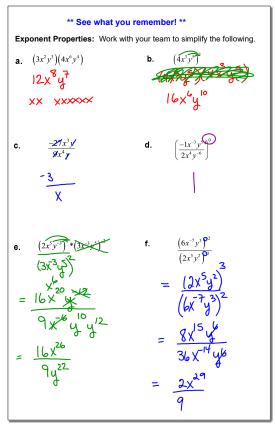# Unit #1 Day #2
Exponent Properties, Rational Exponents and Simplifying Radicals

Objectives:
- Students will be able to simplify radicals accurately using exponent rules.
- Students will be able to simplify rational exponents with and without their calculators (using a powers chart).
- Students will be able to simplify radicals.

A2 Unit 1 Day 2

** See what you remember! **

Exponent Properties: Work with your team to simplify the following.

a. $(3x^2y^3)(4x^6y^4)$

$12x^8y^7$

xx xxxxxx

b. $(4x^3y^5)^2$

$16x^6y^{10}$

c. $\dfrac{-27x^3y}{9x^4y}$

$\dfrac{-3}{x}$

d. $\left(\dfrac{-1x^{-3}y^5}{2x^4y^{-6}}\right)^0$

1

e. $\dfrac{(2x^5y^{-3})^2 \cdot (3x^{-3}x^5)}{(3x^{-3}y^5)^2}$

$= 16x^{20}\dfrac{x^{-12}}{9x^{-16}y^{10}y^{12}}$

$= \dfrac{16x^{26}}{9y^{22}}$

f. $\dfrac{(6x^{-7}y^3y^2)}{(2x^5y^2y^3)}$

$= \dfrac{(2x^5y^2)^3}{(6x^{-7}y^3)^2}$

$= \dfrac{8x^{15}y^6}{36x^{-14}y^6}$

$= \dfrac{2x^{29}}{9}$

Exponent Properties

1

Exponent Rules: **Examples:**

Multiplying Like Bases

$a^m * a^n = a^{m+n}$ $x^3 \cdot x^4 = x^7$

Dividing Like Bases

$\dfrac{a^m}{a^n} = a^{m-n}$ $\dfrac{x^5}{x^3} = x^2$

Power to a Power

$\left(a^m\right)^n = a^{m \cdot n}$ $\left(x^3\right)^2 = x^6$

Zero Exponent

$a^0 = 1$ $\left(\dfrac{x^3 y^2}{z^5}\right)^0 = 1$

Negative Exponents

$a^{-n} = \dfrac{1}{a^n}$ $\dfrac{x^2}{x^7} = \dfrac{1}{x^5}$

$\dfrac{1}{a^{-n}} = \dfrac{a^n}{1} = a^n$ $\dfrac{-1x^2 x^7}{3x^{-7}} = \dfrac{-1x^9}{3}$

$\left(\dfrac{a}{b}\right)^{-n} = \left(\dfrac{b}{a}\right)^n = \dfrac{b^n}{a^n}$ $\left(\dfrac{x^4}{3}\right)^{-2} = \left(\dfrac{3}{x^4}\right)^2$

$= \dfrac{9}{x^8}$

Exponent Rules

Exploration:

1. Using your calculator, evaluate the following:

$25^{\frac{1}{2}}$ $\sqrt{25}$ $64^{\frac{1}{3}}$ $\sqrt[3]{64}$ $625^{\frac{1}{4}}$ $\sqrt[4]{625}$ $729^{\frac{1}{6}}$ $\sqrt[6]{729}$

5   4   5   3

2. What relationship is there between the answer and the exponent?

the denominator of the exponent is the root $a^{\frac{1}{n}} = \sqrt[n]{a}$

3. Using your calculator, evaluate the following:

$25^{\frac{3}{2}}$ 5^3 $64^{\frac{4}{3}}$ $625^{\frac{3}{4}}$ $729^{\frac{5}{6}}$

125   256   125   243

4. What can we conclude?

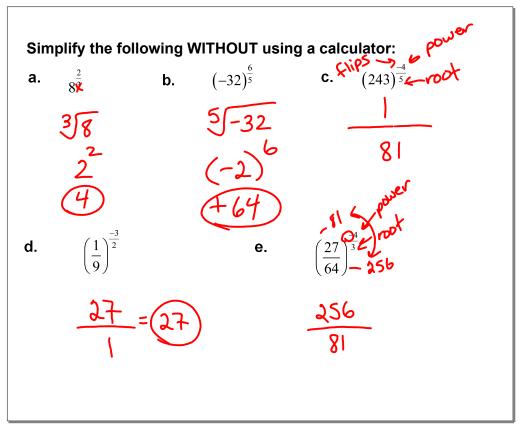$a^{\frac{m}{n}}$ m ← power 2nd   n ← root 1st

Rational Exponents

Rational Exponents Definition:

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

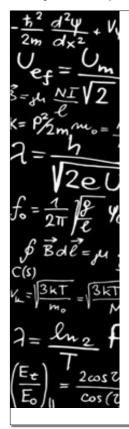$$a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m$$

Rational Exponents

$\sqrt[6]{729}$ **Powers Reference Chart**

First	Squares	Cubes	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth
1	1	1	1	1	1	1	1	1	1
2	4	8	16	32	64	128	256	512	1024
3	9	27	81	243	729	2187	6561		
4	16	64	256	1024	4096				
5	25	125	625	3125	15625				
6	36	216	1296	7776					
7	49	343	2401						
8	64	512	4096						
9	81	729	6561						
10	100	1000	10000						
11	121	1331							
12	144	1728							
13	169	2197							
14	196	2744							
15	225	3375							
16	256	4096							
17	289	4913							
18	324	5832							
19	361	6859							
20	400	8000							

Powers Chart

3

Simplify the following WITHOUT using a calculator:

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

$\sqrt[3]{8}$

2^2

$\boxed{4}$

b. $(-32)^{\frac{6}{5}}$

$\sqrt[5]{-32}$

$(-2)^6$

$\boxed{+64}$

c. flips → power

$(243)^{\frac{-4}{5}}$ ← root

$\dfrac{1}{81}$

d. $\left(\dfrac{1}{9}\right)^{\frac{-3}{2}}$

$\dfrac{27}{1} = \boxed{27}$

e. $\left(\dfrac{27}{64}\right)^{\frac{-4}{3}}$ power root

-81 256

$\dfrac{256}{81}$

Rational Exponents

Simplified Radical - has no perfect factors under the radical sign

1 4 9 16 25 36 49 64 81 100 121 144

To simplify radicals, find perfect factors.

a. $\sqrt{18}$

③ ② ③

$3\sqrt{2}$

b. $\sqrt{48}$

6 ^ 8

② ③ ④ ②

② ②

225 256

$2 \cdot 2\sqrt{3}$

$4\sqrt{3}$

c. $\sqrt{72}$

9 ^ 8

③ ③ ② 4

② ②

$2 \cdot 3\sqrt{2}$

$6\sqrt{2}$

d. $\sqrt{1200}$

② ^ 600

② 300

② 150

② 75

15 ⑤

③ ⑤

$5 \cdot 2 \cdot 2\sqrt{3}$

$20\sqrt{3}$

Simplifying Radicals

Homework:

- Unit #1 Day #2 worksheet
- Complete Learning Channels Inventory on classroom (due Monday)
- Complete Interest Inventory on classroom (due Monday)

HW