

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

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

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

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

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

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

d)  $12^{\frac{2}{3}}$

d)  $y^{\frac{7}{2}}$

### 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)  $\sqrt{x^3}$

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

b)  $\sqrt{5y}$

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

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

c)  $\sqrt{-6}$

d)  $\sqrt{a^3x^2y}$

d)  $\sqrt[3]{16a^2b^5}$

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

**Challenge!** Using rational exponents, prove the following:  $\sqrt[6]{x} \cdot \sqrt[6]{x} = \sqrt[3]{x}$

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

# Rational Exponents

Name: \_\_\_\_\_

Classwork

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

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

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

10)  $81^{\frac{3}{4}}$

11)  $\frac{x^{\frac{2}{3}}}{x^{\frac{1}{3}}}$

12)  $(16^{\frac{3}{2}})^{\frac{1}{2}}$

**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)  $(\sqrt[5]{x^7y})(\sqrt[5]{x^3y})$

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

10)  $\sqrt[6]{x^6y^4}$

11)  $\sqrt[3]{125a^{12}x^3}$

12)  $\sqrt[5]{x^{10}z^5}$

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

7)  $\left(\frac{x^6y}{z^4}\right)^{\frac{5}{2}}$

8)  $\left(\frac{a^2b^{-3}}{x^{-1}y^2}\right)^3 \left(\frac{x^{-2}b^{-1}}{a^{\frac{3}{2}}y^{\frac{1}{3}}}\right)$