

Check Your Understanding

Step-by-Step Solutions begin on page R13.



Example 1 Write each expression in radical form, or write each radical in exponential form.

1. $12^{\frac{1}{2}}$ 2. $3x^{\frac{1}{2}}$ 3. $\sqrt{33}$ 4. $\sqrt{8n}$

Examples 2–4 Simplify.

5. $\sqrt[3]{512}$ 6. $\sqrt[5]{243}$ 7. $343^{\frac{1}{3}}$ 8. $\left(\frac{1}{16}\right)^{\frac{1}{4}}$
 9. $343^{\frac{2}{3}}$ 10. $81^{\frac{3}{4}}$ 11. $216^{\frac{4}{3}}$ 12. $\left(\frac{1}{49}\right)^{\frac{3}{2}}$

Example 5 Solve each equation.

13. $8^x = 4096$ 14. $3^{3x+1} = 81$ 15. $4^{x-3} = 32$

Example 6 16. **CCSS TOOLS** A weir is used to measure water flow in a channel. For a rectangular broad crested weir, the flow Q in cubic feet per second is related to the weir length L in feet and height H of the water by $Q = 1.6LH^{\frac{3}{2}}$. Find the water height for a weir that is 3 feet long and has flow of 38.4 cubic feet per second.



Practice and Problem Solving

Extra Practice is on page R7.

Example 1 Write each expression in radical form, or write each radical in exponential form.

17. $15^{\frac{1}{2}}$ 18. $24^{\frac{1}{2}}$ 19. $4k^{\frac{1}{2}}$ 20. $(12y)^{\frac{1}{2}}$
 21. $\sqrt{26}$ 22. $\sqrt{44}$ 23. $2\sqrt{ab}$ 24. $\sqrt{3xyz}$

Examples 2–4 Simplify.

25. $\sqrt[3]{8}$ 26. $\sqrt[5]{1024}$ 27. $\sqrt[3]{216}$ 28. $\sqrt[4]{10,000}$
 29. $\sqrt[3]{0.001}$ 30. $\sqrt[4]{\frac{16}{81}}$ 31. $1331^{\frac{1}{3}}$ 32. $64^{\frac{1}{6}}$
 33. $3375^{\frac{1}{3}}$ 34. $512^{\frac{1}{9}}$ 35. $\left(\frac{1}{81}\right)^{\frac{1}{4}}$ 36. $\left(\frac{3125}{32}\right)^{\frac{1}{5}}$
 37. $8^{\frac{2}{3}}$ 38. $625^{\frac{3}{4}}$ 39. $729^{\frac{5}{6}}$ 40. $256^{\frac{3}{8}}$
 41. $125^{\frac{4}{3}}$ 42. $49^{\frac{5}{2}}$ 43. $\left(\frac{9}{100}\right)^{\frac{3}{2}}$ 44. $\left(\frac{8}{125}\right)^{\frac{4}{3}}$

Design: Rick Treloar/Alamy Collection/Getty Images

Example 5 Solve each equation.

45. $3^x = 243$ 46. $12^x = 144$ 47. $16^x = 4$
 48. $27^x = 3$ 49. $9^x = 27$ 50. $32^x = 4$
 51. $2^{x-1} = 128$ 52. $4^{2x+1} = 1024$ 53. $6^{x-4} = 1296$
 54. $9^{2x+3} = 2187$ 55. $4^{3x} = 512$ 56. $128^{3x} = 8$

Example 6 57. **CONSERVATION** Water collected in a rain barrel can be used to water plants and reduce city water use. Water flowing from an open rain barrel has velocity $v = 8h^{\frac{1}{2}}$, where v is in feet per second and h is the height of the water in feet. Find the height of the water if it is flowing at 16 feet per second.



58. **ELECTRICITY** The radius r in millimeters of a platinum wire L centimeters long with resistance 0.1 ohm is $r = 0.059L^{\frac{1}{2}}$. How long is a wire with radius 0.236 millimeter?

Write each expression in radical form, or write each radical in exponential form.

59. $17^{\frac{1}{3}}$ 60. $q^{\frac{1}{4}}$ 61. $7b^{\frac{1}{3}}$ 62. $m^{\frac{2}{3}}$
 63. $\sqrt[3]{29}$ 64. $\sqrt[5]{h}$ 65. $2\sqrt[3]{a}$ 66. $\sqrt[3]{xy^2}$

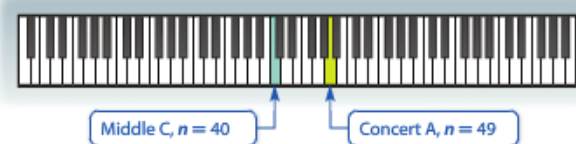
Simplify.

67. $\sqrt[3]{0.027}$ 68. $\sqrt[4]{\frac{n^4}{16}}$ 69. $a^{\frac{1}{3}} \cdot a^{\frac{2}{3}}$ 70. $c^{\frac{1}{2}} \cdot c^{\frac{3}{2}}$
 71. $(8^2)^{\frac{2}{3}}$ 72. $\left(\frac{3}{y^4}\right)^{\frac{1}{2}}$ 73. $9^{-\frac{1}{2}}$ 74. $16^{-\frac{3}{2}}$
 75. $(3^2)^{-\frac{3}{2}}$ 76. $\left(81^{\frac{1}{4}}\right)^{-2}$ 77. $k^{-\frac{1}{2}}$ 78. $\left(\frac{4}{d^3}\right)^0$

Solve each equation.

79. $2^{5x} = 8^{2x-4}$ 80. $81^{2x-3} = 9^{x+3}$ 81. $2^{4x} = 32^{x+1}$
 82. $16^x = \frac{1}{2}$ 83. $25^x = \frac{1}{125}$ 84. $6^{8-x} = \frac{1}{216}$

85. **CCSS MODELING** The frequency f in hertz of the n th key on a piano is $f = 440\left(\frac{1}{12}\right)^{n-49}$.



- a. What is the frequency of Concert A?
 b. Which note has a frequency of 220 Hz?

