## Algebra II

## Lesson 7.3: Binomial Radical Expressions

## Mrs. Snow, Instructor

Like radical terms are radical expressions with the same index and the same radicand. Like radicals may be added or subtracted. This is similar to like variables. $2 x^{3}$ and $4 x^{3}$ may have the same variable, but they have different exponents therefore they are different.

Example: $4 \sqrt{5}$ and $7 \sqrt{5}$ are like radicals; they are both square roots and they both have the same term under the radical. The addition/subtraction property of variables may be applied to numbers with like radicals. Hence, like radicals may be added or subtracted: $4 \sqrt{5}+7 \sqrt{5}=$ $11 \sqrt{5}$. We have 4 of something and 7 of the same something so, we have a total of 11 of that something!

Simplify. If the radical expression can be simplified do this first then add/subtract, if possible.:

| $2 \sqrt{7}+3 \sqrt{7}$ | $4 \sqrt{x y}+5 \sqrt{x y}$ | $14 \sqrt[3]{2}+3 \sqrt[3]{4}$ |
| :--- | :--- | :--- |
| $4 \sqrt{x y}+5 \sqrt{x y}$ | $3 \sqrt{20}-\sqrt{45}+4 \sqrt{80}$ | $\sqrt{50}+2 \sqrt{72}-\sqrt{12}$ |
| $3 \sqrt[3]{16}-4 \sqrt[3]{54}+\sqrt[3]{128}$ |  |  |

Multiplication of radicals that are in the form of a binomial by be done using the distributive property.
Example:

| $(2+\sqrt{7})(1+3 \sqrt{7})$ | $(3+\sqrt{2})(4-\sqrt{5})$ | $(\sqrt{2}-\sqrt{3})^{2}$ |
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## Rationalizing the denominator:

When we find a radical in the denominator, it needs to be removed. It is considered improper format and it will be easier to calculate the decimal approximation. The process that clears out radicals in the denominator is called rationalizing the denominator. To simply, multiply the fraction by another fraction in the form of " 1 ". Remember that the identity value " 1 " comes in many forms: $\frac{2}{2}, \frac{-6}{-6}, \frac{\sqrt{3}}{\sqrt{3}}$, and so on. The form of 1 which you need to use will be such that the denominator becomes a perfect square, cube, etc. of the radical denominator.
Example: Rationalize: $\frac{\sqrt{3}}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}}=\frac{\sqrt{3 \cdot 5}}{\sqrt{5 \cdot 5}}=\frac{\sqrt{15}}{5} \quad$ Now rationalize the denominator:

| $\frac{\sqrt{3 x}}{\sqrt{2}}$ | $\frac{\sqrt{2 x^{2} y}}{\sqrt{3 x}}$ | $\frac{3}{\sqrt[3]{2}}$ |
| :--- | :---: | :---: |
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Conjugates: expressions that only differ in the sign of the second terms. $\sqrt{a}+\sqrt{b}$ and $\sqrt{a}-$ $\sqrt{b}$ are conjugates.
When multiplying conjugates, you will find that the radicals will drop out. Notice the application of the Difference of Two Squares:
Example: $(3+\sqrt{7})(3-\sqrt{7})$

When a radical binomial is in the denominator, multiply by the conjugate to rationalize it: Example:

| $\frac{2-\sqrt{3}}{4+\sqrt{3}}$ |  |  |
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