Chapter 7 Section 5
Multiplying with More Than One Term and Rationalizing Denominators.

Multiplying Radicals
Use the distributive property, FOIL, area model.
Example

a) $\sqrt{7}\left(x+\sqrt{2}\right)$

b) $\left(5\sqrt{2}+2\sqrt{3}\right)\left(4\sqrt{2}-3\sqrt{3}\right)$

solution

a) $\sqrt{7}\left(x+\sqrt{2}\right)$

$\sqrt{7}\cdot x+\sqrt{7}\cdot\sqrt{2}$

$x\sqrt{7}+\sqrt{14}$

b) $\left(5\sqrt{2}+2\sqrt{3}\right)\left(4\sqrt{2}-3\sqrt{3}\right)$

$5\sqrt{2}\cdot 4\sqrt{2}+5\sqrt{2}\cdot\left(-3\sqrt{3}\right)+2\sqrt{3}\cdot 4\sqrt{2}+2\sqrt{3}\cdot\left(-3\sqrt{3}\right)$

F O I L

Show area model

Try:

a) $\sqrt[3]{5}\left(3\sqrt[3]{5}-7\sqrt[3]{25}\right)$

b) $\left(7-\sqrt{3}\right)\left(2\sqrt{2}+3\sqrt{3}\right)$

Example:

c) $\left(\sqrt{3}+\sqrt{7}\right)^2$

d) $\left(\sqrt{7}+\sqrt{5}\right)\left(\sqrt{7}-\sqrt{5}\right)$

Find the missing value:

- $\sqrt{7}\left(?\right)=7$
- $\sqrt{8}\left(?\right)=4$
- $\sqrt{x}\left(?\right)=x$
- $\sqrt[3]{49}\left(?\right)=7$
- $\sqrt[3]{5}\left(?\right)=5$
- $\sqrt{5y}\left(?\right)=5y$

Rationalize the denominator
The process involves rewriting a radical expression as an equivalent expression in which the denominator no longer contains any radical.

Example: Rationalize the denominator.

- $\frac{\sqrt{5}}{\sqrt{6}}$
- $\sqrt[3]{\frac{7}{25}}$

What can you multiply $\sqrt{6}$ so that the radical sign will 'disappear?'
What can you multiply $\sqrt[3]{25}$ or $\sqrt[3]{5^2}$ so the radical sign 'disappears?'

$\frac{\sqrt{5}}{\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}}$ $\sqrt[3]{\frac{7}{25}} \cdot \sqrt[3]{\frac{5}{5}}$

$\frac{\sqrt{30}}{\sqrt{36}}$ $\sqrt[3]{\frac{35}{5^3}}$

$\frac{\sqrt{30}}{6}$ $\frac{\sqrt[3]{35}}{5}$

Since the denominator does not have a radical, the problem is finished.

Try:

a) $\sqrt{\frac{3x}{5y}}$ b) $\frac{10y}{\sqrt[3]{4x^3y}}$

Rationalize Denominators Containing Two Terms

Conjugate:
If (a + b) then the conjugate is (a – b)

If 4x – 3 then the conjugate is 4x + 3

Find the conjugate
a) 3 – 7x b) 8y + 3x

What happens when the binomial and the conjugate are multiplied together?

If the binomial $4-\sqrt{2}$ is multiplied by the conjugate, what happens to the radical?

If the denominator contains two terms, then multiply the denominator by the conjugate will rationalize the denominator.

Example:
Rationalize the denominator: $\dfrac{7}{3\sqrt{2}+5}$

Solution:
Since the denominator has two terms, $3\sqrt{2}+5$, the conjugate is $3\sqrt{2}-5$ so to rationalize the denominator, one multiplies both the numerator and denominator by the conjugate.

$$\frac{7}{3\sqrt{2}+5}\left(\frac{3\sqrt{2}-5}{3\sqrt{2}-5}\right)$$

$$\frac{7\left(3\sqrt{2}-5\right)}{3\bullet 2-25}$$

$$\frac{7\left(3\sqrt{2}-5\right)}{-19}$$

Try:

$$\frac{18}{2\sqrt{3}+3}$$

To rationalize the denominator, what value of one do you multiply the expression?

a) $\dfrac{\sqrt{7}}{\sqrt{3}}$ b) $\dfrac{12}{\sqrt{5y}}$ c) $\sqrt[3]{\dfrac{2}{3}}$

d) $\dfrac{25}{5\sqrt{2}-3\sqrt{5}}$ e) $\dfrac{12}{\sqrt{7}-\sqrt{3}}$