

Add, Subtract, and Multiply Radical Expressions

LIKE RADICALS

Like radicals are radical expressions with the same index and the same radicand.

$$\sqrt{5} \quad \sqrt{2}$$

$$\sqrt[3]{13} \quad \sqrt[3]{13}$$

$$\sqrt[3]{7} \quad \sqrt{11}$$

$$\sqrt{6} \quad \sqrt{6}$$

↳ # under Radical

Simplify: $2x - 7x$

$$\textcircled{a} \quad 2\sqrt{2} - 7\sqrt{2}$$
$$-5\sqrt{2}$$

$$\textcircled{b} \quad 5\sqrt[3]{y} + 4\sqrt[3]{y}$$
$$9\sqrt[3]{y}$$

$$\textcircled{c} \quad 7\sqrt[4]{x} - 2\sqrt[4]{y}$$
$$7\sqrt[4]{x} - 2\sqrt[4]{y}$$

Simplify:

$$\textcircled{a} \quad 2\sqrt{5n} - 6\sqrt{5n} + 4$$
$$-4\sqrt{5n} + 4$$

$$\textcircled{b} \quad \frac{\sqrt[4]{3xy} + 5\sqrt[4]{3xy} - 4\sqrt[4]{3xy}}{2\sqrt[4]{3xy}}$$

Simplify:

Ⓐ $\sqrt{20} + 3\sqrt{5}$

$$\begin{aligned}\sqrt{20} &= \sqrt{4 \cdot 5} \\ &= 2\sqrt{5}\end{aligned}$$

$$\begin{aligned}2\sqrt{5} + 3\sqrt{5} \\ 5\sqrt{5}\end{aligned}$$

Ⓑ $\sqrt[3]{24} - \sqrt[3]{375}$

$$\begin{aligned}\sqrt[3]{8 \cdot 3} - \sqrt[3]{125 \cdot 3} \\ 2\sqrt[3]{3} - 5\sqrt[3]{3} \\ -3\sqrt[3]{3}\end{aligned}$$

Ⓒ $\frac{1}{2}\sqrt[4]{48} - \frac{2}{3}\sqrt[4]{243}$

$$\begin{aligned}\frac{1}{2}\sqrt[4]{16 \cdot 3} - \frac{2}{3}\sqrt[4]{81 \cdot 3} \\ \frac{1}{2} \cdot 2 \cdot \sqrt[4]{3} - \frac{2}{3} \cdot 3 \cdot \sqrt[4]{3} \\ \sqrt[4]{3} - 2\sqrt[4]{3} \\ -\sqrt[4]{3}\end{aligned}$$

TRY IT 8.75

Simplify: (a) $\sqrt{18} + 6\sqrt{2}$ / (b) $6\sqrt[3]{16} - 2\sqrt[3]{250}$ / (c) $\frac{2}{3}\sqrt[3]{81} - \frac{1}{2}\sqrt[3]{24}$.

$$\begin{aligned} &\sqrt{9} \cdot \sqrt{2} + 6\sqrt{2} \\ &3\sqrt{2} + 6\sqrt{2} \\ &9\sqrt{2} \end{aligned}$$

$$\begin{aligned} &6\sqrt[3]{8} \cdot \sqrt[3]{2} - 2\sqrt[3]{125} \cdot \sqrt[3]{2} \\ &6 \cdot 2 \cdot \sqrt[3]{2} - 2 \cdot 5 \sqrt[3]{2} \\ &12\sqrt[3]{2} - 10\sqrt[3]{2} \\ &2\sqrt[3]{2} \end{aligned}$$

$$\begin{aligned} &\frac{2}{3} \cdot \sqrt[3]{27} \cdot \sqrt[3]{3} - \frac{1}{2} \sqrt[3]{8} \cdot \sqrt[3]{3} \\ &\frac{2}{3} \cdot 3 \cdot \sqrt[3]{3} - \frac{1}{2} \cdot 2 \cdot \sqrt[3]{3} \\ &2\sqrt[3]{3} - \sqrt[3]{3} \\ &\sqrt[3]{3} \end{aligned}$$

TRY IT 8.76

Simplify: a) $\sqrt{27} + 4\sqrt{3}$ b) $4\sqrt[3]{5} - 7\sqrt[3]{40}$ c) $\frac{1}{2}\sqrt[3]{128} - \frac{5}{3}\sqrt[3]{54}$.

$$a) 3\sqrt{3} + 4\sqrt{3}$$

$$7\sqrt{3}$$

$$165, 171$$

$$173, 175$$

$$b) 4\sqrt[3]{5} - 7\sqrt[3]{8 \cdot 5}$$

$$4\sqrt[3]{5} - 7 \cdot 2\sqrt[3]{5}$$

$$4\sqrt[3]{5} - 14\sqrt[3]{5}$$

$$-10\sqrt[3]{5}$$

$$c) \frac{1}{2}\sqrt[3]{64 \cdot 2} - \frac{5}{3}\sqrt[3]{27 \cdot 2}$$

$$\frac{1}{2} \cdot 4\sqrt[3]{2} - \frac{5}{3} \cdot 3\sqrt[3]{2}$$

$$2\sqrt[3]{2} - 5\sqrt[3]{2}$$

$$-3\sqrt[3]{2}$$

Simplify:

$$\textcircled{a} 9\sqrt{50m^2} - 6\sqrt{48m^2}$$

$$9 \cdot \sqrt{25} \cdot \sqrt{2} \cdot m - 6 \sqrt{16} \cdot \sqrt{3} \cdot m$$

$$9 \cdot 5 \cdot m \cdot \sqrt{2} - 6 \cdot 4 \cdot m \sqrt{3}$$

$$\underline{45m\sqrt{2}} - \underline{24m\sqrt{3}}$$

$$\textcircled{b} \sqrt[3]{54n^5} - \sqrt[3]{16n^5}$$

$$\sqrt[3]{27} \cdot \sqrt[3]{2} \sqrt[3]{n^3} \sqrt[3]{n^2} - \sqrt[3]{8} \cdot \sqrt[3]{2} \sqrt[3]{n^3} \sqrt[3]{n^2}$$

$$3\sqrt[3]{2} \cdot n\sqrt[3]{n^2} - 2\sqrt[3]{2} \cdot n\sqrt[3]{n^2}$$

$$\underline{3n\sqrt[3]{2n^2}} - \underline{2n\sqrt[3]{2n^2}}$$

$$n\sqrt[3]{2n^2}$$

PRODUCT PROPERTY OF ROOTS

For any real numbers, $\sqrt[n]{a}$ and $\sqrt[n]{b}$, and for any integer $n \geq 2$

$$\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b} \quad \text{and} \quad \sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{ab}$$

Simplify:

$$\textcircled{a} (6\sqrt{2})(3\sqrt{10})$$

$$6 \cdot 3 = 18 \quad \sqrt{2} \cdot \sqrt{10} = \sqrt{20}$$

$$18\sqrt{20}$$

$$18 \cdot \sqrt{4} \cdot \sqrt{5}$$

$$18 \cdot 2 \cdot \sqrt{5}$$

$$36\sqrt{5}$$

$$\textcircled{b} (-5\sqrt[3]{4})(-4\sqrt[3]{6})$$

$$20\sqrt[3]{24}$$

$$20\sqrt[3]{8}\sqrt[3]{3}$$

$$20 \cdot 2 \cdot \sqrt[3]{3}$$

$$40\sqrt[3]{3}$$

Simplify: (a) $(3\sqrt{2})(2\sqrt{30})$ (b) $(2\sqrt[3]{18})(-3\sqrt[3]{6})$

$$6\sqrt{60}$$

$$6\sqrt{4 \cdot 15}$$

$$12\sqrt{15}$$

$$-6\sqrt[3]{108}$$

$$\frac{4}{8}$$

$$-6\sqrt[3]{27} \sqrt[3]{4}$$

$$-18\sqrt[3]{4}$$

Simplify:

$$\textcircled{a} (10 \sqrt{6p^3}) (4 \sqrt{3p})$$

$$40 \sqrt{18p^4}$$

$$40 \sqrt{9} \cdot \sqrt{2} \cdot p^2$$

$$120 p^2 \sqrt{2}$$

$$\begin{array}{l} 179, 181 \\ 183, 187 \end{array}$$

$$\textcircled{b} (2 \sqrt[4]{20y^2}) (3 \sqrt[4]{28y^3})$$

$$6 \sqrt[4]{560y^5}$$

$$6 \sqrt[4]{16} \cdot \sqrt[4]{35} \cdot \sqrt[4]{y^2} \cdot \sqrt[4]{y^3}$$

$$6 \cdot 2 \sqrt[4]{35} \cdot y \cdot \sqrt[4]{y}$$

$$12y \sqrt[4]{35y}$$