Rational Exponents

SWBAT simplify rational exponents by converting them into radicals.

Rational Exponent: _____

- We can rewrite expressions with rational exponents as radical expressions to help us evaluate them more easily
- The denominator of the fraction is the index (root) of your radical and the numerator is the power of the base inside the radical
- **Example:** $x^{\frac{a}{b}} = \sqrt[b]{x^a}$

****Fill out the chart below to refresh on our squares and cubes!****

	1	2	3	4	5	6	7	8	9	10
Squared										
Cubed										

Example 1: Simplify each expression

*Turn it into a radical. The numerator is the power of the base, and the denominator is the number in the corner of the radical!

a) $27^{\frac{1}{3}}$

b) $64^{\frac{1}{2}}$

c) $8^{\frac{2}{3}}$

a) $a^{\frac{1}{6}}$

b) $m^{\frac{1}{2}}$

c) $x^{\frac{3}{4}}$

Example 2: Write each expression as a Rational Exponent

*The numerator is the power of the base, and the denominator is the number in the corner of the square root sign!

a) $\sqrt{x^3}$

b) $\sqrt{5y}$

c) $(\sqrt[4]{b})^3$

a) $\sqrt[3]{m}$

b) $\sqrt[3]{2y^2}$

c) $\sqrt{-6}$

Product of powers: Keep the _____ _____ the same and _____ the exponents.

a) $(-5)^{\frac{1}{3}} \cdot (-5)^{\frac{1}{3}} \cdot (-5)^{\frac{1}{3}}$

b) $7^{\frac{1}{2}} \cdot 7^{\frac{1}{2}}$

c) $x^{\frac{1}{4}} \cdot x^{\frac{2}{4}}$

c)

Power of a power: Keep the _____ the same and _____ the exponents.

a) $4(a^{\frac{1}{2}})^6$

b) $(3x^{\frac{1}{3}})^3$

c) $\left(16x^6y^{-4}\right)^{\frac{1}{2}}$

Rational Exponents

Name: _____

Classwork

Directions: Evaluate each expression; resulting answers should not contain any radicals:

1) $5^2(\frac{1}{5})^3$

2) $\frac{3}{3^{-2}}$

3) $\sqrt[4]{16}$

4) $\sqrt[5]{\frac{1}{32}}$

5) $4^{\frac{3}{2}} \times 4^{\frac{3}{2}}$

6) $\frac{\sqrt[5]{-3}}{\sqrt[5]{96}}$

7) $8^{\frac{2}{3}} 8^{\frac{1}{3}}$

8) $\sqrt[3]{5^3}$

9) $\sqrt[8]{6^8}$

Directions: Simplify the expressions. Write answers as a rational exponent (if needed).

1) $\sqrt[4]{z^{20}}$

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

3) $\sqrt[3]{c^3}$

4) $\sqrt[4]{256x^8}$

5) $\sqrt[4]{16y^{16}}$

6) $\sqrt[4]{16x^4z^8}$

7) $(\sqrt{x})(\sqrt{x})$

8) $\left(\sqrt[5]{x^7y}\right)\left(\sqrt[5]{x^3y}\right)$

9) $\sqrt[4]{81x^8y^4}$

Directions: Simplify the expression and eliminate any negative exponent(s):

1) $(2x^{\frac{3}{2}})(4x)^{-\frac{1}{2}}$

2) $(-2a^{\frac{3}{4}})(5a^{\frac{3}{2}})$

3) $(8x^6)^{-\frac{2}{3}}$

4) $\left(\frac{-2x^{\frac{1}{3}}}{y^{\frac{1}{2}}z^{\frac{1}{6}}}\right)^6$

5) $\frac{(y^{10}z^{-5})^{\frac{1}{5}}}{(y^{-2}z^3)^{\frac{1}{3}}}$

6) $(x^{-5}y^3z^{10})^{-\frac{3}{5}}$

Math 1

Rational Exponents

Unit 5 Day 3

SWBAT simplify rational exponents by converting them into radicals.

Rational Exponent: Exponents in fraction form

- We can rewrite expressions with rational exponents as radical expressions to help us evaluate them more easily
- The denominator of the fraction is the index (root) of your radical and the numerator is the power of the base inside the radical
- **Example:** $x^{\frac{a}{b}} = \sqrt[b]{x^a}$

$x^{\frac{a}{b}}$ — a → power, b → root

****Fill out the chart below to refresh on our squares and cubes!****

	1	2	3	4	5	6	7	8	9	10
Squared	1	4	9	16	25	36	49	64	81	100
Cubed	1	8	27	64	125	216	343	512	729	1,000

Example 1: Simplify each expression

*Turn it into a radical. The numerator is the power of the base, and the denominator is the number in the corner of the radical!

a) $27^{\frac{1}{3}}$ $\sqrt[3]{27} = 3$

b) $64^{\frac{1}{2}}$ $\sqrt{64} = 8$

c) $8^{\frac{2}{3}}$ $\sqrt[3]{8^2}$

a) $a^{\frac{1}{6}}$ $\sqrt[6]{a^1}$

b) $m^{\frac{1}{2}}$ $\sqrt{m}$

c) $x^{\frac{3}{4}}$ $\sqrt[4]{x^3}$

Example 2: Write each expression as a Rational Exponent

*The numerator is the power of the base, and the denominator is the number in the corner of the square root sign!

a) $\sqrt{x^3}$ $x^{\frac{3}{2}}$

b) $\sqrt{5y}$ $(5y)^{\frac{1}{2}}$

c) $(\sqrt[4]{b})^3$ $(b^{1/4})^3 = b^{3/4}$

a) $\sqrt[3]{m}$ $m^{\frac{1}{3}}$

b) $\sqrt[3]{2y^2}$ $(2)^{1/3}\, y^{2/3}$

c) $\sqrt{-6}$ $(-6)^{\frac{1}{2}}$

Product of powers: Keep the ____BASE____ the same and __ADD____ the exponents.

a) $(-5)^{\frac{1}{3}} \cdot (-5)^{\frac{1}{3}} \cdot (-5)^{\frac{1}{3}}$ $-5^{\frac{3}{3}} = (-5)$

b) $7^{\frac{1}{2}} \cdot 7^{\frac{1}{2}}$ $7^{\frac{2}{2}} = 7$

c) $x^{\frac{1}{4}} \cdot x^{\frac{2}{4}}$ c) $x^{3/4}$

Power of a power: Keep the ____BASE____ the same and _____MULITPLY_____ the exponents.

a) $4(a^{\frac{1}{2}})^6$ $4a^{\frac{6}{2}} = 4a^3$

b) $(3x^{\frac{1}{3}})^3$ $3^3 x^{3/3} = 27x$

c) $(16x^6y^{-4})^{\frac{1}{2}}$ $16^{\frac{1}{2}} x^{\frac{6}{2}} y^{\frac{-4}{2}} = \frac{4x^3}{y^2}$

Rational Exponents

Name: Key

Classwork – DO ODD PROBLEMS!

Directions: Evaluate each expression; resulting answers should not contain any radicals:

1) $5^2\left(\frac{1}{5}\right)^3$ $25\left(\frac{1}{125}\right)$ $\frac{1}{5}$ or .2

2) $\frac{3}{3^{-2}}$ $3 \cdot 3^2 = 3 \cdot 9 = 27$

3) $\sqrt[4]{16}$ $16^{\frac{1}{4}} = 2$

4) $\sqrt[5]{\frac{1}{32}}$ $\left(\frac{1}{32}\right)^{\frac{1}{5}}$ .5

5) $4^{\frac{3}{2}} \times 4^{\frac{3}{2}} = 4^{\frac{6}{2}} = 4^3 = 64$

6) $\frac{\sqrt[5]{-3}}{\sqrt[5]{96}}$ $\frac{-3^{\frac{1}{5}}}{96^{\frac{1}{5}}} = -.5$

7) $8^{\frac{2}{3}} 8^{\frac{1}{3}} = 8^{\frac{3}{3}} = 8^1 = 8$

8) $\sqrt[3]{5^3}$ $5^{3/3} = 5$

9) $\sqrt[8]{6^8}$ $6^{8/8} = 6$

Directions: Simplify the expressions. Write answers as a rational exponent (if needed).

1) $\sqrt[4]{z^{20}}$ $z^{20/4} = z^5$

2) $\sqrt[3]{x^4}$ $x^{4/3}$

3) $\sqrt[3]{c^3}$ $c^{3/3} = c$

4) $\sqrt[4]{256x^8}$ $256^{\frac{1}{4}} x^{8/4}$ $4 \cdot x^2$

5) $\sqrt[4]{16y^{16}}$ $16^{\frac{1}{4}} y^{16/4}$ $2y^4$

6) $\sqrt[4]{16x^4z^8}$ $2xz^2$

7) $(\sqrt{x})(\sqrt{x}) = x$

8) $\left(\sqrt[5]{x^7y}\right)\left(\sqrt[5]{x^3y}\right)$ $x^{\frac{7}{5}} y^{\frac{1}{5}} x^{\frac{3}{5}} y^{\frac{1}{5}} = x^{\frac{10}{5}} y^{\frac{2}{5}}$

9) $\sqrt[4]{81x^8y^4}$ $3x^2y$

Directions: Simplify the expression and eliminate any negative exponent(s):

1) $(2x^{\frac{3}{2}})(4x)^{-\frac{1}{2}}$ $2x^{\frac{3}{2}} \frac{1}{2}(x^{-1/2})$ $1 \cdot x^{\frac{2}{2}} = x$

2) $(-2a^{\frac{3}{4}})(5a^{\frac{3}{2}})$ $-2a^{\frac{3}{4}} 5^{\frac{3}{2}}$ $-10a^{3/4} a^{\frac{6}{4}} = -10a^{\frac{9}{4}}$

3) $(8x^6)^{-\frac{2}{3}}$ $8^{-2/3} x^{-12/3} = \frac{1}{4x^4}$

4) $\left(\frac{-2x^{\frac{1}{3}}}{y^{\frac{1}{2}}z^{\frac{1}{6}}}\right)^6 \frac{-2^6x^2}{y^3z}$ $= \frac{64x^2}{y^3z}$

5) $\frac{(y^{10}z^{-5})^{\frac{1}{5}}}{(y^{-2}z^3)^{\frac{1}{3}}}$ $\frac{y^{\frac{10}{5}} z^{-1}}{y^{-\frac{2}{3}} z^{\frac{3}{3}}} = \frac{y^2 z^{-2}}{y^{-\frac{2}{3}} z^1}$ $\frac{y^2 \cdot y^{\frac{2}{3}}}{z^3} = \frac{y^{6/3}}{z^3}$

6) $(x^{-5}y^3z^{10})^{-\frac{3}{5}}$ $x^{\frac{15}{5}} y^{-\frac{9}{5}} z^{-\frac{30}{5}}$ $\frac{x^3}{w^{-9/5} z^6}$