PRINCIPLES - LESSON 14E
MAKING USE OF CONJUGATES

Simplify.

No radicals in a denominator!

ex1) $\dfrac{3+\sqrt{2}}{\sqrt{6}} \cdot \dfrac{\sqrt{6}}{\sqrt{6}}$

$= \dfrac{3\sqrt{6} + \sqrt{12}}{\sqrt{36}}$
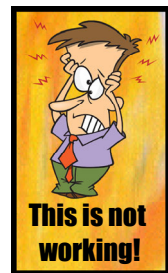
$= \dfrac{3\sqrt{6} + \sqrt{4\cdot 3}}{6}$

$= \boxed{\dfrac{3\sqrt{6} + 2\sqrt{3}}{6}}$

ex2) $\dfrac{\sqrt{6}}{3+\sqrt{2}} \cdot \dfrac{\sqrt{2}}{\sqrt{2}}$?

$= \dfrac{\sqrt{12} \cdot \sqrt{2}}{3\sqrt{2} + 2 \cdot \sqrt{2}}$?

$= \dfrac{\sqrt{24} \cdot \sqrt{2}}{6 + 2\sqrt{2} \cdot \sqrt{2}}$?

$= \dfrac{\sqrt{48}}{6\sqrt{2} + 4}$!!!

This is not working!

CONJUGATES

Conjugates: 2 binomials that are half-opposite
- The first terms have the same signs, while the second terms have opposite signs.
- When FOILing 2 conjugates, the outside and inside terms will cancel.

ex3) What is the conjugate of $8x - 1$?

$$8x + 1$$

ex4) What is the conjugate of $\sqrt{7} + 4$?

$$\sqrt{7} - 4$$

ex5) Simplify.

$$(3 - \sqrt{6})(3 + \sqrt{6})$$

$$= \overset{F}{9} + \overset{O}{3\sqrt{6}} - \overset{I}{3\sqrt{6}} - \overset{L}{\sqrt{36}}$$

$$= 9 - 6 = \boxed{3}$$

The outside and inside terms have cancelled!

SIMPLIFYING RADICALS USING CONJUGATES

Simplify.

ex6)

$$\frac{3-\sqrt{2}}{3+\sqrt{2}} \cdot \frac{3-\sqrt{2}}{3-\sqrt{2}}$$

$$= \frac{\overset{F}{9} - \overset{O}{3\sqrt{2}} - \overset{I}{3\sqrt{2}} + \overset{L}{\sqrt{4}}}{\underset{F \quad \cancel{OI} \quad L}{9 \quad - \quad \sqrt{4}}}$$

conjugate shortcut in denominator →

THE CONJUGATE SHORTCUT

Since we know that FOILing two conjugates will cause the OUTSIDE and INSIDE terms to cancel, we only need to multiply the FIRST and LAST terms when FOILing conjugates.

$$= \frac{9 - 6\sqrt{2} + 2}{9 - 2}$$

$$= \boxed{\frac{11 - 6\sqrt{2}}{7}}$$

SIMPLIFYING RADICALS USING CONJUGATES

Simplify.

ex7) $\dfrac{4\sqrt{3} + 5\sqrt{5}}{5\sqrt{3} + 2\sqrt{6}} \cdot \dfrac{5\sqrt{3} - 2\sqrt{6}}{5\sqrt{3} - 2\sqrt{6}}$

$= \dfrac{\overset{F}{20\sqrt{9}} - \overset{O}{8\sqrt{18}} + \overset{I}{25\sqrt{15}} - \overset{L}{10\sqrt{30}}}{\underset{\text{conjugate shortcut in denominator}}{\underbrace{\overset{F}{25\sqrt{9}} \;\; \overset{or}{-} \;\; \overset{L}{4\sqrt{36}}}}}$

$= \dfrac{60 - 8\sqrt{9 \cdot 2} + 25\sqrt{15} - 10\sqrt{30}}{75 - 24}$

$= \boxed{\dfrac{60 - 24\sqrt{2} + 25\sqrt{15} - 10\sqrt{30}}{51}}$