Objectives:

- Use the Laws of Exponents to simplify expressions that contain rational exponents.
- Use the Laws of Exponents to simplify radical expressions.
- Factor expressions containing rational exponents.

The Laws of Exponents that we learned before when we worked with exponents that were integers, will also work for rational exponents. Here is a quick overview:

LAWS OF EXPONENTS:

Assuming that a and b are real numbers, and assuming the expression is defined (there aren't any denominators equal to zero)...

Zero Exponent Rule:	$a^0 = 1$	if $a \neq 0$
Negative-Exponent Rule:	$a^{-\frac{m}{n}} = \dfrac{1}{a^{\frac{m}{n}}}$	if $a \neq 0$

Lesson 7.2: Simplifying Expressions using Laws of Exponents

Product Rule:
$$a^{\frac{m}{n}} \cdot a^{\frac{r}{s}} = a^{\left(\frac{m}{n}+\frac{r}{s}\right)}$$

Quotient Rule:
$$\frac{a^{m/n}}{a^{r/s}} = a^{\left(\frac{m}{n}-\frac{r}{s}\right)} = \frac{1}{a^{\left(\frac{r}{s}-\frac{m}{n}\right)}} \text{ if } a \neq 0$$

Power Rule:
$$\left(a^{\frac{m}{n}}\right)^{\frac{r}{s}} = a^{\frac{m}{n}\cdot\frac{r}{s}}$$

Product to Power Rule:
$$(a \cdot b)^{\frac{m}{n}} = a^{\frac{m}{n}} \cdot b^{\frac{m}{n}}$$

Quotient to Power Rule:
$$\left(\frac{a}{b}\right)^{\frac{m}{n}} = \frac{a^{\frac{m}{n}}}{b^{\frac{m}{n}}} \quad \text{if } b \neq 0$$

Quotient to a Negative Power Rule:
$$\left(\frac{a}{b}\right)^{-\frac{m}{n}} = \left(\frac{b}{a}\right)^{\frac{m}{n}}$$
$$\text{if } a \neq 0, \, b \neq 0$$

"To Simplify" *means the following* :

- All exponents are positive.
- Each base occurs only once (we combine all x's, y's, numerical coefficients, etc.).
- There are no parentheses left in the expression.
- There are no powers written to powers left in the expression.

EXAMPLES: Simplify each of the following.

A) $16^{2/3} \cdot 16^{5/6}$

B) $\dfrac{4^{2/3}}{4^{-5/6}}$

EXAMPLES: Simplify each of the following.

C) $\left(4^{3/2}\right)^{5/3}$

D) $\left(a^{-3/2}b^{1/4}\right)^{8}$

EXAMPLES: Simplify each of the following.

E) $\left(x^{-4/3}y^{-2}\right)\left(x^2y^{1/2}\right)^{4/3}$

EXAMPLES: Simplify each of the following.

F) $\dfrac{\left(2x^{-1}y^{2/5}\right)^{5}}{x^{2}y^{2}}$

EXAMPLE: Use Rational Exponents to simplify the radicals.

G) $\sqrt[6]{9^3}$

H) $\sqrt[3]{27a^3b^9}$

EXAMPLE: Use Rational Exponents to simplify the radicals.

I) $\dfrac{\sqrt[4]{x^3}}{\sqrt{x}}$

J) $\sqrt{\sqrt[3]{n}}$

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Homework:

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25, 29, 31, 27, 41, 45, 65, 69, 73
(15 problems)