Pre-Calculus 11
Chapter 5: Radical Expressions and Equations

5.2 Multiplying and Dividing Radical Expressions (III)

The **conjugate** of a + b is a − b.

Example: Multiply each binomial by its conjugate.

a) $(a+b)(a-b)$
$= a^2 - ab + ab - b^2$
$= a^2 - b^2$

b) $(2+\sqrt{3})(2-\sqrt{3})$
$= 4 - 2\sqrt{3} + 2\sqrt{3} - 3$
$= 1$

c) $(5-\sqrt{2})(5+\sqrt{2})$
$= 25 + 5\sqrt{2} - 5\sqrt{2} - 2$
$= 23$

d) $(2\sqrt{7}+4)(2\sqrt{7}-4)$
$= 4(7) - 8\sqrt{7} + 8\sqrt{7} - 16$
$= 12$

e) $(x-3\sqrt{2})(x+3\sqrt{2})$
$= x^2 - 9(2)$
$= x^2 - 18$

Note: The middle terms have a sum of 0 each time

Notice that when you multiply conjugates involving a radical together we eliminate the radical.

We often use a conjugate to rationalize a denominator.

Example: Rationalize each denominator. Simplify completely.

a) $\dfrac{8}{3+\sqrt{5}} \cdot \dfrac{(3-\sqrt{5})}{(3-\sqrt{5})}$

$= \dfrac{8(3-\sqrt{5})}{9-5}$

$= \dfrac{8(3-\sqrt{5})}{4}$

$= 2(3-\sqrt{5})$

b) $\dfrac{5\sqrt{3}}{4-\sqrt{6}} \cdot \dfrac{(4+\sqrt{6})}{(4+\sqrt{6})}$

$= \dfrac{5\sqrt{3}(4+\sqrt{6})}{16-6}$

$= \dfrac{5\sqrt{3}(4+\sqrt{6})}{10}$

$= \dfrac{\sqrt{3}(4+\sqrt{6})}{2}$

$= \dfrac{4\sqrt{3}+3\sqrt{2}}{2}$

c) $\dfrac{-4}{3\sqrt{5}+2} \cdot \dfrac{(3\sqrt{5}-2)}{(3\sqrt{5}-2)}$

$= \dfrac{-4(3\sqrt{5}-2)}{9(5)-4}$

$= \dfrac{-4(3\sqrt{5}-2)}{41}$

$= \dfrac{-12\sqrt{5}+8}{41}$