

Simplify. Use a calculator or the tables at the back of the book as necessary. See Examples 2-4.

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|--|--|--|---|
| 1. $121^{1/2}$                           | 2. $169^{1/2}$                           | 3. $441^{1/2}$                           | 4. $2401^{1/2}$                           |
| 5. $512^{1/3}$                           | 6. $729^{1/3}$                           | 7. $256^{1/4}$                           | 8. $-4096^{1/4}$                          |
| 9. $-6561^{1/4}$                         | 10. $\left(\frac{1}{256}\right)^{1/4}$   | 11. $\left(\frac{1}{32}\right)^{1/5}$    | 12. $\left(\frac{4}{9}\right)^{1/2}$      |
| 13. $\left(\frac{16}{25}\right)^{1/2}$   | 14. $\left(\frac{64}{27}\right)^{1/3}$   | 15. $\left(\frac{8}{125}\right)^{1/3}$   | 16. $8^{2/3}$                             |
| 17. $100^{3/2}$                          | 18. $32^{2/5}$                           | 19. $32^{6/5}$                           | 20. $(-125)^{2/3}$                        |
| 21. $-144^{3/2}$                         | 22. $-49^{3/2}$                          | 23. $1728^{2/3}$                         | 24. $\left(\frac{1}{9}\right)^{3/2}$      |
| 25. $\left(\frac{16}{81}\right)^{3/4}$   | 26. $-\left(\frac{81}{625}\right)^{3/4}$ | 27. $-\left(\frac{9}{4}\right)^{5/2}$    | 28. $\left(\frac{27}{64}\right)^{-1/3}$   |
| 29. $\left(\frac{16}{625}\right)^{-1/4}$ | 30. $\left(\frac{25}{36}\right)^{-3/2}$  | 31. $\left(\frac{121}{36}\right)^{-3/2}$ | 32. $\left(\frac{27}{1000}\right)^{-2/3}$ |

Use the rules of exponents to simplify each of the following. Assume that all variables represent positive real numbers. Write all answers with only positive exponents. See Example 5.

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|-----------------------------|-----------------------------|---------------------------------|-----------------------------------|
| 33. $9^{3/5} \cdot 9^{7/5}$ | 34. $7^{3/4} \cdot 7^{9/4}$ | 35. $\frac{81^{5/4}}{81^{3/4}}$ | 36. $\frac{125^{2/3}}{125^{1/3}}$ |
|-----------------------------|-----------------------------|---------------------------------|-----------------------------------|

- |  |   |  |   |
|--|---|--|---|
| 37. $x^{5/3} \cdot x^{-2/3}$   | 38. $m^{-8/9} \cdot m^{17/9}$   | 39. $\frac{k^{2/3}k^{-1}}{k^{1/3}}$                                    | 40. $\frac{z^{5/4}z^{-2}}{z^{3/4}}$             |
| 41. $(8p^9q^6)^{2/3}$  | 42. $(25m^8r^{10})^{3/2}$   | 43. $\frac{(r^{2/3})^2}{(r^2)^{5/3}}$                                  | 44. $\frac{(k^{5/4})^2}{(k^3)^{4/3}}$           |
| 45. $\left(\frac{z^{10}}{x^{12}}\right)^{1/4}$                         | 46. $\left(\frac{r^5}{s^7}\right)^{2/5}$                              | 47. $\frac{(m^2h)^{1/2}}{m^{3/4}h^{-1/4}}$                             | 48. $\frac{(a^{-3}b^2)^{1/6}}{(a^2b^5)^{-1/4}}$ |
| 49. $\frac{p^{1/5}p^{7/10}p^{1/2}}{(p^3)^{-1/5}}$                      | 50. $\frac{z^{1/3}z^{-2/3}z^{1/6}}{(z^{-1/6})^3}$                     | 51. $\left(\frac{m^{-2/3}}{a^{-3/4}}\right)^4 (m^{-3/8}a^{1/4})^{-2}$  |   |
| 52. $\left(\frac{b^{-3/2}}{c^{-5/3}}\right)^2 (b^{-1/4}c^{-1/3})^{-1}$ | 53. $\left(\frac{p^{-1/4}q^{-3/2}}{3^{-1}p^{-2}q^{-2/3}}\right)^{-2}$ | 54. $\left(\frac{2^{-2}w^{-3/4}x^{-5/8}}{w^{3/4}x^{-1/2}}\right)^{-3}$ |   |

Multiply. Assume that all variables represent positive real numbers. See Example 5(d).

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|-----------------------------------|--------------------------------------|--------------------------------------|
| 55. $p^{2/3}(p^{1/3} + 2p^{4/3})$ | 56. $z^{5/8}(3z^{5/8} + 5z^{11/8})$  | 57. $k^{1/4}(k^{3/2} - k^{1/2})$     |
| 58. $r^{3/5}(r^{1/2} + r^{3/4})$  | 59. $6a^{7/4}(a^{-7/4} + 3a^{-3/4})$ | 60. $4m^{5/3}(m^{-2/3} - 4m^{-5/3})$ |
| 61. $x^{-3/5}(x^{11/5} - 4x)$     | 62. $y^{-11/7}(y^2 - 3y^3)$          | 63. $-z^{-5/6}(5z^3 - 2z^2)$         |

Factor, using the given common factor. Assume that all variables represent positive real numbers.

- |                                       |                                      |                                      |
|---------------------------------------|--------------------------------------|--------------------------------------|
| 64. $3x^{-1/2} - 4x^{1/2}; x^{-1/2}$  | 65. $m^3 - 3m^{5/2}; m^{5/2}$        | 66. $4t^{-1/2} + 7t^{3/2}; t^{-1/2}$ |
| 67. $8x^{2/3} - 5x^{-1/3}; x^{-1/3}$  | 68. $4p - p^{3/4}; p^{3/4}$          | 69. $2m^{1/8} - m^{5/8}; m^{1/8}$    |
| 70. $9k^{-3/4} - 2k^{-1/4}; k^{-3/4}$ | 71. $7z^{-5/8} - z^{-3/4}; z^{-3/4}$ | 72. $8a^{-2/3} - a^{-5/3}; a^{-5/3}$ |

Work each problem.

73. The length  $L$  of an animal is related to its surface area  $S$  by the equation

$$L = \left(\frac{S}{a}\right)^{1/2},$$

where  $a$  is a constant that depends on the type of animal. Find the length of an animal with a surface area of 1000 square centimeters if  $a = 2/5$ .

74. The threshold weight  $T$  for a person is the weight above which the risk of death increases greatly. One researcher found that the threshold weight in pounds for men aged 40-49 is related to height in inches by the equation

$$h = 12.3T^{1/3}.$$

What height corresponds to a threshold of 216 pounds for a man in this age group?

Write Exercises 75-82 as a single term or a product. Assume that  $x$  and  $y$  are positive real numbers and that  $a$  and  $b$  are rational numbers, with all indicated roots existing. See Example 5(e).

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75.  $y^{a/2}y^{a/3}$

76.  $(x^{3/4}y^b)(x^5)^b$

77.  $\frac{x^{5a/3}}{x^{a/6}}$

78.  $\left(\frac{x^b}{x^{3b}}\right)^{1/2} \left(\frac{x^{-2b}}{x^{-4b}}\right)^{-1}$

79.  $\left(\frac{x^{a/b}y^a}{x}\right)^{1/a}$

80.  $\frac{x^a x^{a/2}}{x^{2a}}$

81.  $\frac{x^{-1/b}y^{-1/a}}{x^{2/b}y^{-2/b}}$

82.  $\frac{x^{a/b}y^{1/b}}{(x^a y^b)^{1/a}}$

83. Find a value of  $a$  such that  $(a^2)^{1/2} \neq a$ .

### CHAPTER 5

#### Section 5.1 (page 209)

1. 11      3. 21      5. 8      7. 4      9. -9      11. 1/2      13. 4/5      15. 2/5  
 17. 1000      19. 64      21. -1728      23. 144      25. 8/27      27. -243/32      29. 5/2  
 31. 216/1331      33.  $9^2$  or 81      35.  $81^{1/2}$  or 9      37.  $x$       39.  $1/k^{2/3}$       41.  $4p^6q^4$   
 43.  $1/r^2$       45.  $z^{5/2}/x^3$       47.  $m^{1/4}h^{3/4}$       49.  $p^2$       51.  $a^{5/2}/m^{23/12}$       53.  $q^{5/3}/(9p^{7/2})$   
 55.  $p + 2p^2$       57.  $k^{7/4} - k^{3/4}$       59.  $6 + 18a$       61.  $x^{8/5} - 4x^{2/5}$       63.  $-5z^{13/6} + 2z^{7/6}$   
 65.  $m^{5/2}(m^{1/2} - 3)$       67.  $x^{-1/3}(8x - 5)$       69.  $m^{1/8}(2 - m^{1/2})$       71.  $z^{-3/4}(7z^{1/8} - 1)$       73. 50  
 centimeters      75.  $y^{5a/6}$       77.  $x^{3a/2}$       79.  $x^{(a-b)/(ab)} \cdot y$       81.  $x^{-3/b}y^{(2a-b)/(ab)}$       83. Use any  
 negative number for  $a$       85. Use  $x = 9, y = 16$ , for example      87. 13      89. 4      91. -4  
 93. -2

#### Section 5.2 (page 214)

1. 9      3. 4      5. -6      7. 3      9. -5      11. Not a real number      13. -9      15. 2  
 17. 4      19. -2      21. 4      23. -2      25.  $m^5$       27.  $q^3$       29. 6      31. 3  
 33. 2.646      35. -4.359      37. -9.055      39. 12.247      41. -22.583      43. 29.833  
 45. 6 square meters      47.  $\sqrt{12}$       49.  $\sqrt[5]{9}$       51.  $\sqrt[3]{(7y)^2}$  or  $\sqrt[3]{49y^2}$       53.  $\sqrt[4]{3py^2}$   
 55.  $1/\sqrt{(2m)^3}$  or  $1/\sqrt{8m^3}$       57.  $\sqrt[3]{(2y+x)^2}$       59.  $\sqrt{p^2 + q^2}$       61.  $1/\sqrt[3]{(3m^4 + 2k^2)^2}$   
 63.  $13^{1/2}$       65.  $7^{1/3}$       67.  $2^{3/2}$       69.  $6^{4/3}$       71.  $-8^{5/3}$       73.  $x^{3/4}$       75.  $a^{2/7}$