

7.3 Binomial Radical Expressions

Adding/Subtracting: The radicands must be the same & roots

* only add or subtract the coefficients

$$\begin{array}{c} 3\sqrt{5} \\ \uparrow \quad \uparrow \\ \text{coefficient} \quad \text{radicand} \end{array}$$

$$\underline{3}\sqrt{5} + \underline{8}\sqrt{5} = \boxed{11\sqrt{5}}$$

(ex) $7\sqrt{5} - 2\sqrt{5} = 5\sqrt{5}$

(ex) $\sqrt[3]{3x} + 5\sqrt[4]{3x} = \text{cannot combine}$

(ex) $4\sqrt{xy} - 1\sqrt{xy} = \boxed{3\sqrt{xy}}$

(ex)
$$\begin{array}{ccc} \sqrt{50} & + & 3\sqrt{32} & - & 5\sqrt{18} \\ \begin{array}{c} \uparrow \\ 25 \end{array} \begin{array}{c} \uparrow \\ 2 \end{array} & & \begin{array}{c} \uparrow \\ 16 \end{array} \begin{array}{c} \uparrow \\ 2 \end{array} & & \begin{array}{c} \uparrow \\ 9 \end{array} \begin{array}{c} \uparrow \\ 2 \end{array} \\ \downarrow & & \downarrow & & \downarrow \\ 5\sqrt{2} & + & 12\sqrt{2} & - & 15\sqrt{2} & = & \boxed{2\sqrt{2}} \end{array}$$

Multiplying 2 Binomials

(ex) $(3 + 2\sqrt{5})(2 + 4\sqrt{5})$ (FOIL)

⑥ $\boxed{+12\sqrt{5} + 4\sqrt{5} + 8\sqrt{25}}$

$\begin{array}{c} 8 \cdot 5 \\ \text{④} \\ 40 \end{array}$

$= \boxed{46 + 16\sqrt{5}}$

ex

$$(\sqrt{2} - \sqrt{3})^2$$
$$(\sqrt{2} - \sqrt{3})(\sqrt{2} - \sqrt{3})$$

$$\sqrt{4} - \sqrt{6} - \sqrt{6} + \sqrt{9}$$

$$2 - \sqrt{6} - \sqrt{6} + 3$$

$$= \boxed{5 - 2\sqrt{6}}$$

$$\begin{array}{r} 5x - 2x \\ 5\sqrt{6} - 2\sqrt{6} \end{array}$$

Conjugates

Same binomial except for the sign in the middle.

$$5 - \sqrt{3} \rightarrow 5 + \sqrt{3}$$

$$-\sqrt{x} + \sqrt{y} \rightarrow -\sqrt{x} - \sqrt{y}$$

① $(\sqrt{5} + \sqrt{2})(\sqrt{5} - \sqrt{2})$

$$5 - \sqrt{10} + \sqrt{10} - 2 = \textcircled{3}$$

② $(3 + \sqrt{7})(3 - \sqrt{7}) = 9 - \sqrt{49} = 9 - 7 = \textcircled{2}$

~~$3\sqrt{7}$~~
 ~~$-3\sqrt{7}$~~



If you have a binomial with a radical in the denominator of a fraction, multiply the top + bottom by the conjugate.

$$\frac{(6 + \sqrt{15}) \cdot (4 + \sqrt{15})}{(4 - \sqrt{15}) \cdot (4 + \sqrt{15})} = \frac{24 + 6\sqrt{15} + 4\sqrt{15} + 15}{16 - 15}$$
$$= \frac{39 + 10\sqrt{15}}{1} = \boxed{39 + 10\sqrt{15}} \quad -2\sqrt{49}$$

$$\frac{(3 - 2\sqrt{7}) \cdot (10 + \sqrt{7})}{(10 - \sqrt{7}) \cdot (10 + \sqrt{7})} = \frac{30 + 3\sqrt{7} - 20\sqrt{7} - 14}{100 - 7}$$
$$= \boxed{\frac{16 - 17\sqrt{7}}{93}}$$

p. 382 - 383 (a - 40 even)