PRODUCTS OF RADICALS ~~(6.4)~~

Pay attention to examples in class. Multiply the "inside of same roots" together, except when we later get to complex numbers and have square roots of negative numbers. When there are two binomial expressions to be multiplied, just remember to follow the pattern of FOIL. Remember to simplify radicals and if any can be combined as "like terms" to do so.

Rules: $\sqrt{A}\sqrt{B} = \sqrt{AB}$ IF $A \geq 0$ and $B \geq 0$
$\sqrt[3]{A}\,\sqrt[3]{B} = \sqrt[3]{AB}$, with NO restrictions on A and B.

Warning: Remember the above restriction on A and B when we get to Complex numbers later on. If A and/or B is *negative*, then we must use order of operations to deal with this correctly. It will be explained later.

Distributive Property, FOIL & Combining Like Terms: These ideas that have been used before, will now be used with radical expressions involved. In a sense, this is not really anything *new* ... we are just putting together several concepts that we already knew.

RATIONALIZE BINOMIAL DENOMINATOR

What if Multiplied by the Denominator?: If the denominator is a binomial with either one or both terms being a square root, what would happen if you multiplied by that same binomial? Remember, you would have to FOIL, and this would leave at least one *radical* term *still* in the denominator, and it would *not* be rationalized.

What "Works": HOWEVER, if we use the idea of how the Difference of Squares Factors, we can solve the problem. Rather than multiply by the *same* binomial, we will multiply by what we will call the "*conjugate*" (this same idea and term is used later when simplifying complex numbers with binomial complex terms in the denominator). The basic idea of the conjugate is if you have a denominator of the form $A + B$, where A and/or B contain a square root, then you multiply both the numerator and denominator by $(A - B)$, the conjugate. Since $(A + B)(A - B) = A^2 - B^2$, the radical(s) "in" A and/or B will be "removed", and the problematic middle term will be avoided. Of course, we had to multiply both numerator and denominator by $(A - B)$, so that we really only multiplied by "one" and did not change the value of our expression. This is essential in any simplification process - to make sure that each step, or expression is equal to the previous one.

If, on the other hand, the denominator is of the form $A - B$, the conjugate would have to be $A + B$. We would repeat the simplification process, multiplying by $(A + B)$ "over" $(A + B)$, again yielding $A^2 - B^2$ in the denominator, as desired.

WARNING: This process "removes" the *square roots* in binomials. It does NOT eliminate the entire denominator! (Occasionally the denominator may happen to simplify to 1, but not as a general rule).