

Algebra RH

Essential Question: How do we add and subtract radical expressions?

Do Now: Are the following statements true or false?

A. $\sqrt{4} + \sqrt{4} = \sqrt{8}$ False
 $2 + 2 \neq 2\sqrt{2}$

B. $\sqrt{4} + \sqrt{4} = 2\sqrt{4}$
 $2 + 2 = 2(2)$ True ✓
 $4 = 4$ ✓

C. $\sqrt{9} + \sqrt{16} = \sqrt{25}$
 $3 + 4 = 5$ False
 $7 \neq 5$

D. $2\sqrt{9} + 3\sqrt{9} = 5\sqrt{9}$
 $2(3) + 3(3) = 5(3)$
 $6 + 9 = 15$ True ✓
 $15 = 15$ ✓

Adding and Subtracting Radicals

← Simplify first!

- In order to add or subtract radicals, the radicals must be "like radicals" (same radicand and same index)
- Add or subtract the coefficients of the radicals and keep the radicand the same
- Simplify final answer

Examples:

A. $8\sqrt{5} + 1\sqrt{5}$

$$9\sqrt{5}$$

B. $5\sqrt{3} + 4\sqrt{12}$

$$\begin{array}{l} 4\sqrt{4}\sqrt{3} \\ \downarrow \\ 4 \cdot 2\sqrt{3} \\ 5\sqrt{3} + 8\sqrt{3} \\ 13\sqrt{3} \end{array}$$

C. $2\sqrt{6} + 3\sqrt{6} - \sqrt{24}$

$$\begin{array}{l} \downarrow \quad \downarrow \quad -\sqrt{4}\sqrt{6} \\ 2\sqrt{6} + 3\sqrt{6} - 2\sqrt{6} \\ 3\sqrt{6} \end{array}$$

Perform the indicated operation. All final answers must be in simplest radical form.

1. $14\sqrt{6} - 2\sqrt{6}$

$$12\sqrt{6}$$

2. $\sqrt{2} + \sqrt{50}$

$$\begin{array}{l} \sqrt{25}\sqrt{2} \\ \downarrow \\ \sqrt{2} + 5\sqrt{2} \\ 6\sqrt{2} \end{array}$$

3. $3\sqrt{8} - \sqrt{2}$

$$\begin{array}{l} 3\sqrt{4}\sqrt{2} \\ 3 \cdot 2\sqrt{2} \\ \downarrow \\ 6\sqrt{2} - \sqrt{2} \\ 5\sqrt{2} \end{array}$$

$$\begin{aligned}
 4. \quad & 3\sqrt{32} - 6\sqrt{8} \\
 & 3\sqrt{16}\sqrt{2} - 6\sqrt{4}\sqrt{2} \\
 & 3(4)\sqrt{2} - 6(2)\sqrt{2} \\
 & 12\sqrt{2} - 12\sqrt{2} \\
 & 0
 \end{aligned}$$

$$\begin{aligned}
 5. \quad & \sqrt{80} - \sqrt{5} \\
 & \sqrt{16}\sqrt{5} - \sqrt{5} \\
 & 4\sqrt{5} - \sqrt{5} \\
 & 3\sqrt{5}
 \end{aligned}$$

$$\begin{aligned}
 6. \quad & 3\sqrt{50} - 5\sqrt{18} \\
 & 3\sqrt{25}\sqrt{2} - 5\sqrt{9}\sqrt{2} \\
 & 3(5)\sqrt{2} - 5(3)\sqrt{2} \\
 & 15\sqrt{2} - 15\sqrt{2} \\
 & 0
 \end{aligned}$$

$$\begin{aligned}
 7. \quad & \sqrt{3} + \sqrt{6} \\
 & \text{already} \\
 & \text{simplified}
 \end{aligned}$$

$$\begin{aligned}
 8. \quad & \sqrt{3a^2} + \sqrt{12a^2} \\
 & \sqrt{a^2}\sqrt{3} + \sqrt{4a^2}\sqrt{3} \\
 & a\sqrt{3} + 2a\sqrt{3} \\
 & 3a\sqrt{3}
 \end{aligned}$$

$$\begin{aligned}
 9. \quad & 3\sqrt{3x^3} - \sqrt{12x^3} \\
 & 3\sqrt{x^2}\sqrt{3x} - \sqrt{4x^2}\sqrt{3x} \\
 & 3x\sqrt{3x} - 2x\sqrt{3x} \\
 & x\sqrt{3x}
 \end{aligned}$$

$$\begin{aligned}
 10. \quad & \sqrt{100b} - \sqrt{64b} + \sqrt{9b} \\
 & \sqrt{100}\sqrt{b} - \sqrt{64}\sqrt{b} + \sqrt{9}\sqrt{b} \\
 & 10\sqrt{b} - 8\sqrt{b} + 3\sqrt{b} \\
 & 5\sqrt{b}
 \end{aligned}$$

$$\begin{aligned}
 11. \quad & \sqrt{7a} + \sqrt{28a} \\
 & \sqrt{7a} + \sqrt{4}\sqrt{7a} \\
 & \sqrt{7a} + 2\sqrt{7a} \\
 & 3\sqrt{7a}
 \end{aligned}$$

$$\begin{aligned}
 12. \quad & 5\sqrt{3}(3\sqrt{2} - \sqrt{3}) \\
 & 15\sqrt{6} - 5\sqrt{9} \\
 & 15\sqrt{6} - 5(3) \\
 & 15\sqrt{6} - 15
 \end{aligned}$$

$$\begin{aligned}
 13. \quad & (2 - \sqrt{5})^2 \\
 & (2 - \sqrt{5})(2 - \sqrt{5}) \\
 & 4 - 2\sqrt{5} - 2\sqrt{5} + \sqrt{25} \\
 & 4 - 4\sqrt{5} + 5 \\
 & 9 - 4\sqrt{5}
 \end{aligned}$$

14. Represent the perimeter and area of the following rectangle in simplest radical form.



simplify first \rightarrow

$$\begin{aligned}
 & 11\sqrt{72} \\
 & 11\sqrt{36}\sqrt{2} \\
 & 11 \cdot 6\sqrt{2} \\
 & 66\sqrt{2}
 \end{aligned}$$

$$\begin{aligned}
 P &= 2(7\sqrt{2}) + 2(66\sqrt{2}) \\
 &= 14\sqrt{2} + 132\sqrt{2} \\
 &= 146\sqrt{2} \text{ units}
 \end{aligned}$$

$$\begin{aligned}
 A &= bh \\
 &= (7\sqrt{2})(66\sqrt{2}) \\
 &= 462\sqrt{4} \\
 &= 462 \cdot 2 \\
 &= 924 \text{ units}^2
 \end{aligned}$$