Algebra 1R – Mr. Bo
Unit 5 – Day 5 Notes

Name:________________________
Date:__________________

Properties of Exponents & Solving Exponential Equations

Exponents – Division Rule:

1. Simplify:

$$\frac{x^5}{x^3} = \frac{\cancel{x}\cdot\cancel{x}\cdot\cancel{x}\cdot x\cdot x}{\cancel{x}\cdot\cancel{x}\cdot\cancel{x}} = \frac{x^2}{1} = x^2$$

2. What happens to the exponents when dividing two terms that have the same base?

the exponent are subtracted. $5-3=2$.

3. Use the Exponent Division Rule to simplify each.

a. $\frac{y^{15}}{y^8} = y^7$

b. $\frac{4^7}{4^4} = 4^3 = 64$

c. $\frac{z^5}{z^9} = z^{-4}$

4. In-example 3c, what do you notice about the resulting exponent? Explain.

It is negative because $5-9=-4$

Negative Exponents:

1. Simplify using the method demonstrated in example 1 above.

$$\frac{x^3}{x^5} = \frac{\cancel{x}\cdot\cancel{x}\cdot\cancel{x}}{\cancel{x}\cdot\cancel{x}\cdot\cancel{x}\cdot x\cdot x} = \frac{1}{x^2}$$

2. Simplify using the Exponent – Division Rule.

$$\frac{x^3}{x^5} = x^{-2}$$

3. What do examples 1 and 2 tell us about negative exponents? Explain.

Here we see that $x^{-2} = \frac{1}{x^2}$

So a negative exponent makes a reciprocal Fraction.

4. Re-write each expression as a fraction.

a. $6^{-3} = \frac{1}{6^3} = \frac{1}{216}$

b. $y^{-4} = \frac{1}{y^4}$

5. Re-write each fraction as a negative exponent.

a. $\frac{1}{25} = 25^{-1}$

or $= \frac{1}{5^2} = 5^{-2}$

b. $\frac{1}{256} = 256^{-1}$

or $= \frac{1}{4^4} = 4^{-4}$

6. Write the exponential function f(x) = a·b^x represented by the table of values.

x	y
0	2 $= 2^1$
1	1 $= 2^0$
2	$\frac{1}{2} = 2^{-1}$
3	$\frac{1}{4} = 2^{-2}$

$f(x) = 2^{(x-1)}$

Roots & Radicals:

1. $\sqrt[n]{a}$ is called a radical where **n** is called the **index** and **a** is called the **radicand**.

$\sqrt{a}$ is a **square root**. $\sqrt{16}$ = 4 because $4 \cdot 4 = 16$

$\sqrt[3]{a}$ is a **cube root**. $\sqrt[3]{64}$ = 4 because $4 \cdot 4 \cdot 4 = 64$

$\sqrt[4]{a}$ is a **fourth root**. $\sqrt[4]{256}$ = 4 because $4 \cdot 4 \cdot 4 \cdot 4 =$ 256

$\sqrt[5]{a}$ is a **fifth root**. $\sqrt[5]{1024}$ = 4 because $4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 = 1024$

And so on.

2. Simplify each radical expression.

a. $\sqrt{81} =$ 9 because 9 · 9 = 81.

b. $\sqrt[5]{243} =$ 3 because 3 · 3 · 3 · 3 · 3 = 243.

c. $\sqrt[3]{-8} =$ −2 because (−2)(−2)(−2) = −8.

d. $\sqrt{-144} =$? Impossible because (−12)(−12) = 144 and (12)(12) = 144. two Identical #'s can't multiply to a negative value.

Fractional Exponents:

1. The radical expression $\sqrt[r]{a^p}$ can be rewritten using a fractional exponent: $a^{\frac{p}{r}}$.

$$\sqrt[r]{a^p} = a^{\frac{p}{r}}$$

root is in the bottom... just like a tree!

Where p is the POWER and r is the ROOT.

2. Identify the power and the root and then rewrite the expression in radical form.

a. $x^{\frac{3}{2}}$ Power = 3, Root = 2, Radical Form = $\sqrt{x^3}$

b. $10^{\frac{4}{5}}$ Power = 4, Root = 5, Radical Form = $\sqrt[5]{10^4}$

3. Identify the power and the root and then rewrite the expression using a fractional exponent.

a. $\sqrt[4]{x^7}$ Power = 7, Root = 4, Exponent Form = $x^{7/4}$

b. $\sqrt{8^5}$ Power = 5, Root = 2, Exponent Form = $8^{5/2}$

Solving Exponential Equations:

We can sometimes use a common base to solve an exponential equation.

1. Perry is repeatedly folding a piece of paper in half. The number of layers created can be determined by the exponential function $f(x) = 2^x$, where x is the number of folds made.

   a. How many layers are created if Perry makes 2 folds? $f(2) = 2^2 = 4$ layers.

   b. How many folds must Perry make to create 32 layers?

   $32 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^5$

   $32 = 2^x$

   $2^5 = 2^x$

   Same base

   this means...

   $x = 5$

2. Use a common base to solve each exponential equation:

   a. $3^x = 81$

   $81 = 3^4$

   $3^x = 3^4$

   $x = 4$

   b. $4^{x+1} = 1024$

   $1024 = 4^5$

   $4^{x+1} = 4^5$

   $x + 1 = 5$

   $x = 4$

   c. $6^{3x} = \frac{1}{36}$

   $\frac{1}{36} = \frac{1}{6^2} = 6^{-2}$

   $6^{3x} = 6^{-2}$

   $3x = -2$

   $x = -2/3$

3. Write the exponential function $f(x) = a \cdot b^x$ represented by the table of values.

x	y
0	3
3	$\frac{1}{9} = 3^{-2}$
6	$\frac{1}{243}$
9	$\frac{1}{6561}$

y-int = (0, 3) this makes a = 3.

$f(x) = 3b^x$

$\frac{1}{9} = 3(b)^3$

$\frac{3^{-2}}{3} = \frac{\cancel{3}(b)^3}{\cancel{3}}$

$3^{-3} = b^3$

negative exponent makes a reciprocal.

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

Same power

$\frac{1}{3} = b$