[06-12-19-L11-B]

5.1 Exercises

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

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.

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).

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.** $y^{-11/7}(y^2 - 3y^{-5})$ **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.** $7z^{-5/8} - z^{-3/4}$; $z^{-5/8}$ **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).

75. $y^{a/2}y^{a/3}$ **76.** $(x^{3/4})^b(x^5)^b$ **77.** $\dfrac{x^{5a/3}}{x^{a/6}}$ **78.** $\left(\dfrac{x^b}{x^{3b}}\right)^{1/2}\left(\dfrac{x^{-2b}}{x^{-4b}}\right)^{-1}$

79. $\left(\dfrac{x^{a/b}y^a}{x}\right)^{1/a}$ **80.** $\dfrac{x^a x^{a/2}}{x^{2a}}$ **81.** $\dfrac{x^{-1/b}y^{-1/a}}{x^{2/b}y^{-2/b}}$ **82.** $\dfrac{x^{a/b}y^{1/b}}{(x^a y^b)^{1/a}}$

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

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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