

Name: _____

Date: _____ Block: _____

Chapter 4.3: Fractional Exponents and Radicals

Variable: An _____ value that is represented by a given letter.

What to do if you have a fractional exponent:

$$\begin{array}{l} \rightarrow n \text{ is a natural } \# \\ \rightarrow x \text{ is a rational } \# \end{array} \quad \frac{1}{x^n} = \sqrt[n]{x}$$

We can apply the product of power rule to fractional exponents. Recall,

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

To multiply:
→ same base
→ ADD exponents.

Example 1:

Raising a number to the exponent $\frac{1}{2}$ is equivalent to taking the square root of the number.

Raising a $\#$ to the exponent $\frac{1}{2}$ is equivalent to taking the square root of the $\#$

$$5^{\frac{1}{2}} = \sqrt{5} \quad 5^{\frac{1}{3}} = \sqrt[3]{5}$$

Solve $5^{\frac{1}{2}} \times 5^{\frac{1}{2}}$ using two different methods:

Example 2: Evaluate the following without using a calculator

a) $1000^{\frac{1}{3}}$

b) $0.25^{\frac{1}{2}}$

c) $(-8)^{\frac{1}{3}}$

d) $\left(\frac{16}{81}\right)^{\frac{1}{4}}$

Powers with rational exponents:

↳ When m, n are natural #'s

↳ x is a rational #

$$x^{\frac{m}{n}} = \left(x^{\frac{1}{n}}\right)^m \quad \text{and} \quad x^{\frac{m}{n}} = \left(x^m\right)^{\frac{1}{n}}$$
$$= \left(\sqrt[n]{x}\right)^m \quad = \sqrt[n]{x^m}$$

Example 3: Solve $8^{\frac{2}{3}}$ using two different methods

Example 4: Evaluate the following using either method

a) $0.01^{\frac{3}{2}}$

b) $27^{\frac{4}{3}}$

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

d) $0.75^{1.2}$

Example 5: Write each product or quotient as a power with a single exponent

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

b) $x^5 \times x^{-\frac{1}{2}}$

c) $3^{\frac{-3}{4}} \div 3^{0.25}$

d) $x^{1.5} \times x^{3.5}$

e) $4^{\frac{1}{2}} \div 4^{0.5}$

f) $1.5^{\frac{4}{3}} \div 1.5^{\frac{1}{6}}$

Example 5: Write each product or quotient as a power with a single exponent

a) $(4x^3)^{0.5}$

b) $[(x^3)(x^{3/2})]^{1/2}$

c) $(3^4/16)^{-0.75}$

d) $(27x^6)^{2/3}$

e) $[(t^{4/3})(t^{1/3})]^9$

Example 7: Applying Rational Exponents

Biologists use the formula $b = 0.01m^{2/3}$ to estimate the brain mass, b kilograms, of a mammal with body mass m kilograms. Estimate the brain mass of each animal.

a) a husky with a body mass of 27 kg

b) a polar bear with a body mass of 200 kg

Cody invests \$5000 in a fund that increases in value at the rate of 12.6% per year. The bank provides a quarterly update on the value of the investment using the formula $A=5000(1.126)^{q/4}$, where q represents the number of quarterly periods and A represents the final amount of the investment.

a) What is the value of the investment after the 3rd quarter?

b) What is the value of the investment after 3 years?

Homework:

P. 180 # 1 – 5 (pick 3)

#6, 7, 8, 9, 10, 11, 12, 17