Name: _____ Date: Jan 29 Hour: 2nd

Unit 5 Day 6: The Zero power and Negative powers

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

THE INFORMATION PRESENTED TODAY WILL NOT BE ON YOUR TEST, BUT COULD BE ON THE ACT!

A. The exponent of zero
If you work a problem two different ways and get two different answers, one answer must simplify to the other answer.

1. Fill in the table.

Problem	Work Using the Quotient Rule	Work Using Expanded Form	Therefore we know…
$\frac{5^4}{5^4}$	$5^{4-4} = 5^0$	$\frac{5 \cdot 5 \cdot 5 \cdot 5}{5 \cdot 5 \cdot 5 \cdot 5} = \frac{1}{1} = 1$	$5^0 = 1$
$\frac{7^1}{7^1}$	$7^{1-1} = 7^0$	$\frac{7}{7} = 1$	$7^0 = 1$
$\frac{x^3}{x^3}$	$x^{3-3} = x^0$	$\frac{x \cdot x \cdot x}{x \cdot x \cdot x} = \frac{1}{1} = 1$	$x^0 = 1$
$\frac{m^2}{m^2}$	$m^{2-2} = m^0$	$\frac{m \cdot m}{m \cdot m} = \frac{1}{1} = 1$	$m^0 = 1$

2. **ANY BASE to the zero power is** 1 **(except for zero. 0^0=** $\frac{0}{0}$ **)**

$$a^0 = 1$$

3. Examples:

$4x^0 = 4$ → $4 \cdot 1$

$5^0 + 6^0 = 2$ → $1 + 1$

$7x^3y^0 = 7x^3$ → $7x^3 \cdot 1$

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

B. Negative exponents
1. Fill in the table

Problem	Answer in standard form (Use a calculator)	Answer as a fraction	Answer in expanded form	Answer in exponential form
10^{-1}	0.1	$\frac{1}{10}$		$\frac{1}{10^1}$
10^{-2}	0.01	$\frac{1}{100}$	$\frac{1}{10 \cdot 10}$	$\frac{1}{10^2}$
10^{-3}	0.001	$\frac{1}{1000}$	$\frac{1}{10 \cdot 10 \cdot 10}$	$\frac{1}{10^3}$

2. Where the 10's were in your answer as a fraction and expanded form?

the denominator

3. What do you notice about the exponent and how many tens are in the expanded form answer?

it changed to positive

4. Fill in the table for each problem
Remember if you work a problem two ways and get two different answers, the answers must simplify to the same thing.

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

5. A negative exponent means that the number of times the base is a factor is correct, but the base is in the wrong part of the fraction.
So, when a base has a negative exponent, the exponent will become positive when the base is moved to the opposite part of the fraction.

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

It USUALLY works best if you wait until the end to simplify the negative exponent.

6. Practice: Simplify each of the following

a. $\frac{x^{-5}}{1} = \frac{1}{x^5}$

b. $\frac{2}{m^{-6}} = 2m^6$

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

d. $5x^{-2} \cdot 6x^7$
$5 \cdot 6x^{-2+7}$
$30x^5$

e. $\frac{10b^{-3}}{2b^5}$

f. $3h^4 \cdot 7h^{-9}$

g. $\frac{4w^3}{10w^7}$

h. $\frac{14j}{7j^3}$

k. $\frac{5^3}{5^{-7}}$