TOPIC: MULTIPLYING, DIVIDING, AND RATIONALIZING RADICAL EXPRESSIONS

Multiplication of Radical Expressions

◆ We can multiply radical expressions using the **Product Rule of Radicals** & other basic properties of multiplication.

EXAMPLE Multiply and simplify the product.

Recall
$\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{a \cdot b}$

$(\boldsymbol{A})$ $(2a\sqrt{5})(8\sqrt{10})$

$(\boldsymbol{B})$ $7\sqrt{2}(3 + \sqrt{2})$

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PRACTICE Simplify the following.

Recall
$\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{a \cdot b}$

($\boldsymbol{A}$) $(2\sqrt{5})(4\sqrt{7})$

($\boldsymbol{B}$) $(4\sqrt{x})(3\sqrt{xy})$

PRACTICE Simplify the following.

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

($\boldsymbol{B}$) $\sqrt{5x}(4+\sqrt{x})$

EXAMPLE Simplify the following.

$(4-6\sqrt{2y})(3+\sqrt{2y})$

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PRACTICE Simplify the following.

Recall

$\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{a \cdot b}$

$$\left(4\sqrt{3} - 5\right)^2$$

EXAMPLE Simplify the following.

$$\left(\sqrt[3]{4a} + 2\right)\left(\sqrt[3]{4a} + 5\right)$$

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Rationalizing Denominators

◆ Radicals CANNOT be left in the BOTTOM of a fraction. This is **BAD!** $\frac{\sqrt[n]{a}}{\cancel{\sqrt[n]{b}}}$

- If you can't simplify the $\sqrt{\ }$ to perf. square, you must *make* it a perf. square by **Rationalizing the Denominator:**
  - Multiply _____ & _________ by *something* (usually bottom $\sqrt{\ }$)

Radical simplifies to perfect square

$$\frac{\sqrt{2}}{\sqrt{8}} = \sqrt{\frac{2}{8}} = \sqrt{\frac{1}{4}} = \frac{1}{2}$$

Rationalizing Denominator

EXAMPLE: Rationalize the denominator.

$$\frac{1}{\sqrt{3}} \cdot \left(-\right)$$

Caution!
Multiplying *only* the bottom is wrong!

PRACTICE Rationalize the denominator.

(A) $-\frac{5}{2\sqrt{7}}$

(B) $\frac{6+\sqrt{x}}{-\sqrt{x}}$

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EXAMPLE Write the following quotients in the lowest terms.

(A)

$$\frac{\sqrt{18}+6}{3}$$

(B)

$$\frac{2\sqrt[3]{16}-4}{4}$$

EXAMPLE Write the following quotients in the lowest terms.

(A)

$$\frac{\sqrt{81}}{\sqrt{9}}$$

(B)

$$\frac{\sqrt{49x^2}}{\sqrt{x^2}}$$

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Rationalize Denominators Using Conjugates

- When the denominator has ____ terms, multiplying by same $\sqrt{\ }$ won't eliminate the $\sqrt{\ }$
  - Instead, multiply by the bottom's **conjugate** (reverse _________ between terms)

One Term Denominator	Two Term Denominator
$\frac{1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{3}$	EXAMPLE: Rationalize the denominator. $\frac{1}{2+\sqrt{3}} \cdot \frac{(\qquad)}{(\qquad)}$ Conjugates $\boxed{\underline{\qquad\qquad}}\ \boxed{\underline{\qquad\qquad}}$

- Multiplying a radical by its **conjugate** ALWAYS _______________ the $\sqrt{\ }$ and results in rational numbers.

PRACTICE Rationalize the denominator and simplify the radical expression.

(A) $\frac{\sqrt{7}}{5-\sqrt{6}}$

(B) $\frac{2-\sqrt{3}}{2+\sqrt{3}}$

SPECIAL PRODUCT FORMULAS
$(a+b)(a-b) = a^2 - b^2$

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EXAMPLE Rationalize the denominators of the following.

$(\boldsymbol{A})$

$$\frac{x+2}{\sqrt{x}+1}$$

$(\boldsymbol{B})$

$$\frac{1}{\sqrt{x}+\sqrt{y}}$$