Lesson 22 (5.6): Roots (Part 2)

By the end of the lesson, you will be able to:

- ★ Simplify radicals by using distribution and FOIL
- ★ Simplify radicals by rationalizing the denominator
- ★ Finding conjugates to rationalize denominators

Lesson 22 (5.6): Roots (part 2)

Review: Simplify each

1st: $3\sqrt{5} \cdot 10\sqrt{15}$

2nd: $4\sqrt{10} \cdot 5\sqrt{10}$

Multiplying using the distributive property

Just like multiplying polynomials, we can distribute and FOIL radical expressions.

Examples:

1. $\sqrt{5}(\sqrt{3}+2\sqrt{2})$

2. $6\sqrt{2}(4-\sqrt{5})$

Lesson 22 (5.6): Roots (Part 2)

More Examples

a. $(\sqrt{6}+\sqrt{3})(\sqrt{3}+\sqrt{2})$

b. $(2\sqrt{3}+4)(\sqrt{3}+6\sqrt{5})$

Lesson 22 (5.6): Roots (part 2)

Examples Continued

c. $\left(4\sqrt{5}+2\sqrt{7}\right)\left(4\sqrt{5}-2\sqrt{7}\right)$

d. $\left(12+\sqrt{3}\right)\left(12-\sqrt{3}\right)$

Dividing radicals by rationalizing the denominator

We can also divide by monomials. However, we don't like square roots (or any roots) in the denominator of a fraction. So we do something called "**rationalizing the denominator**" to get rid of the root on the bottom.

Lesson 22 (5.6): Roots (part 2)

Rationalize

We must multiply the numerator and the denominator by the same quantity so that the radicand has an exact root.

Example 1: What can we multiply by to make the denominator a rational number?

$$\frac{\sqrt{b^4}}{\sqrt{a^3}}$$

Example

What can we multiply by to make the denominator a rational number? (Hint: we are looking for a perfect 5th this time).

$$\sqrt[5]{\frac{3}{4s^2}} = \frac{\sqrt[5]{3}}{\sqrt[5]{4s^2}}$$

Examples

What can we multiply by to make the denominator a rational number?

a. $\frac{6}{2\sqrt{3}}$

b. $4\sqrt{\frac{5}{7x}}$

Lesson 22 (5.6): Roots (part 2)

Example

What can we multiply by to make the denominator a rational number?

C. $\dfrac{5}{\sqrt[3]{a}}$

Lesson 22 (5.6): Roots (part 2)

What would happen if we had something like $\sqrt{6} + \sqrt{3}$ in the denominator? What would we multiply by?

We would need to multiply by the "conjugate" of the binomial.

The **CONJUGATE** is another binomial that when multiplied by the original binomial, we get a rational number as a result.

The conjugate of $\sqrt{6} + \sqrt{3}$ is $\sqrt{6} - \sqrt{3}$. Test it.

Lesson 22 (5.6): Roots (Part 2)

Are these conjugates of each other?

a. $(12+\sqrt{3})(12-\sqrt{3})$

b. $(1-4\sqrt{5})(1+4\sqrt{5})$

Why is one "+" and the other is "−"?

Find the conjuagte of each.

c. $6-\sqrt{5}$

d. $\sqrt{3}-5$

Lesson 22 (5.6): Roots (Part 2)

Simplify:

What can we multiply by to make the denominator a rational number? (Hint: use conjugates)

a. $\dfrac{1+2\sqrt{5}}{6-\sqrt{5}}$

b. $\dfrac{\sqrt{3}+2}{\sqrt{3}-5}$

Lesson 22 (5.6): Roots (part 2)

Simplify:

What can we multiply by to make the denominator a rational number?

a. $\dfrac{5\sqrt{3}+2\sqrt{7}}{4\sqrt{6}}$

b. $\dfrac{5}{2+\sqrt{10}}$

Assignment #22:

Due at the beginning of next class