## Lesson 5.8 Rational Exponents

Goal: Explore the meaning of rational exponents

## 1 <u>ACTIVITY</u> – Exploring $a^n$

Examine the entries in the tables below. Determine the pattern to complete the next entries in each table.

Exponent 2	Exponent -2	Exponent $\frac{1}{2}$
$1^2 = 1$	$1^{-2} = 1$	$1^{\frac{1}{2}} = 1$
$2^2 = 4$	$2^{-2} = \frac{1}{4}$	$4^{\frac{1}{2}} = 2$
$3^2 = 9$	$3^{-2} = \frac{1}{9}$	$9^{\frac{1}{2}} = 3$
$4^2 = 16$	$4^{-2} = \frac{1}{16}$	$16^{\frac{1}{2}} = 4$
5=25	5-2-25	25 <sup>1/2</sup> 5
6 <sup>2</sup> =36	$6^{-2} = \frac{1}{36}$	36=6
72=49	$7^{-2} = \frac{1}{49}$	49 =7

Exponent 3	Exponent -3	Exponent $\frac{1}{3}$
$1^3 = 1$	$1^{-3} = 1$	$1^{\frac{1}{3}} = 1$
$2^3 = 8$	$2^{-3} = \frac{1}{8}$	$8^{\frac{1}{3}} = 2$
$3^3 = 27$	$3^{-3} = \frac{1}{27}$	$27^{\frac{1}{3}} = 3$
$4^3 = 64$	$4^{-3} = \frac{1}{64}$	$64^{\frac{1}{3}} = 4$
5=125	5-3= 125	125=5
$6^3 = 216$	$\int_{0}^{-3} = \overline{2} \overline{1} \overline{1}$	$216^{1/3} = 6$
73=343	7-3= 343	343 <sup>73</sup> =7

Compare the entries in the first and second column of each table. Describe the relationship that you see.

The second column is the reciprocal (flip) of the first column. A negative exponent flips the numerator and denominator

Compare the entries in the first and third column. What do you think it means to raise a number to an exponent of ½ or ½?

Raising a number to 1/2 is the same as square rooting Raising a number to 3 is the same as cube root.

Use your results above to define a formula for  $a^{\frac{1}{n}} = \sqrt{2}$ SAME! Just different age 1 of 3 Notation

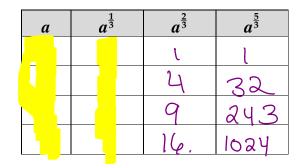
## <u>ACTIVITY</u> – Exploring $a^{\frac{m}{n}}$

Examine the entries in the tables below. Use your calculator to complete each table.

To do a fractional (rational) exponent on your calculator you will need to:

- Use exponent button on your calculator (either the  $x^{y}$ ,  $(y^{x})$ , or (^) button)
- Use brackets around the fraction
- For example: Enter  $25^{\frac{3}{2}}$  as 25  $x^{y}$  (3 ÷ 2) =

a	$a^{\frac{1}{2}}$	$a^{\frac{3}{2}}$	$a^{\frac{5}{2}}$
1		<b>→</b> [	١
4		<b>&gt;</b> ₹	32
9		>	243
16		764	1024



> 25 ~ (3 - 2)

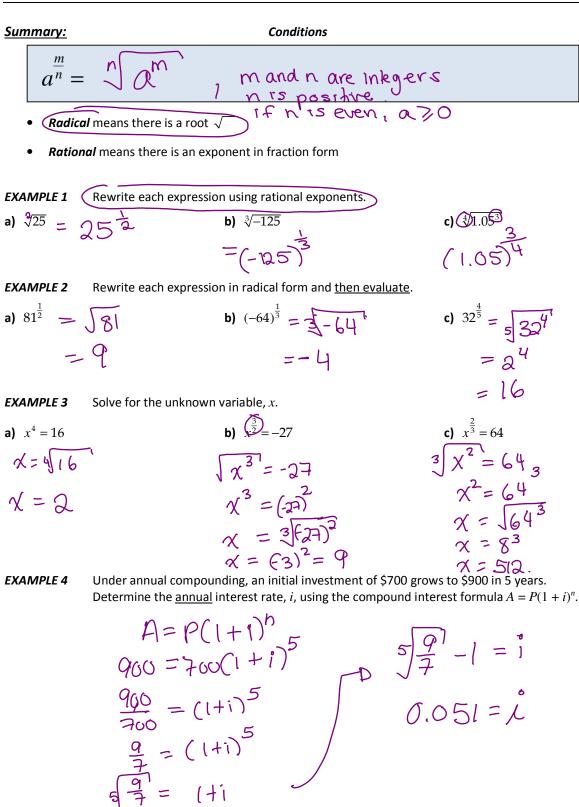
Compare the entries in the second, third, and fourth columns of each table.

How do the values of 
$$a^{\frac{3}{2}}$$
 and  $a^{\frac{5}{2}}$  relate to the values of  $a^{\frac{1}{2}}$ ?  
 $a^{\frac{3}{2}}$  is the cube of  $a^{\frac{1}{2}}$   
 $a^{\frac{5}{2}}$  is  $a^{\frac{1}{2}}$  raised to the power of 5

How do the values of  $a^{\frac{2}{3}}$  and  $a^{\frac{5}{3}}$  relate to the values of  $a^{\frac{1}{3}}$ ?

Use your results above to define a formula for

or 
$$a^{(m)} = n a^{(m)}$$
  
( n is the root.)



**Practice**: Page 369 #2bde, 3 – 5 Page 376 #3ad, 5cd, 6acf, 9, 10ade, 12b, 13, 14ac