

Building Understanding for Rational Powers

Successful students will be able to perform operations with rational, real, and complex numbers, using both numeric and algebraic expressions, including expressions involving exponents and roots.

- Convert between and among radical and exponential forms of numerical expressions.
- Simplify and perform operations on numerical expressions containing radicals.
- Apply the laws of exponents to numerical expressions with rational and negative exponents to order and rewrite them in alternative forms.

Part I

- Enter $y = x^{1/2}$ in your graphing calculator
- Build a table starting at 1 and increasing by increments of 1.
- Describe the relationship between values of x and values of $x^{1/2}$.
- Create a graph of $y = x^{1/2}$.
- Does this graph look like any graph you have seen before?
- Enter another equation in y_2 that you believe is the same as $y = x^{1/2}$.
- Complete the following statement:
- Raising a number to the power of $1/2$ is equivalent to _____

Part II

- Enter $y = x^{1/3}$ in your graphing calculator
- Build a table starting at 1 and increasing by increments of 1.
- Describe the relationship between values of x and values of $x^{1/3}$.
- Create a graph of $y = x^{1/3}$.
- Does this graph look like any graph you have seen before?
- Enter another equation in y_2 that you believe is the same as $y = x^{1/3}$.
- Complete the following statement:
- Raising a number to the power of $1/3$ is equivalent to _____

Part III

- Raising a number to the power of $1/4$ is equivalent to _____
- $\sqrt[5]{\#}$ or the fifth root of a number is equivalent to _____

Part IV

Give another name for each of the following:

$$9^{1/2} \quad \sqrt{169} \quad 125^{1/3} \quad \sqrt[3]{81} \quad 81^{1/4}$$

$$\sqrt{100} \quad 121^{1/2} \quad \sqrt[4]{64}$$

Part V

- Enter the equation $y = 16^x$ in your graphing calculator.
- Create a table of values for this function beginning at $x = 1$ and increasing by increments of 0.5.
- Study the table and describe any relationships you see in the table.
- Notice that $16^{0.5} = 16^{1/2}$. What is another name for this?
- Study the third entry. What does it say?
- What is another way to write $16^{1.5}$ using an improper fraction for the exponent.

- Why does $16^{3/2} = 64$?
- Think about exponent rules.

$$16^{3/2} = (16^{\quad})^{\quad}$$

or

$$16^{3/2} = (16^{\quad})^{\quad}$$

$$16^{3/2} = \left(16^{1/2}\right)^3 \text{ means } 16^{3/2} = (\sqrt{16})^3$$

$$16^{3/2} = (16^3)^{1/2} \text{ means } 16^{3/2} = \sqrt{16^3}$$

- Suppose you want to find $36^{3/2}$. What equation would you enter into your graphing calculator?
- What table would you build to find the value?
- Rewrite the expression two different ways.

$$36^{3/2} = (36^{\quad})^{\quad} \quad 36^{3/2} = (36^{\quad})^{\quad}$$

- Show how to write these expression using radical signs.

$$36^{3/2} = (36^3)^{1/2}$$

$$36^{3/2} = (36^{1/2})^3$$

- Show why these expressions equal 216.

Part VI

- Suppose I want to find the value of $27^{2/3}$ using a table. What equation should I enter in my graphing calculator? What table should I build?
- Rewrite each expression using rational powers.
- Rewrite each expression using radicals.
- Show why each expression equals 81.
- Suppose I want to find the value of $8^{5/3}$ using a table. What equation should I enter in my graphing calculator? What table should I build?
- Rewrite each expression using rational powers.
- Rewrite each expression using radicals.

- Show why each expression equals 32.
- Suppose I want to find the value of $16^{3/4}$ using a table. What equation should I enter in my graphing calculator? What table should I build?
- Rewrite each expression using rational powers.
- Rewrite each expression using radicals.
- Show why each expression equals 8.

Part VII

- Describe what it means to raise a number to a rational exponent.
- Generalize your rule to explain how you would write equivalent expressions for $a^{m/n}$ for $a > 0$.

- Simplify $4^{5/2}$ using ideas we just learned in this lesson.