19.4 Addition, Subtraction, and More Multiplication

❖ **Adding and Subtracting Radical Expressions**

Like Radicals: two radical expressions have the same indices and radicands.

Like radicals can be combined by <u>adding</u> or <u>subtracting</u>.

To add or subtract like radicals, <u>add or subtract the coefficients</u> and keep the radicals the same.

Ex. Simplify by combining like radical terms, if possible.   Assume variables represent nonnegative values.

(a) $2\sqrt{6} + 8\sqrt{6} - \sqrt{6}$

(b) $3\sqrt{7} - \sqrt[3]{x} + 4\sqrt{7} - 3\sqrt[3]{x}$

(c) $\dfrac{\sqrt{3}}{2} + \dfrac{4\sqrt{3}}{3}$

(d) $3y^3 \sqrt[4]{8y} - 9y^3 \sqrt[4]{8y}$

Ex. Simplify the radicals and then find the sum or difference.   Assume variables represent nonnegative values.

(a) $\sqrt{4x^7} + 9x^2 \sqrt{x^3} - 5x\sqrt{x^5}$

(b) $2\sqrt{45a^3} - \sqrt{5a}$

(c) $4\sqrt{32} - \sqrt{18} + 2\sqrt{128}$

(d) $2\sqrt[3]{3a^4} - 3a\sqrt[3]{81a}$

❖ Products of Two or More Radical Terms

Ex. Multiply.

(a) $\sqrt[3]{3}\left(\sqrt[3]{9} - 4\sqrt[3]{21}\right)$

(b) $\left(7 - 3\sqrt{5}\right)\left(2 - 2\sqrt{10}\right)$

(c) $\left(4\sqrt{2} - 5\sqrt{6}\right)^2$

(d) $\left(7 + \sqrt{3}\right)^2$

(e) $\left(2 - 3\sqrt{5}\right)\left(2 + 3\sqrt{5}\right)$

(f) $\left(\sqrt{a} - \sqrt{b}\right)\left(\sqrt{a} + \sqrt{b}\right)$

Pairs of radical terms, like $\sqrt{a} + \sqrt{b}$ and $\sqrt{a} - \sqrt{b}$, are called **conjugates**.