EXERCISES

Practice and Problem Solving

Example 1

Simplify each expression.

1. $36^{\frac{1}{2}}$
2. $27^{\frac{1}{3}}$
3. $49^{\frac{1}{2}}$
4. $10^2 \cdot 10^2$
5. $(-3)^{\frac{1}{3}} \cdot (-3)^{\frac{1}{3}} \cdot (-3)^{\frac{1}{3}}$
6. $3^{\frac{1}{2}} \cdot 12^{\frac{1}{2}}$
7. $2^{\frac{1}{2}} \cdot 32^{\frac{1}{2}}$
8. $3^{\frac{1}{3}} \cdot 9^{\frac{1}{3}}$
9. $3^{\frac{1}{4}} \cdot 27^{\frac{1}{4}}$

Example 2

Write each expression in radical form.

10. $x^{\frac{1}{6}}$
11. $x^{\frac{1}{5}}$
12. $x^{\frac{2}{5}}$
13. $y^{\frac{2}{5}}$
14. $y^{-\frac{9}{8}}$
15. $t^{-\frac{3}{4}}$
16. $x^{1.5}$
17. $y^{1.2}$

radical

Write each expression in exponential form.

18. $x^{\frac{1}{6}}$
19. $x^{\frac{1}{5}}$ $\sqrt[5]{x}$
20. $x^{\frac{2}{5}}$
21. $y^{\frac{2}{5}}$ $\sqrt[5]{y^2}$
22. $y^{-\frac{9}{8}}$
23. $t^{-\frac{3}{4}}$ $\frac{1}{\sqrt[4]{t^3}}$
24. $x^{1.5}$
25. $y^{1.2}$ $(\sqrt[5]{y})^6$

Example 3

The optimal height h of the letters of a message printed on pavement is given by the formula $h = \frac{0.00252d^{2.27}}{e}$. Here d is the distance of the driver from the letters and e is the height of the driver's eye above the pavement. All of the distances are in meters. Find h for the given values of d and e.

26. $d = 100$ m, $e = 1.2$m
27. $d = 50$ m, $e = 1.2$m
28. $d = 50$ m, $e = 2.3$m
29. $d = 25$ m, $e = 2.3$ m

Example 4

Simplify each number.

30. $8^{\frac{2}{3}}$
31. $64^{\frac{2}{3}}$ 16
32. $(-8)^{\frac{2}{3}}$
33. $(-32)^{\frac{2}{3}}$
34. $(32)^{-\frac{4}{5}}$
35. $4^{1.5}$ 8
36. $16^{1.5}$
37. $10{,}000^{0.75}$

Example 5

Write each expression in simplest form. Assume that all variables are positive.

38. $(x^{\frac{2}{3}})^{-3}$
39. $(x^{-\frac{4}{7}})^7$ $\frac{1}{x^4}$
40. $(3x^{\frac{2}{3}})^{-1}$
41. $5(x^{\frac{2}{3}})^{-1}$ $\frac{5}{x^{2/3}}$
42. $(-27x^{-9})^{\frac{1}{3}}$
43. $(-32y^{15})^{\frac{1}{5}}$ $-2y^3$
44. $\left(\frac{x^3}{x^{-1}}\right)^{-\frac{1}{4}}$
45. $\left(\frac{x^2}{x^{-11}}\right)^{\frac{1}{3}}$ $x^{13/3}$
46. $(x^{\frac{1}{2}}y^{-\frac{2}{3}})^{-6}$
47. $(x^{\frac{2}{3}}y^{-\frac{1}{6}})^{-12}$ x^8y^2
48. $\left(\frac{x^{\frac{1}{4}}}{y^{-\frac{3}{4}}}\right)^{12}$
49. $\left(\frac{x^{-\frac{2}{3}}}{y^{-\frac{1}{3}}}\right)^{15}$ $\frac{y^5}{x^{10}}$

Simplify each expression. Assume that all variables are positive.

65. $x^{\frac{2}{7}} \cdot x^{\frac{3}{14}}$ $x^{\frac{1}{2}}$
66. $y^{\frac{1}{2}} \cdot y^{\frac{3}{10}}$ $y^{\frac{4}{5}}$
67. $x^{\frac{3}{5}} \div x^{\frac{1}{10}}$ $x^{\frac{5}{2}}$
68. $y^{\frac{5}{7}} \div y^{\frac{3}{14}}$ $y^{\frac{7}{2}}$
69. $\frac{x^{\frac{2}{3}}y^{-\frac{1}{4}}}{x^{\frac{1}{2}}y^{-\frac{1}{2}}}$
70. $\frac{x^{\frac{1}{2}}y^{-\frac{1}{3}}}{x^{\frac{3}{4}}y^{\frac{1}{2}}}$
71. $\left(\frac{16x^{14}}{18y^{18}}\right)^{\frac{1}{2}}$
72. $\left(\frac{81y^{16}}{16x^{12}}\right)^{\frac{1}{2}}$
73. $(x^{\frac{1}{2}} \cdot x^{\frac{5}{12}})^{\frac{1}{3}} \div x^{\frac{2}{3}}$
74. $(x^{\frac{3}{4}} \div x^{\frac{7}{8}}) \cdot x^{-\frac{1}{6}}$
75. $\left[(x^{-\frac{1}{2}})^2\right]^{\frac{1}{3}}$
76. $\left[\left(\sqrt{x^3y^3}\right)^{\frac{1}{3}}\right]^{-1}$

World Connection
ologists estimate the
artifacts and fossils by
xponential functions

KEY

EXERCISES

Simplify each expression. Use only positive exponents.

1. $(3a^2)(4a^6)$ $12a^8$
2. $(-4x^2)(-2x^{-2})$ 8
3. $(4x^3y^5)^2$ $16x^6y^{10}$
4. $(2x^{-5}y^4)^3$ $8y^{12}/x^{15}$
5. $\frac{8a^5}{2a^2}$ $4a^3$
6. $\frac{6x^7y^5}{3x^{-1}}$ $2x^8y^5$
7. $\frac{(4x^2)^0}{2xy^5}$ $1/2xy^5$
8. $\left(\frac{3x^2}{2}\right)^2$ $9x^4/4$
9. $(-6m^2n^2)(3mn)$ $-18m^3n^3$
10. $(3x^4y^5)^{-3}$ $1/27x^{12}y^{15}$
11. $\frac{(2r^{-1}s^2t^0)^{-2}}{2rs}$ $r/8s^5$
12. $x^5(2x)^3$ $8x^8$
13. $\frac{x^4x^{-2}}{x^{-5}}$ x^7
14. $\frac{(12x^2y^6)^2}{8x^4y^7}$ $18y^5$
15. $(4p^2q)(p^2q^3)$ $4p^4q^4$
16. $\frac{4x^3}{2x}$ $2x^2$
17. $(p^2)^{-2}$ $1/p^4$
18. $\frac{-15x^4}{3x}$ $-5x^3$
19. $\frac{r^2s^3t^4}{r^2s^{-4}t^{-4}}$ $\cancel{t^8/s}$ t^8s^7
20. $\frac{xy^2}{2} \cdot \frac{6x}{y^2}$ $3x^2$
21. $(s^2t)^3(st)$ $\cancel{s^7t^4}$ s^7t^4
22. $(3x^{-3}y^{-2})^{-2}$ $x^6y^4/9$
23. $(h^4k^5)^0$ 1
24. $\frac{s^2t^3}{r} \cdot \frac{sr^3}{t}$ $r^2s^3t^2$

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

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

20. $y = 5^x$

21. $y = \sqrt{2x - 6}$

Solve each equation by factoring.

22. $x^2 - 18x - 40 = 0$

23. $x^2 - 49 = 0$

24. $5x^2 = 15x$

25. $2x^2 + x = 10$

26. $5x^2 + 2 = -7x$

27. $x^2 - 16 = 0$

28. $6x^2 + 18x = 0$

29. $x^2 - 3x - 4 = 0$

30. $x^2 + 9x + 20 = 0$

31. $4x^2 + 5 + 9x = 0$

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

33. $2x^2 - 3x = 0$

34. $25x^2 - 9 = 0$

35. $6x^2 + 2 = 7x$

36. $4x^2 + 2 = 6x$

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

2) $(x-5)(x-2)$

3) $(x+8)(x-1)$

4) $(3x-6)(x+2)$

5) $(2x-1)(x-4)$

6) $(x+7)(x-5)$

7) $(x+5)(x+1)$

9) $(x-16)(x+3)$

10) $2(x+7)(x-7)$

11) $(2x+1)(4x^2-2x+1)$

12) $(x-3)(x+8)$

13) $(x-3)(x+2)$

14) $(3x+1)(3x-1)$

15) $x(3x-2)$

17) $[-4, \infty)$

18) $(-\infty, \infty)$

19) $(-\infty, -1/2)(-1/2, 0)(0, \infty)$

20) $(-\infty, \infty)$

21) $[3, \infty)$

22) $(x-20)(x+2)$
$x = 20, -2$

23) $x = \pm 7$

25) $(2x+5)(x-2)$
$x = -5/2, 2$

26) $(5x+2)(x+1)$
$x = -2/5, -1$

27) $x = \pm 4$

28) $6x(x+3)$
$x = 0, -3$

29) $(x-4)(x+1)$