10.4 Adding, Subtracting and Dividing Radical Expressions

Adding and Subtracting Radical Expressions

Radical expressions that have the same index and the same radicand are called "like radicals". Like radicals can be combined by adding or subtracting their coefficients.

Please note that in order to add (or subtract) two radicals, the two indicies **AND** the two radicands must be **identical**.

Example 1: Simplify.

a. $8\sqrt{5} - 10\sqrt{5} = -2\sqrt{5}$

b. $3\sqrt[3]{3} + 5\sqrt[3]{3} - 4\sqrt{3}$

c. $x\sqrt{7} - 2\sqrt{7}$

d. $\sqrt{15} + 4\sqrt{15} - x\sqrt{15}$

In some cases radicals can be combined only after they have been simplified.

Example 2: Simplify.

a. $\sqrt{12} + \sqrt{27} = \sqrt{4*3} + \sqrt{9*3} = 2\sqrt{3} + 3\sqrt{3} = ?$

b. $\sqrt{20} + \sqrt{5}$

c. $2\sqrt{18} + 3\sqrt{8}$

d. $\sqrt{2x^2y} + \sqrt{18y}$

e. $\sqrt[3]{16x^4y^2} + \sqrt[3]{54xy^2}$

f. $\sqrt[4]{4x^5y^3} + \sqrt[4]{32xy^7}$

Dividing Rational Expressions

The Quotient Rule

If $\sqrt[n]{a}$ and $\sqrt[n]{b}$ are real numbers and $b \neq 0$, then

$$\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}.$$

The nth root of a quotient is the quotient of the nth roots.

The quotient rule may be used to simplify radical expressions or to divide radical expressions.

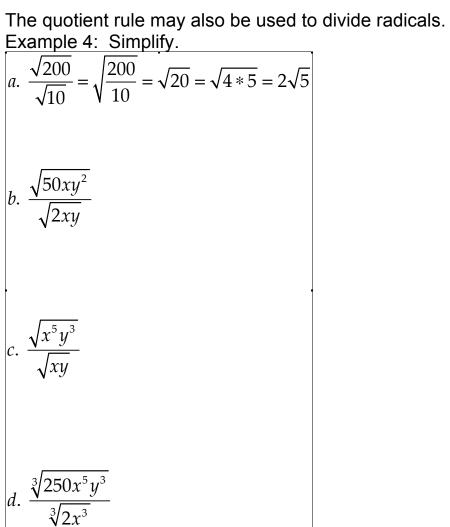Example 3: Use the quotient rule to **simplify** the radicals.

a. $\sqrt{\frac{15}{25}} = \frac{\sqrt{15}}{\sqrt{25}} = \frac{\sqrt{15}}{5}$

b. $\sqrt{\frac{8}{49}}$

c. $\sqrt{\frac{15x}{25y^2}}$

d. $\sqrt[3]{\dfrac{x^4}{8y^3}}$

e. $\sqrt[4]{\dfrac{13y^7}{x^8}}$

The quotient rule may also be used to divide radicals.
Example 4: Simplify.

a. $\dfrac{\sqrt{200}}{\sqrt{10}} = \sqrt{\dfrac{200}{10}} = \sqrt{20} = \sqrt{4*5} = 2\sqrt{5}$

b. $\dfrac{\sqrt{50xy^2}}{\sqrt{2xy}}$

c. $\dfrac{\sqrt{x^5 y^3}}{\sqrt{xy}}$

d. $\dfrac{\sqrt[3]{250x^5 y^3}}{\sqrt[3]{2x^3}}$

Answers Section 10.4

Example 1:
  a. $-2\sqrt{5}$
  b. $8\sqrt[3]{3} - 4\sqrt{3}$
  c. $(x-2)\sqrt{7}$
  d. $(5-x)\sqrt{15}$
Example 2:
  a. $5\sqrt{3}$
  b. $3\sqrt{5}$
  c. $12\sqrt{2}$
  d. $(x+3)\sqrt{2y}$
  e. $(2x+3)\sqrt[3]{2xy^2}$
  f. $x\sqrt[4]{4xy^3} + 2y\sqrt[4]{2xy^3}$
Example 3:
  a. $\dfrac{\sqrt{15}}{5}$

  b. $\dfrac{2\sqrt{2}}{7}$

  c. $\dfrac{\sqrt{15x}}{5y}$

  d. $\dfrac{x\sqrt[3]{x}}{2y}$

  e. $\dfrac{y\sqrt[4]{13y^3}}{x^2}$
Example 4:
  a. $2\sqrt{5}$
  b. $5\sqrt{y}$
  c. $x^2 y$
  d. $5y\sqrt[3]{x^2}$