SIMPLEST FORM A radical with index n is in **simplest form** if the radicand has no perfect nth powers as factors and any denominator has been rationalized.

EXAMPLE 4 Write radicals in simplest form

Write the expression in simplest form.

a. $\sqrt[3]{135} = \sqrt[3]{27 \cdot 5}$ — Factor out perfect cube.

$= \sqrt[3]{27} \cdot \sqrt[3]{5}$ — Product property

$= 3\sqrt[3]{5}$ — Simplify.

REVIEW RADICALS
For help with rationalizing denominators of radical expressions, see p. 266.

b. $\frac{\sqrt[5]{7}}{\sqrt[5]{8}} = \frac{\sqrt[5]{7}}{\sqrt[5]{8}} \cdot \frac{\sqrt[5]{4}}{\sqrt[5]{4}}$ — Make denominator a perfect fifth power.

$= \frac{\sqrt[5]{28}}{\sqrt[5]{32}}$ — Product property

$= \frac{\sqrt[5]{28}}{2}$ — Simplify.

LIKE RADICALS Radical expressions with the same index and radicand are **like radicals**. To add or subtract like radicals, use the distributive property.

EXAMPLE 5 Add and subtract like radicals and roots

Simplify the expression.

a. $\sqrt[4]{10} + 7\sqrt[4]{10} = (1 + 7)\sqrt[4]{10} = 8\sqrt[4]{10}$

b. $2(8^{1/5}) + 10(8^{1/5}) = (2 + 10)(8^{1/5}) = 12(8^{1/5})$

c. $\sqrt[3]{54} - \sqrt[3]{2} = \sqrt[3]{27} \cdot \sqrt[3]{2} - \sqrt[3]{2} = 3\sqrt[3]{2} - \sqrt[3]{2} = (3 - 1)\sqrt[3]{2} = 2\sqrt[3]{2}$

✓ GUIDED PRACTICE for Examples 3, 4, and 5

Simplify the expression.

6. $\sqrt[4]{27} \cdot \sqrt[4]{3}$

7. $\frac{\sqrt[3]{250}}{\sqrt[3]{2}}$

8. $\sqrt[5]{\frac{3}{4}}$

9. $\sqrt[3]{5} + \sqrt[3]{40}$

VARIABLE EXPRESSIONS The properties of rational exponents and radicals can also be applied to expressions involving variables. Because a variable can be positive, negative, or zero, sometimes absolute value is needed when simplifying a variable expression.

	Rule	Example
When *n* is odd	$\sqrt[n]{x^n} = x$	$\sqrt[7]{5^7} = 5$ and $\sqrt[7]{(-5)^7} = -5$
When *n* is even	$\sqrt[n]{x^n} = \lvert x \rvert$	$\sqrt[4]{3^4} = 3$ and $\sqrt[4]{(-3)^4} = 3$

Absolute value is not needed when all variables are assumed to be positive.