Name________________________________

Algebra II

Lesson 7.2

Multiplying and Dividing radical Expressions

There are two basic square root properties:

1. **Product Property** of Square Roots, which states that the square root of a number is equal to the product of the square roots of the factors

   example: $\sqrt{20} = \sqrt{4 \cdot 5} = \sqrt{4} \cdot \sqrt{5} = 2\sqrt{5}$ ⟶ $\sqrt{ab} = \sqrt{a \cdot b} = \sqrt{a} \cdot \sqrt{b}$

   $\sqrt{5} \cdot \sqrt{20} = \sqrt{5 \cdot 20} = \sqrt{100} = \pm 10$ $\qquad \sqrt{a} \cdot \sqrt{b} = \sqrt{a \cdot b} = \sqrt{ab}$

2. **Quotient Property** of Square Roots, states that the square root of a quotient is equal to the quotient of the square roots of the dividend and the divisor.

   example: $\sqrt{\frac{9}{16}} = \frac{\sqrt{9}}{\sqrt{16}} = \frac{3}{4}$ ⟶ $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

   $\frac{\sqrt{8}}{\sqrt{2}} = \sqrt{\frac{8}{2}} = \sqrt{4} = \pm 2$ ⟶ $\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$

Example:

Combine the two integers under the same radical sign, multiply or divide as indicated simplify

$\sqrt{3} \times \sqrt{12}$ $\qquad \sqrt[4]{8} \times \sqrt[4]{-4}$

$\frac{\sqrt{24}}{\sqrt{6}}$ $\qquad \frac{\sqrt{12x^4}}{\sqrt{3x}}$

$3\sqrt{7x^3} \cdot 2\sqrt{21x^3y^2}$

Recall from our radical review, we can also simplify radicals. Here we need to note that unless otherwise stated, the variables are assumed to be positive and thus we do not need the absolute value symbols in our answers.

Example:

$\sqrt{72x^3} = \sqrt{6^2 \cdot 2 \cdot x^2 \cdot x}$

$= 6x\sqrt{2x}$

Factor into perfect squares
pull out pairs, leaving orphans behind

Simplify:

$\sqrt[4]{64x^3y^6}$

When we find a radical in the denominator, it needs to be removed; this will make it easier to calculate the decimal approximation. The process that clears out radicals in the denominator is called **rationalizing the denominator**. We simply multiply the fraction by "1". Remember that the value "1" comes in many forms: $\frac{2}{2}, \frac{-6}{-6}, \frac{\sqrt{3}}{\sqrt{3}}, and\ so\ on.$ So multiply the fraction by "1" in the form of the radical denominator.

Example: Rationalize: $\frac{\sqrt{3}}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{3 \cdot 5}}{\sqrt{5 \cdot 5}} = \frac{\sqrt{15}}{5}$

Rationalize:

$\sqrt{\frac{7}{5}}$ $\qquad \frac{\sqrt{2x^3}}{\sqrt{10xy}}$