

I. Consider the following pattern:

A. Fill in the blanks based off of the examples. Then answer the questions in the text box.

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

$$2^3 = \underline{2} \cdot \underline{2} \cdot \underline{2} = \underline{8}$$

$$2^2 = \underline{2} \cdot \underline{2} = \underline{4}$$

$$2^1 = \underline{2}$$

$$2^0 = \underline{1}$$

$$2^{-1} = \underline{1/2}$$

$$2^{-2} = \frac{1}{2^2} = \underline{1/4}$$

$$2^{-3} = \underline{\quad} = \underline{\quad} \cdot \underline{\quad} \cdot \underline{\quad} = \underline{1/8}$$

$$2^{-4} = \underline{\quad} = \underline{\quad} \cdot \underline{\quad} \cdot \underline{\quad} \cdot \underline{1} = \underline{1/16}$$

$2^{1/2}$   
 $2^{1/3}$

}

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

My estimated value of  $2^{1/2}$ :   $\approx 1.5$   $1.41$

- Now enter  $2^{1/2}$  in your calculator. What is the most specific number classification for the result?  
 $1.41$

- What is another key sequence on your calculator to find  $2^{1/2}$ ?  $\sqrt{2}$

C. Now consider  $2^{1/3}$ . Where would this fit in the pattern above? Draw an arrow where you think  $2^{1/3}$  should be placed. What do you think the value will be?

My estimated value of  $2^{1/3}$ :   $1.3$  Calculator value:   $1.26$

- What is another key sequence on your calculator to find  $2^{1/3}$ ?  $\sqrt[3]{2}$

D. Evaluate the following using your calculator:

$$36^{1/2} = \underline{6} \quad \left(\frac{1}{81}\right)^{1/2} = \underline{1/9}$$

$$64^{1/2} = \underline{8} \quad \left(\frac{1}{144}\right)^{1/2} = \underline{1/12}$$

Write a statement about what the exponent  $\frac{1}{2}$  represents.  
 $\sqrt{\quad}$  Take the  $\sqrt{\quad}$   
Try to write this symbolically in radical form:  $a^{1/2} = \sqrt{a}$

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

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

$$27^{\frac{1}{3}} = 3$$

$$1000^{\frac{1}{3}} = 10$$

$$\left(\frac{1}{125}\right)^{\frac{1}{3}} = \frac{1}{5}$$

Write a statement about what the exponent  $\frac{1}{3}$  represents?

$\sqrt[3]{\quad}$  cube root

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

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

II. Practice:

A. Write in radical form. Simplify completely.

a.  $100^{\frac{1}{2}} = 10$

b.  $125^{\frac{1}{3}} = 5$

c.  $\left(\frac{1}{9}\right)^{\frac{1}{2}} = \frac{1}{3}$

d.  $64^{\frac{1}{3}} = 4$

e.  $16^{\frac{1}{4}} =$

f.  $\left(\frac{1}{4}\right)^{\frac{1}{2}} = \frac{1}{2}$

h.  $\left(8^{\frac{1}{3}}\right)^3 = 8$

i.  $\left(\left(\frac{1}{8}\right)^4\right)^{\frac{1}{4}} = \frac{1}{8}$

$$a^{\frac{1}{n}} = \sqrt[n]{a}$$

III. Extension:  $25^{\frac{3}{2}} = \sqrt{25^3} = 5^3 = 125$

$$25^{\frac{3}{2}} = \sqrt{25^3} = \sqrt{25 \cdot 25 \cdot 25} = \sqrt{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5} = 5 \cdot 5 \cdot 5 = 125$$

$$a^{\frac{m}{n}} = \sqrt[n]{a^m} \quad \text{or} \quad \left(\sqrt[n]{a}\right)^m$$

SIMPLIFY – NO CALCULATOR

a.  $(27)^{\frac{2}{3}}$

$$\sqrt[3]{27^2} = 9$$

b.  $\left(\frac{1}{16}\right)^{\frac{3}{4}}$

$$\sqrt[4]{\frac{1}{16^3}} = \frac{1}{8}$$

c.  $\left(\frac{1}{32}\right)^{\frac{3}{5}}$

$$\left(\frac{1}{8}\right)^3 = \frac{1}{8}$$

d.  $4^{2.5}$  (rewrite as fractional exp!)

$$4^{5/2} = \sqrt{4^5} = 2^5 = 32$$

e.  $(27)^{\frac{2}{3}}$

$$\left(\frac{1}{27}\right)^{2/3} = \sqrt[3]{\frac{1}{27^2}} = \frac{1}{9}$$

f.  $25^{\frac{3}{2}}$

$$\sqrt{25^3} = 125$$

g.  $\left(\frac{1}{16}\right)^{\frac{3}{4}}$

$$\left(\frac{1}{2}\right)^3 = \frac{1}{8}$$