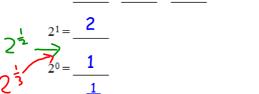
## Investigation: Rational Exponents

## Consider the following pattern:

A. Fill in the blanks based off of the examples. Then answer the questions to the right.

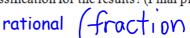
$$2^4 = 2 \cdot 2 \cdot 2 \cdot 2 = 16$$

$$2^2 = 2 \cdot 2 = 4$$



1. With the number system in mind, what type of exponents is being used?

2. What is the most specific number classification for the results? (Final products)



$$2^{-2} = \frac{1}{2^{2}} = \frac{1}{2} \cdot \frac{1}{2} = \frac{\frac{1}{4}}{\frac{1}{4}}$$

$$2^{-3} = \frac{2^{3}}{\frac{1}{2^{4}}} = \frac{2}{2} \cdot \frac{2}{2} \cdot \frac{2}{2} \cdot \frac{2}{2} = \frac{8}{12}$$

$$2^{-4} = \frac{2^{4}}{2^{4}} = \frac{2}{2} \cdot \frac{2}{2} \cdot \frac{2}{2} \cdot \frac{2}{2} = \frac{16}{16}$$

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B. Now consider  $2^{\frac{1}{2}}$ . Where would this fit in the pattern above? Draw an arrow where you think  $2^{\frac{1}{2}}$  should be placed. What do you think the value will be?

My estimated value of  $2^{\frac{1}{2}}$ : | 1.  $\overline{5}$ 

Now enter  $2^{\frac{1}{2}}$  in your calculator. Record the value below. What is the most specific number classification for the result?

1.41421...

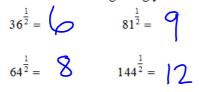
irrational

- What is another key sequence on your calculator to find  $2^{\frac{1}{2}}$ ?
- C. Now consider  $2^{\frac{3}{3}}$ . Where would this fit in the pattern above? Draw an arrow where you think  $2^{\frac{3}{3}}$  should be placed. What do you think the value will be?

Calculator value: 1.25992... Number classification: irrational

What is another key sequence on your calculator to find  $2^{\frac{3}{3}}$ ?

D. Evaluate the following using your calculator:



$$81^{\frac{1}{2}} =$$

$$144^{\frac{1}{2}} = 17$$

 $25^{\frac{1}{2}} = 5$ 

Write a statement about what the exponent  $\frac{1}{2}$  represents.

Try to write this symbolically in radical form:  $a^{\frac{1}{2}} = \int$ 

E. Based on your observations from part D, try to evaluate the following without your calculator.

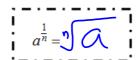
$$8^{\frac{1}{3}} = 2$$

 $8^{\frac{1}{3}} = 2$   $27^{\frac{1}{3}} = 3$ Write a statement about what the exponent  $\frac{1}{3}$  represents?

Try to write this symbolically in radical form:  $a^{\frac{1}{3}} = 3$ 

Try to write this symbolically in radical form:  $a^{\frac{1}{3}} = 3$ 

F. Look back at parts D and E to complete the following symbolic rule in radical form:



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G. Another way of understanding this rule:

Evaluate  $\left(4^{\frac{1}{2}}\right)\left(4^{\frac{1}{2}}\right)$  using product rule Evaluate  $\left(\sqrt{4}\right)\left(\sqrt{4}\right)$  (2) (2)

(2)(2) = 4

Evaluate  $\left(8^{\frac{1}{3}}\right)\left(8^{\frac{1}{3}}\right)\left(8^{\frac{1}{3}}\right)$  using product rule Evaluate  $\left(\sqrt[3]{8}\right)\left(\sqrt[3]{8}\right)\left(\sqrt[3]{8}\right)$  =  $\left(2\sqrt[3]{2}\right)\left(2\right) = 8$ 

What do you notice?

G. Another way of understanding this rule:

Evaluate 
$$\left(4^{\frac{1}{2}}\right)\left(4^{\frac{1}{2}}\right)$$
 using product rule Evaluate  $\left(\sqrt{4}\right)\left(\sqrt{4}\right)$  = (2) (2) = 4

Evaluate 
$$\left(8^{\frac{1}{3}}\right)\left(8^{\frac{1}{3}}\right)\left(8^{\frac{1}{3}}\right)\left(8^{\frac{1}{3}}\right)$$
 using product rule Evaluate  $\left(\sqrt[3]{8}\right)\left(\sqrt[3]{8}\right)\left(\sqrt[3]{8}\right) = (2)(2)(2)$  = 8

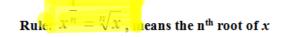
What do you notice?

$$\frac{1}{4^2} = \sqrt{4}$$

$$\frac{1}{8^3} = {}^3 \int 8$$

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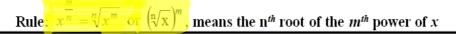




Ex 1) Evaluate

a) 
$$49^{\frac{1}{2}}$$
 b)  $(-64)^{\frac{1}{3}}$  c)  $8^{-\frac{1}{3}}$  d)  $\left(\frac{1}{36}\right)^{\frac{1}{2}}$  =  $2\sqrt{19}$  =  $3\sqrt{-69}$  =  $-\sqrt{1}$  =  $\sqrt{1}$  =  $\sqrt{1}$  =  $\sqrt{1}$  =  $\sqrt{2}$  =

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Ex 2) Evaluate. Write in radical form first.

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

b)  $-25^{\frac{5}{2}}$ 

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

$$= 2^{2} = -5^{5}$$

$$= 4 = -3125$$

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

$$= \left(\frac{1}{81}\right)^{\frac{3}{4}}$$

$$= \left(\frac{1}{81}\right)^{\frac{3}{4}}$$

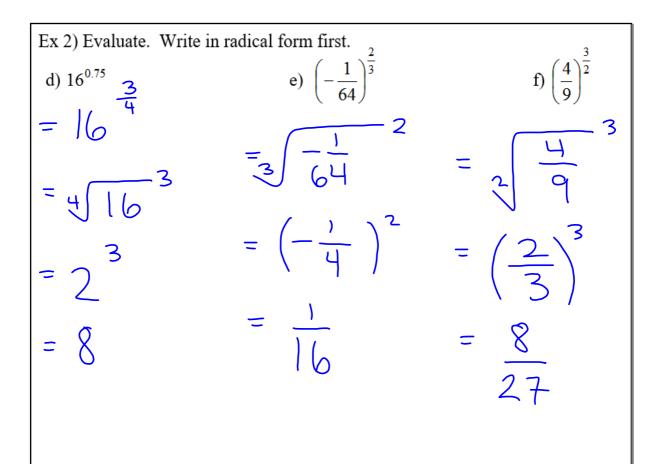
$$= \left(\frac{1}{3}\right)^{\frac{3}{4}}$$

$$= \left(\frac{1}{3}\right)^{\frac{3}{4}}$$

$$= \left(\frac{1}{3}\right)^{\frac{3}{4}}$$

$$= \frac{1}{27}$$

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Ex 3) Evaluate, no decimals:  

$$128^{-\frac{5}{7}} - 16^{0.75}$$

$$= \left(\frac{1}{128}\right)^{\frac{5}{7}} - 16$$

$$= 7 \cdot \frac{1}{128} - 4 \cdot 16$$

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

$$= \frac{1}{32} - 8$$

$$= \frac{1}{32} - \frac{256}{32}$$

$$= -255$$

$$= \frac{32}{32}$$

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Ex 5) Express as a single, positive power, then evaluate.

Do ALL homework questions without a calculator, unless specified otherwise.

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## **HW U2L3:**

- p. 229 #4-6ace,8-11,12ace,14,15a
   (calculator permitted for #8,9,12
- 2. study for quiz (Day 2/3/4/5)

()Thursday