Algebra 1: Exponent Rules – Part 2 **Name** _____ **Period** _____

Let's Review!

Distributive Property

Grouping symbols, such as parentheses ( ) or brackets [ ], may mean slightly different things.

a. ***In this example, what do the parentheses mean? 5 – (3 + 4)***

Think PEMDAS (Order of Operations)! Do what's inside the parentheses first.

$5 - (3 + 4)$
$5 - 7$
-2

b. ***In this example, what do the parentheses mean? 3(x + 2)***

Distribute! Multiply what's inside by whatever is outside the parentheses.

$3(x + 2)$
$3x + 3(2)$
$3x + 6$

Fill out the table.

Product	**Repeated Multiplication**	**Rearrange the Multiplication so Like Terms are Grouped Next to Each Other**	**Power of the Form $a^c \cdot b^c$**
$(2 \cdot 3)^3$	$(2 \cdot 3) \cdot (2 \cdot 3) \cdot (2 \cdot 3)$	$2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3$	$2^3 3^3$
$(x \cdot y)^5$	$(x \cdot y) \cdot (x \cdot y) \cdot (x \cdot y) \cdot (x \cdot y) \cdot (x \cdot y)$	$x \cdot x \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y \cdot y$	$x^5 y^5$
$(3x)^4$	$(3x) \cdot (3x) \cdot (3x) \cdot (3x)$	$3 \cdot 3 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x \cdot x$	$3^4 x^4$

In the table, what do the parentheses mean?

Product to a Power Rule. $(a \cdot b)^c = a^c \cdot b^c$

An expression raised to a power = the product of its factors raised to the same power.

- Power to a Power Rule

$$\left(x^a\right)^b = x^{a \cdot b}$$

When you RAISE a power to a power, MULTIPLY the exponents.

When you RAISE an (expression) to a power, raise EACH number or variable to the power.

Fill out the table.

Problem to Simplify	First Repeated Multiplication	Second Repeated Multiplication	Power of the Form a^b
$(2^2)^3$	$2^2 \cdot 2^2 \cdot 2^2$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$	2^6
$(5^3)^4$	$5^3 \cdot 5^3 \cdot 5^3 \cdot 5^3$	$5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5$	5^{12}
$(x^5)^2$	$x^5 \cdot x^5$	$x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	x^{10}
$(3^2 y^2)^3$	$(3^2 y^2) \cdot (3^2 y^2) \cdot (3^2 y^2)$	$3 \cdot 3 \cdot y \cdot y \cdot 3 \cdot 3 \cdot y \cdot y \cdot 3 \cdot 3 \cdot y \cdot y$	$3^6 y^6$

Use the Power to a Power Rule to simplify each of the following.

a. $\dfrac{(x^3)^2}{x^4}$ x^2

b. $(-2m^5)^2 \cdot m^3$ $4m^{13}$

c. $(2r^{-4})^{-3}$ $\dfrac{r^{12}}{8}$

How does the Power to a Power Rule differ from The Product Rule?

Product Rule: ADD exponents

Power to a Power Rule: MULTIPLY exponents

- Negative Exponent Rule

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

If the exponent is NEGATIVE, move it up or down to make it POSITIVE.

SKIP THIS TABLE

Evaluate the first 5 exponential expressions and try to determine the pattern for the remaining 3.

2^4	2^3	2^2	2^1	2^0	2^{-1}	2^{-2}	2^{-3}
16	8	4	2	1	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$

Fill out the table.

Quotient	Repeated Multiplication SKIP THIS COLUMN	Answer as a Fraction	Use the Quotient Rule to get the Power in the Form a^b
$\frac{2^2}{2^5}$	$\frac{2 \cdot 2}{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}$	$\frac{1}{2^3}$	$2^{2-5} = 2^{-3}$
$\frac{a^4}{a^9}$	$\frac{a \cdot a \cdot a \cdot a}{a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a}$	$\frac{1}{a^5}$	$a^{4-9} = a^{-5}$
$\frac{5^0}{25^4}$	$\frac{5^0}{25 \cdot 25 \cdot 25 \cdot 25} = \frac{5^0}{5^2 \cdot 5^2 \cdot 5^2 \cdot 5^2}$	$\frac{1}{(5^2)^4} = \frac{1}{5^8}$	$5^{0-8} = 5^{-8}$
$\frac{a^4b^5}{a^7b^6}$	$\frac{a \cdot a \cdot a \cdot a \cdot b \cdot b \cdot b \cdot b \cdot b}{a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot b \cdot b \cdot b \cdot b \cdot b \cdot b}$	$\frac{1}{a^3b}$	$a^{4-7}b^{5-6} = a^{-3}b^{-1}$

Use the Negative Exponent Rule to simplify each of the following. Write your answer using only positive exponents.

a. $-5x^{-2}$

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

b. $\frac{4k^2}{8k^5} = \frac{4}{8} \cdot \frac{k^2}{k^5}$

$\frac{1}{2k^3}$

$5-2=3$

c. $\frac{xy^{-2}}{x^4y^{-3}} = \frac{x^1}{x^4} \cdot \frac{y^{-2}}{y^{-3}}$

$\frac{y}{x^3}$

$4-1=3$

$-2-(-3)$

$-2+3=1$

What does a negative exponent mean?

The base is on the wrong side of the division sign or fraction bar.

To turn a negative into a positive exponent, *cross the line and change the sign of the exponent!*

How do you simplify $\frac{1}{2^{-3}}$ ***?***

Move 2^{-3} up to the numerator so it becomes positive.

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

- Zero Exponent Rule

$x^0 = 1$

Anything (except zero) raised to the "0" power = 1.

Fill out the table.

Quotient	Use the Quotient Rule to Write in the Form a^b	Look at the Original Quotient. Rewrite it as Just a Number
$\frac{2^3}{2^3}$	$2^{3-3} = 2^0 = 1$	$\frac{2^3}{2^3} = \frac{8}{8} = 1$
$\frac{x^7}{x^7}$	$x^{7-7} = x^0 = 1$	$\frac{x^7}{x^7} = 1$

Use the Zero Exponent Rule to simplify each of the following.

a. $(ab)^0$ = $a^0 b^0$ — 1

b. $(-2)^0$ — 1

c. -2^0 = $-1 \cdot 2^0$ — -1

d. $7x^0$ = $7 \cdot x^0$ — 7