Name: _____ Date: Aug 26 Hour: __Alg 1_____

Unit 1A Day 6: The Zero Power and Negative Exponents

Focus Question: How do I simplify zero and negative exponents?

A. Revisiting Scientific notation

When we looked at scientific notation we said if the exponent was positive, it moved the decimal right and if the exponent was negative, it moved the decimal left. So the exponent that will not move the decimal is Zero.

Fill in the blanks:

$6 \cdot 10^2 = 6 \cdot$ 100 $= 600$

$6 \cdot 10^0 = 6 \cdot$ 1 $= 6$ (Think, what can I multiply by that doesn't change the value?)….

So 10^0 must equal 1

$6 \cdot 10^{-2} = 6 \cdot$ $\frac{1}{100}$ $= 0.06$ (Think, how do you say that decimal correctly? What would that look like as a fraction?)…So 10^{-2} must equal $\frac{1}{100}$.

6 · .01

6 · -100 = -600

B. The Exponent of Zero

1. Use a calculator to find the following:

a. 42^0 1 b. 247^0 1 c. 8408^0 1

2. What if the base is a variable? Fill in the table.

*Remember: If you work a problem two different ways and get two different answers, one answer must simplify to the other answer.

Problem	Work Using the Quotient Rule	Work Using Expanded Form	So we know…
$\frac{x^3}{x^3}$	$x^{3-3} = x^0$	$\frac{x \cdot x \cdot x}{x \cdot x \cdot x} \Rightarrow \frac{1}{1} \Rightarrow 1$	$x^0 = 1$
$\frac{m^2}{m^2}$	$m^{2-2} = m^0$	$\frac{m \cdot m}{m \cdot m} \Rightarrow \frac{1}{1} \Rightarrow 1$	$m^0 = 1$
$\frac{b^5}{b^5}$	$b^{5-5} = b^0$	1	$b^0 = 1$

ANY BASE raised to the zero power simplifies to 1 (except 0^0 = ∅ because you can't ÷ by 0

Easy Examples: $5^0 =$ 1 $5.62 \times 10^0 =$ 5.62 $a^0 =$ 1

Tougher Examples:

$4x^0$ → $4 \cdot 1$ → 4

$5^0 + 6^0$ → $1 + 1$ → 2

base

$(4x - 2y^7)^0$ → 1

$7x^3y^0$ → $7x^3 \cdot 1$ → $7x^3$

$4n^2 + 2n^0$ → $4n^2 + 2 \cdot 1$ → $4n^2 + 2$

sci. notation

C. Negative exponents

1. Fill in the table for $f(x) = 3 \cdot 10^x$

Input (x)	Substitution	Answer in standard form	Answer as a fraction	Answer in expanded for
-1	$3 \cdot 10^{-1}$	0.3	$\frac{3}{10}$	
-2	$3 \cdot 10^{-2}$	0.03	$\frac{3}{100}$	$\frac{3}{10 \cdot 10}$ or $\frac{3}{10^2}$
-3	$3 \cdot 10^{-3}$	0.003	$\frac{3}{1000}$	$\frac{3}{10 \cdot 10 \cdot 10}$ or $\frac{3}{10^3}$

Place you can have negative five exponents in your answer

2. Fill in the table for each problem

Problem	Work Using the Quotient Rule	Work Using Expanded Form	So we know…
$\frac{x^3}{x^5}$	$x^{3-5} = x^{-2}$	$\frac{x \cdot x \cdot x}{x \cdot x \cdot x \cdot x \cdot x} = \frac{1}{x^2}$	$x^{-2} = \frac{1}{x^2}$
$\frac{m^2}{m^6}$			
$\frac{b^1}{b^4}$	$b^{1-4} = b^{-3}$	$\frac{b}{b \cdot b \cdot b \cdot b} = \frac{1}{b^3}$	$b^{-3} = \frac{1}{b^3}$

The only time we have

3. Negative exponents are NOT considered SIMPLIFIED. So we must only have positive exponents in final answers. So, when a base has a negative exponent, the exponent will become positive when the base is moved to the opp. part of the fraction. (**A negative exponent means make the reciprocal of the base.**) It USUALLY works best if you wait until the end to simplify the negative exponent.

4. Practice

$\frac{y^{-7}}{1} = \frac{1}{y^7}$

$\frac{1}{x^{-2}} = x^2$

$4^0 + 2^{-1}$

$1 + \frac{1}{2} = \frac{3}{2}$

$\frac{2x^{-12}}{8x^{-5}}$

$\frac{2}{8} x^{-12--5}$

$\frac{1}{4} x^{-7}$

$\frac{1}{4x^7}$

$(4y^{-17})(11y^2)$

$4 \cdot 11 y^{-17+2}$

$44 y^{-15}$

$\frac{44}{y^{15}}$

$\frac{90k^4}{10k^{-2}}$

$\frac{90}{10} k^{4--2}$

$9k^6$

$(4c^{-5})(9c^{-6})$

$4 \cdot 9c^{-5+-6}$

$36c^{-11}$

$\frac{36}{c^{11}}$

$\frac{-2x^{-9}y^{-1}}{8x^{-3}y^4}$

$\frac{-2}{8} x^{-9--3} y^{-1-4}$

$-\frac{1}{4} x^{-6} y^{-5}$

$\frac{-1}{4x^6y^5}$

$(3m^5n^5p^{-2})(2m^2n^{-3}p^4)(5m^{-2}n^1p^{-2})$

$3 \cdot 2 \cdot 5 \cdot m^{5+2+-2} n^{5+-3+1} p^{-2+4+-2}$

$30m^5n^3p^0$

$30m^5n^3$

$\left(\frac{3}{x}\right)^{-2}$

$\left(\frac{x}{3}\right)^2$