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

- Write Expressions with rational exponents in simplest radical form and vice versa.
- Evaluate (simplify) expressions in either exponential or radical form.

What is a rational number?

~What forms can it have?

Rational Exponents

Fraction exponents, called **rational exponents**, are another way to represent roots. For rational exponents, the *numerator* represents the power, and the *denominator* represents the root.

$$a^{\frac{1}{m}} = \sqrt[m]{a}$$

$$5^{\frac{1}{3}} = \sqrt[3]{5}$$

$$a^{\frac{n}{m}} = \sqrt[m]{a^n} = \left(\sqrt[m]{a}\right)^n$$

$$5^{\frac{2}{3}} = \sqrt[3]{5^2} = \left(\sqrt[3]{5}\right)^2$$

Most helpful way!

Example 1:

a.) $36^{\frac{1}{2}} =$

b.) $64^{\frac{1}{3}} =$

c.) $36^{\frac{3}{2}} =$

d.) $27^{\frac{4}{3}} =$

Example 1:

e.) $(-9)^{\frac{3}{2}} =$

f.) $(-27)^{\frac{2}{3}} =$

g.) $49^{-\frac{1}{2}} =$

h.) $\left(\frac{1}{8}\right)^{-\frac{1}{3}} =$

Remember?

Rules of Powers

A POWER is an expression in the form of x^n.

Multiplying Powers:

For any real number a and integers m and n,

$$a^m \cdot a^n = a^{m+n}$$

Dividing Powers:

For any real number a, except a=0, and integers m and n,

$$\frac{a^m}{a^n} = a^{m-n}$$

Remember?

Properties of Powers

Suppose m and n are integers and a and b are real numbers. Then the following properties hold.

Power of a Power: $(a^m)^n = a^{mn}$

Power of a Product: $(ab)^m = a^m b^m$

Remember?

Properties of Powers

Suppose m and n are integers and a and b are real numbers. Then the following properties hold.

Power of a Quotient: $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

Zero Exponents: $\frac{a^m}{a^m} = a^0 = 1$

Lesson 16: Monomials Negative Exponents

Remember?

Properties of Powers

Negative Exponents: $a^{-n} = \frac{1}{a^n}$ or $\frac{1}{a^{-n}} = a^n$

Power of a Quotient: $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^{n}$ or $\frac{b^n}{a^n}, a \neq 0, b \neq 0$

All the properties we have used for integer exponents apply to rational exponents.

Example 2: Express using rational exponents.

$$x^{\frac{2}{5}} \cdot x^{\frac{1}{5}} =$$

All the properties we have used for integer exponents apply to rational exponents.

Example 3: Express using rational exponents.

$$x^{\frac{5}{4}} \cdot x =$$

All the properties we have used for integer exponents apply to rational exponents.

Example 4: Express using rational exponents.

$$x^{\frac{2}{3}} \cdot x^{\frac{3}{5}} =$$

All the properties we have used for integer exponents apply to rational exponents.

Example 5: Express using rational exponents.

$$\left(x^{\frac{2}{5}}\right)^{\frac{3}{2}} =$$

Example 6: Express using rational exponents.

$$\left(x^{\frac{2}{3}}y^{\frac{7}{2}}\right)^{6} =$$

Example 7: Express using rational exponents.

$$\left(x^{-\frac{1}{4}}\right)^{-6} =$$

Example 8: Express using rational exponents.

$$\frac{x^{\frac{5}{3}}}{x^{\frac{1}{3}}} =$$

Example 9: Express using rational exponents.

$$\frac{x}{x^{\frac{3}{4}}} =$$

Example 10: Express using rational exponents.

$$\left(\frac{16x^3}{y^4}\right)^{\frac{1}{2}} =$$

Example 11: Express using rational exponents.

$$\left(\frac{3x^{-\frac{3}{2}}}{y^{-\frac{3}{2}}}\right)^{-2} =$$

With rational exponents, we are able to simplify radical expressions with different types of roots.

Example 12: Express in simplest radical form

a.) $\sqrt[3]{a} \cdot \sqrt[4]{a} =$

b.) $\sqrt{x} \cdot \sqrt[3]{x^4} =$

Example 12: Express in simplest radical form

c.) $m^{\frac{1}{3}} n^{\frac{3}{4}} p^{\frac{5}{6}} =$

d.) $8^{\frac{1}{2}} b^{\frac{2}{3}} c^{\frac{7}{6}} =$

Example 12: Express in simplest radical form

e.) $\sqrt[3]{\sqrt{y^3}} =$

f.) $\sqrt[4]{49} =$

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

- Write Expressions with rational exponents in simplest radical form and vice versa.
- Evaluate (simplify) expressions in either exponential or radical form.

Can you?

Homework:

Exponent monster worksheet

&

Assignment #23

Due at the beginning of next class