

Warm Up

1) List the steps to simplify radicals.

2) List the steps to multiply radicals.

Solve:

3) $\sqrt{245}$

4) $\sqrt{6} \times \sqrt{12}$

5) $2\sqrt{5x} \times \sqrt{3x^2}$

Dividing Radicals

* Simplified radicals do not have roots in the denominator.

Rationalize the denom

$$\text{Ex: } \sqrt{\frac{64}{49}} = \left(\frac{8}{7}\right)$$

$$\text{Ex: } \frac{\sqrt{3}}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \left(\frac{\sqrt{21}}{7}\right)$$

TRY THIS!!

$$\sqrt{\frac{3}{7}} =$$

$$\text{Ex) } \frac{\sqrt{15}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{45}}{3} \stackrel{5 \cdot 3}{=} \frac{3\sqrt{5}}{3}$$

$$\sqrt{\frac{15}{3}} = \sqrt{5}$$

$$\text{Ex) } \frac{\sqrt{10}}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{20}}{2} \stackrel{4 \cdot 5}{=} \frac{2\sqrt{5}}{2}$$

$$\text{Ex: } \frac{\sqrt{5}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \left(\frac{\sqrt{15}}{3}\right)$$

Simplify:

$$1. \sqrt{20a^2b^3}$$
$$\sqrt{4 \cdot 5 \cdot a^2 \cdot b \cdot b^2}$$
$$\sqrt{2ab\sqrt{5b}}$$

$$2. \frac{16a}{\sqrt{6a^3}}$$
$$\frac{8\sqrt{6a}}{3a}$$

$$3. \frac{\sqrt{16a}}{\sqrt{6a^3}}$$
$$\frac{2\sqrt{6}}{3a}$$

Operations With Radical Expressions

$$c. 5\sqrt{3} - 2\sqrt{3} = 3\sqrt{3}$$

How can I add and subtract radical expressions?
By combining like radicals

Examples:

a. $6\sqrt{11} + 9\sqrt{11}$

$$15\sqrt{11}$$

b. $\sqrt{3} - 5\sqrt{3}$

$$-4\sqrt{3}$$

Simplifying to Combine like Radicals

c. $5\sqrt{3} - \sqrt{12}$
 \uparrow
4·3

You try: $4\sqrt{7} + 2\sqrt{28}$

$$\sqrt{4 \cdot 7}$$

$$2 \cdot 2\sqrt{7}$$
$$4\sqrt{7} + 4\sqrt{7}$$

$$8\sqrt{7}$$

Multiplying Radical Expressions:

Distributive Property & FOIL

d. $\sqrt{10}(\sqrt{6} + 3)$

e. $(\sqrt{6} - 2\sqrt{3})(\sqrt{6} + \sqrt{3})$

You Try: $\sqrt{2}(\sqrt{6} + 5)$

$(\sqrt{11} - 2)^2$

$$(\sqrt{11}-2)(\sqrt{11}-2)$$

$$\Downarrow -2\sqrt{11} - 2\sqrt{11} + 4$$

$$\boxed{-4\sqrt{11} + 15}$$

$$\sqrt{3} (2\sqrt{3} + \sqrt{5}) \quad \text{T.)}$$

$$2\sqrt{9} + \sqrt{15}$$

$$2 \cdot 3 + \sqrt{15} = 6 + \sqrt{15}$$

$$2\sqrt{3} (3\sqrt{5} + \sqrt{6}) \quad W.$$

$$6\sqrt{15} + 2\sqrt{18}$$

$$\downarrow \quad \frac{A}{\sqrt{9 \cdot 2}}$$
$$6\sqrt{15} + 2 \cdot 3\sqrt{2}$$

$$\boxed{6\sqrt{15} + 6\sqrt{2}}$$

Warm Up

Simplify:

$$\cancel{12}\sqrt{3} + \sqrt{3} - \cancel{15}\sqrt{3} + 5\sqrt{3}$$

6 $-3\sqrt{3}$

$$\begin{array}{r} 12 \\ +25 \\ \hline 37 \end{array} \quad \begin{array}{r} \cancel{4}15 \\ -37 \\ \hline 8 \end{array}$$

1) $3\sqrt{12} + \sqrt{3} - 5\sqrt{27} + \sqrt{75}$

$$3\sqrt{4 \cdot 3}$$

$$\sqrt{9 \cdot 3} \quad \sqrt{25 \cdot 3}$$

2) $3\sqrt{5} \times \sqrt{12} = 3\sqrt{60} = \boxed{6\sqrt{15}}$

3) $2\sqrt{6}(\sqrt{3} - 3\sqrt{2})$

$$\begin{array}{l} 2\sqrt{18} = 6\sqrt{12} \\ \hline 6\sqrt{2} - 12\sqrt{3} \end{array}$$

^{9·2} ^{4·3}

$$\begin{array}{l} 5 \cdot 12 \\ \hline 3\sqrt{5 \cdot 4 \cdot 3} \\ \hline 2 \cdot 2 \end{array}$$

$$S \quad 9\sqrt{3}(2\sqrt{6} + 3\sqrt{6})$$

$$18\sqrt{18} + 27\sqrt{18}$$

$$18 \cdot 3\sqrt{2} + 27 \cdot 3\sqrt{2}$$

$$54\sqrt{2} + 81\sqrt{2}$$

$$135\sqrt{2}$$

$$\begin{aligned} \text{H) } & 2\sqrt{3}(\sqrt{2} + 5\sqrt{6}) \\ & 2\sqrt{6} + 10\sqrt{18} \quad \sqrt{9 \cdot 2} \\ & 2\sqrt{6} + 10 \cdot 3\sqrt{2} \\ & \boxed{2\sqrt{6} + 30\sqrt{2}} \end{aligned}$$

$$\begin{aligned} \text{C) } & 4\sqrt{2}(3\sqrt{5} - 2\sqrt{8}) \\ & 12\sqrt{10} - 8\sqrt{16} \\ & 12\sqrt{10} - 8 \cdot 4 \\ & \boxed{12\sqrt{10} - 32} \end{aligned}$$

Robin Hood...

$$R) (2\sqrt{5} - 3\sqrt{8})(2\sqrt{5} - 3\sqrt{8})$$

$$\begin{array}{r} 40 \\ \sqrt{4 \cdot 10} \end{array}$$

$$4\sqrt{25} - 6\sqrt{40} - 6\sqrt{40} + 9\sqrt{64}$$

$$4 \cdot 5 - 12\sqrt{40} + 9 \cdot 8$$

$$20 - 24\sqrt{10} + 72$$

$$\boxed{92 - 24\sqrt{10}}$$

$$E) (7 + \sqrt{5})(7 + \sqrt{5})$$

$$49 + \sqrt{5} + \sqrt{5} + \sqrt{25}$$

$$49 + 14\sqrt{5} + 5$$

$$54 + 14\sqrt{5}$$

$$A) (7 + 2\sqrt{3})(7 + 2\sqrt{3})$$

$$49 + 14\sqrt{3} + 14\sqrt{3} + 4\sqrt{9}$$

$$49 + 28\sqrt{3} + 4 \cdot 3$$

$$61 + 28\sqrt{3}$$

$$R) (3+\sqrt{8})(3+\sqrt{8})$$

$$9 + 3\sqrt{8} + 3\sqrt{8} + 8$$

$$17 + 6\sqrt{8}$$

$$\begin{array}{c} \wedge \\ \sqrt{4 \cdot 2} \end{array}$$

$$17 + 6 \cdot 2\sqrt{2}$$

$$17 + 12\sqrt{2}$$

$$O) (3\sqrt{5}-2\sqrt{3})(3\sqrt{5}-2\sqrt{3})$$

$$9 \cdot 5 - 6\sqrt{15} - 6\sqrt{15} + 4 \cdot 3$$

$$45 - 12\sqrt{15} + 12$$

$$57 - 12\sqrt{15}$$

What's A "Maybe"?

$$\sqrt{60x^2y^4}$$

$$\begin{array}{c} 6 \cdot 10 \\ \hline 3 \cdot 2 \cdot 5 \cdot 2 \end{array}$$

$$2\sqrt{15}$$

$$2xy^2\sqrt{15}$$

$$\sqrt{12x^4y^7}$$

$$\sqrt{4 \cdot 3 \cdot x^4 \cdot y^6 \cdot y}$$

$$2x^2y^3\sqrt{3y}$$

$$E) \sqrt{144xy^3}$$

$12y\sqrt{xy}$

$y^2 \cdot y$

$$R) \sqrt{81x^4y^6}$$

$9x^2y^3$

$$B) \sqrt{75x^3y^5}$$
$$\sqrt{3 \cdot 25 \cdot x \cdot x^2 \cdot y \cdot y^4}$$

$$5xy^2\sqrt{3xy}$$

$$N) \sqrt{18x^5y^4}$$
$$\sqrt{2 \cdot 9 \cdot x \cdot x^4 \cdot y^4}$$

$$3x^2y^2\sqrt{2x}$$

$$A) \sqrt{48x^4y^4}$$
$$\sqrt{4 \cdot 4 \cdot 3 \cdot x^4 \cdot y^4}$$

$$4x^2y^2\sqrt{3}$$

Quiz Review

1 $4\sqrt{150}$
 $\sqrt{25 \cdot 6} = 4 \cdot 5\sqrt{6} = 20\sqrt{6}$

4 $\sqrt{24} + 4\sqrt{6}$
 $\sqrt{4 \cdot 6} = 2\sqrt{6} + 4\sqrt{6} = 6\sqrt{6}$

2 $\sqrt{\frac{36}{144}} = \frac{6}{12} = \frac{1}{2}$

5 $\sqrt{5}(\sqrt{10} - 2)$
 $\sqrt{50} - 2\sqrt{5} \rightarrow \underline{5\sqrt{2} - 2\sqrt{5}}$
 $\sqrt{0.5 \cdot 2} = \dots$

3 $\sqrt{12} - 3\sqrt{27}$
 $\sqrt{4 \cdot 3} - 3\sqrt{9 \cdot 3}$
 $2\sqrt{3} - 9\sqrt{3} = \boxed{-7\sqrt{3}}$

6 $(\sqrt{5} + \sqrt{3})(\sqrt{2} - 1)$
 $\sqrt{10} - \sqrt{5} + \sqrt{6} - \sqrt{3}$

7 $\frac{4\sqrt{2n}}{\sqrt{16n}}$

$\frac{4\sqrt{2n}}{4\sqrt{n}} \cdot \frac{\sqrt{n}}{\sqrt{n}} = \frac{\sqrt{2n^2}}{n} = \frac{n\sqrt{2}}{n}$

8 $\frac{\sqrt{15x^2y^5}}{\sqrt{3xy^2}}$

$\sqrt{\frac{15x^2y^5}{3xy^2}} = \sqrt{5xy^3} = \frac{y\sqrt{5xy}}{\sqrt{5xy^3}} = \frac{y\sqrt{5xy}}{y^2 \cdot y}$

Radical Equations:

You may work on "Why do boxers..." practice sheet

- 1) Square both sides
- 2) Use inverse operations to isolate the variable
- 3) Check your answer

$$\text{Ex) } \sqrt{5x + 2} = 6$$

$$\begin{array}{r} 5x + 2 = 36 \\ -2 \quad -2 \\ \hline 5x = 34 \\ \frac{5x}{5} = \frac{34}{5} \\ \boxed{x = 6.8} \end{array}$$

$$\text{Ex) } \sqrt{4x - 3} = \sqrt{2x}$$

$$\begin{array}{r} 4x - 3 = 2x \\ -2x \quad -2x \\ \hline 2x - 3 = 0 \\ \quad +3 \quad +3 \\ \hline 2x = 3 \\ \frac{2x}{2} = \frac{3}{2} \end{array}$$

$x = 1.5$
or $3/2$

$$\begin{array}{r} S) \quad -8 + \sqrt{5x-5} = -3 \\ +8 \qquad \qquad +8 \\ \hline \sqrt{5x-5}^2 = 5^2 \end{array}$$

$$\begin{array}{r} 5x - 5 = 25 \\ +5 \quad +5 \\ \hline 5x = 30 \\ \frac{5x}{5} = \frac{30}{5} \end{array}$$

$$\boxed{x = 6}$$

$$\begin{array}{r} A) \quad 8\sqrt{7-3x} = 24 \\ \frac{8}{8} \qquad \frac{24}{8} \\ \hline \sqrt{7-3x}^2 = 3^2 \end{array}$$

$$\begin{array}{r} 7 - 3x = 9 \\ -7 \qquad -7 \\ \hline -3x = 2 \\ \frac{-3x}{-3} = \frac{2}{-3} \end{array}$$

$$\boxed{x = -\frac{2}{3}}$$

$$0) -4\sqrt{x} + 11 = 3$$

$$\begin{array}{r} -11 \quad -11 \\ \hline -4\sqrt{x} = -8 \\ \underline{-4} \quad \underline{-4} \end{array}$$

$$\sqrt{x^2} = 2^2$$

$$\boxed{x = 4}$$