Radical Expressions, Multiply and Divide (Rationalizing the **Denominator**)

Question: Can you add and subtract radicals the same way you multiply and divide them? e.g.) Since $\sqrt{a} \cdot \sqrt{b} = \sqrt{ab}$, does $\sqrt{a} + \sqrt{b} = \sqrt{a+b}$? NO!!!!!!!!!!



Don't make the following mistakes:

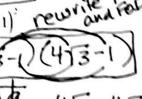
•
$$\sqrt{x^2 - 4} \neq x - 2$$

•
$$(\sqrt{x} + \sqrt{y})^2 * x + y$$

Multiplying Radical Expressions: Use the Product Property. Use the Distributive Property and FOII to multiply radical expressions with more than one term.

d)
$$(5\sqrt{3} - 4\sqrt{2})(\sqrt{3} + \sqrt{2})$$





Dividing Radicals

The Quotient Rule for Radicals

For any real numbers $\sqrt[n]{a}$ and $\sqrt[n]{b}$, where $b \neq 0$, $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$.

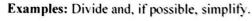


Examples: Simplify.

a)
$$\sqrt{\frac{9}{25}} = \frac{19}{125} = \frac{3}{5}$$

b)
$$\sqrt{\frac{x^3}{27}} = \frac{3\sqrt{3}}{3\sqrt{37}} = \boxed{\frac{x}{3}}$$

$$\sqrt{\frac{m^2}{10n^2}} = \sqrt{\frac{m^3}{10n^3}} = \sqrt{\frac{m}{10n^3}} =$$



a)
$$\frac{\sqrt{2}34}{\sqrt{2}1} = \frac{\sqrt{3}6}{1} = \frac{6}{1} = \frac{6}{1} = \frac{1}{1} = \frac{1}{1}$$

Rationalizing Denominators with One Term:

Rationalizing the denominator means to write the expression as an equivalent expression but without a radical in the denominator. To do this, multiply by 1 under the radical or multiply by 1 outside the radical to make the denominator a perfect power. $\frac{12}{12} \cdot 1 = \frac{12}{12}$

Examples: Rationalize each denominator.

a)
$$\sqrt{\frac{2}{3}} = \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{\sqrt{3}} = \frac{5\sqrt{3}}{\sqrt{3}} = \frac{5\sqrt{3}}{\sqrt{3}} = \frac{5\sqrt{3}}{\sqrt{3}} = \frac{5\sqrt{5}}{\sqrt{3}} = \frac{5\sqrt{5}}{\sqrt{5}} = \frac{5\sqrt{5}}{2\sqrt{5}} = \frac{5\sqrt{5}}{2\sqrt{5}} = \frac{5\sqrt{5}}{2\sqrt{5}} = \frac{5\sqrt{5}}{\sqrt{11}} = \frac{5\sqrt{$$

Rationalizing Denominators with Two Terms:

To do this, multiply by 1 under the radical or multiply by 1 outside the radical to make the denominator a perfect power. However, since the denominator now has two terms, we will have to multiply by the **conjugate** of the denominator.

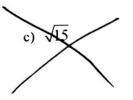
Conjugate of a binomial Radical Expression: Conjugates have the same first term, with the second terms being opposites. For example, these two expressions are conjugates: $(3-\sqrt{2})$ and $(3+\sqrt{2})$.

What happens when you multiply these conjugates together?

Examples: Find the conjugate of each number.

a)
$$4 + \sqrt{5}$$

b)
$$-3 - \sqrt{7}$$



Examples: Rationalize each denominator by multiplying by the conjugate.

a)
$$\frac{4}{(2-\sqrt{2})}$$
 $(2-\sqrt{2})$ $(2-\sqrt{2})$ $(2-\sqrt{2})$

$$c)$$
 $(5-\sqrt{3})$ $(2-15)$ $(2-15)$ $(2-15)$