CUBE ROOTS If $b^3 = a$, then b is the **cube root** of a. For example, $2^3 = 8$, so 2 is the cube root of 8. The cube root of a can be written as $\sqrt[3]{a}$ or $a^{1/3}$.

EXAMPLE 2 Evaluate expressions involving cube roots

a. $27^{1/3} = \sqrt[3]{27} = \sqrt[3]{3^3} = 3$

b. $8^{-1/3} = \frac{1}{8^{1/3}} = \frac{1}{\sqrt[3]{8}} = \frac{1}{2}$

c. $64^{4/3} = 64^{(1/3) \cdot 4} = (64^{1/3})^4 = (\sqrt[3]{64})^4 = 4^4 = 256$

d. $125^{-2/3} = 125^{(1/3) \cdot (-2)} = (125^{1/3})^{-2} = (\sqrt[3]{125})^{-2} = 5^{-2} = \frac{1}{5^2} = \frac{1}{25}$

PROPERTIES OF EXPONENTS The properties of exponents for integer exponents also apply to fractional exponents.

EXAMPLE 3 Use properties of exponents

a. $12^{-1/2} \cdot 12^{5/2} = 12^{(-1/2) + (5/2)} = 12^{4/2} = 12^2 = 144$

b. $\frac{6^{4/3} \cdot 6}{6^{1/3}} = \frac{6^{(4/3)+1}}{6^{1/3}} = \frac{6^{7/3}}{6^{1/3}} = 6^{(7/3)-(1/3)} = 6^2 = 36$

PRACTICE

EXAMPLES 1, 2, and 3 on pp. 509–510 for Exs. 1–12

Evaluate the expression.

1. $100^{3/2}$
2. $121^{-1/2}$
3. $81^{-3/2}$
4. $216^{2/3}$
5. $27^{-1/3}$
6. $343^{-2/3}$
7. $9^{7/2} \cdot 9^{-3/2}$
8. $\left(\frac{1}{16}\right)^{1/2}\left(\frac{1}{16}\right)^{-1/2}$
9. $36^{5/2} \cdot \frac{36^{-1/2}}{(36^{-1})^{-7/2}}$
10. $(27^{-1/3})^3$
11. $(-64)^{-5/3}(-64)^{4/3}$
12. $(-8)^{1/3}(-8)^{-2/3}(-8)^{1/3}$
13. **REASONING** Show that the cube root of a can be written as $a^{1/3}$ using an argument similar to the one given for square roots on the previous page.