) = \sqrt[3]{4x-8};\quad g(4), g(0), g(-14)$

In Exercises 8–9, find the domain of each square root function.

8. $f(x) = \sqrt{x-2}$
9. $g(x) = \sqrt{100-4x}$

In Exercises 10–15, simplify each expression. Assume that each variable can represent any real number, so include absolute value bars where necessary.

10. $\sqrt{25x^2}$
11. $\sqrt{(x+14)^2}$
12. $\sqrt{x^2-8x+16}$
13. $\sqrt[3]{64x^3}$
14. $\sqrt[4]{16x^4}$
15. $\sqrt[5]{-32(x+7)^5}$

10.2 *In Exercises 16–18, use radical notation to rewrite each expression. Simplify, if possible.*

16. $(5xy)^{\frac{1}{3}}$
17. $16^{\frac{3}{2}}$
18. $32^{\frac{4}{5}}$

In Exercises 19–20, rewrite each expression with rational exponents.

19. $\sqrt{7x}$
20. $\left(\sqrt[3]{19xy}\right)^5$

In Exercises 21–22, rewrite each expression with a positive rational exponent. Simplify, if possible.

21. $8^{-\frac{2}{3}}$
22. $3x(ab)^{-\frac{4}{5}}$

In Exercises 23–26, use properties of rational exponents to simplify each expression.

23. $x^{\frac{1}{3}}\cdot x^{\frac{1}{4}}$
24. $\frac{5^{\frac{1}{2}}}{5^{\frac{1}{3}}}$
25. $(8x^6y^3)^{\frac{1}{3}}$
26. $\left(x^{-\frac{2}{3}}y^{\frac{1}{4}}\right)^{\frac{1}{2}}$

In Exercises 27–31, use rational exponents to simplify each expression. If rational exponents appear after simplifying, write the answer in radical notation.

27. $\sqrt[3]{x^9y^{12}}$
28. $\sqrt[9]{x^3y^9}$
29. $\sqrt{x}\cdot\sqrt[3]{x}$
30. $\frac{\sqrt[3]{x^2}}{\sqrt[4]{x^2}}$
31. $\sqrt[5]{\sqrt[3]{x}}$

32. The function $f(x) = 350x^{\frac{2}{3}}$ models the expenditures, $f(x)$, in millions of dollars, for the U.S. National Park Service x years after 1985. According to this model, what were expenditures in 2012?

10.3 *In Exercises 33–35, use the product rule to multiply.*

33. $\sqrt{3x}\cdot\sqrt{7y}$
34. $\sqrt[5]{7x^2}\cdot\sqrt[5]{11x}$
35. $\sqrt[6]{x-5}\cdot\sqrt[6]{(x-5)^4}$

36. If $f(x) = \sqrt{7x^2-14x+7}$, express the function, f, in simplified form. Assume that x can be any real number.

In Exercises 37–39, simplify by factoring. Assume that all variables in a radicand represent positive real numbers.

37. $\sqrt{20x^3}$

38. $\sqrt[3]{54x^8y^6}$

39. $\sqrt[4]{32x^3y^{11}z^5}$

In Exercises 40–43, multiply and simplify, if possible. Assume that all variables in a radicand represent positive real numbers.

40. $\sqrt{6x^3} \cdot \sqrt{4x^2}$

41. $\sqrt[3]{4x^2y} \cdot \sqrt[3]{4xy^4}$

42. $\sqrt[5]{2x^4y^3z^4} \cdot \sqrt[5]{8xy^6z^7}$

43. $\sqrt{x+1} \cdot \sqrt{x-1}$

10.4

Assume that all variables represent positive real numbers. In Exercises 44–47, add or subtract as indicated.

44. $6\sqrt[3]{3} + 2\sqrt[3]{3}$

45. $5\sqrt{18} - 3\sqrt{8}$

46. $\sqrt[3]{27x^4} + \sqrt[3]{xy^6}$

47. $2\sqrt[3]{6} - 5\sqrt[3]{48}$

In Exercises 48–50, simplify using the quotient rule.

48. $\sqrt[3]{\frac{16}{125}}$

49. $\sqrt{\frac{x^3}{100y^4}}$

50. $\sqrt[4]{\frac{3y^5}{16x^{20}}}$

In Exercises 51–54, divide and, if possible, simplify.

51. $\frac{\sqrt{48}}{\sqrt{2}}$

52. $\frac{\sqrt[3]{32}}{\sqrt[3]{2}}$

53. $\frac{\sqrt[4]{64x^7}}{\sqrt[4]{2x^2}}$

54. $\frac{\sqrt{200x^3y^2}}{\sqrt{2x^{-2}y}}$

10.5

Assume that all variables represent positive real numbers.

In Exercises 55–62, multiply as indicated. If possible, simplify any radical expressions that appear in the product.

55. $\sqrt{3}(2\sqrt{6} + 4\sqrt{15})$

56. $\sqrt[3]{5}(\sqrt[3]{50} - \sqrt[3]{2})$

57. $(\sqrt{7} - 3\sqrt{5})(\sqrt{7} + 6\sqrt{5})$

58. $(\sqrt{x} - \sqrt{11})(\sqrt{y} - \sqrt{11})$

59. $(\sqrt{5} + \sqrt{8})^2$

60. $(2\sqrt{3} - \sqrt{10})^2$

61. $(\sqrt{7} + \sqrt{13})(\sqrt{7} - \sqrt{13})$

62. $(7 - 3\sqrt{5})(7 + 3\sqrt{5})$

In Exercises 63–75, rationalize each denominator. Simplify, if possible.

63. $\frac{4}{\sqrt{6}}$

64. $\sqrt{\frac{2}{7}}$

65. $\frac{12}{\sqrt[3]{9}}$

66. $\sqrt{\frac{2x}{5y}}$

67. $\frac{14}{\sqrt[3]{2x^2}}$

68. $\sqrt[4]{\frac{7}{3x}}$

69. $\frac{5}{\sqrt[5]{32x^4y}}$

70. $\frac{6}{\sqrt{3} - 1}$

71. $\frac{\sqrt{7}}{\sqrt{5} + \sqrt{3}}$

72. $\frac{10}{2\sqrt{5} - 3\sqrt{2}}$

73. $\frac{\sqrt{x} + 5}{\sqrt{x} - 3}$

74. $\frac{\sqrt{7} + \sqrt{3}}{\sqrt{7} - \sqrt{3}}$

75. $\frac{2\sqrt{3} + \sqrt{6}}{2\sqrt{6} + \sqrt{3}}$

In Exercises 76–79, rationalize each numerator. Simplify, if possible.

76. $\sqrt{\frac{2}{7}}$

77. $\frac{\sqrt[3]{3x}}{\sqrt[3]{y}}$

78. $\frac{\sqrt{7}}{\sqrt{5} + \sqrt{3}}$

79. $\frac{\sqrt{7} + \sqrt{3}}{\sqrt{7} - \sqrt{3}}$

10.6

In Exercises 80–84, solve each radical equation.

80. $\sqrt{2x+4} = 6$

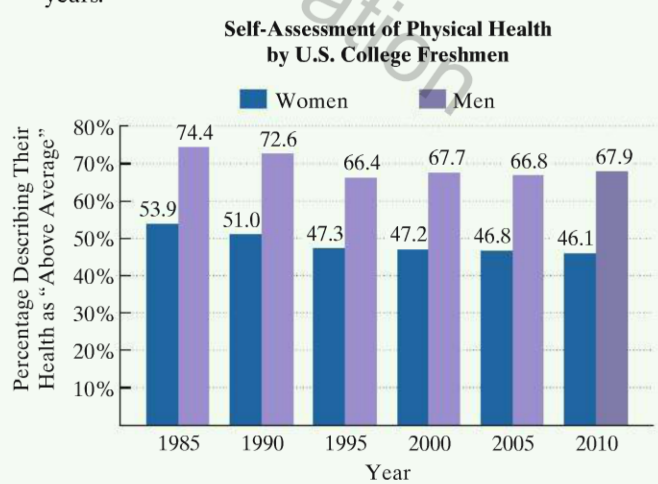
81. $\sqrt{x-5} + 9 = 4$

82. $\sqrt{2x-3} + x = 3$

83. $\sqrt{x-4} + \sqrt{x+1} = 5$

84. $(x^2 + 6x)^{\frac{1}{3}} + 2 = 0$

85. The bar graph shows the percentage of U.S. college freshmen who described their health as "above average" for six selected years.



Source: John Macionis, *Sociology, Fourteenth Edition*, Pearson, 2012.

The function

$$f(x) = -1.6\sqrt{x} + 54$$

models the percentage of freshmen women who described their health as above average, $f(x)$, x years after 1985.

a. Find and interpret $f(20)$. Round to the nearest tenth of a percent. How does this rounded value compare with the percentage of women displayed by the graph?

b. According to the model, in which year will 44.4% of freshmen women describe their health as above average?