Exploration: Properties of Exponents   Name: _____

I.   Multiplication Property of Exponents

Complete the table below and answer the questions that follow.

Product	Expanded Form	Exponential Form
$3^2 \cdot 3^3$	$(3 \cdot 3) \cdot (3 \cdot 3 \cdot 3)$	3^5
$2^3 \cdot 2^3$		
$2^5 \cdot 2^4$		
$4^7 \cdot 4^1$		
$x^4 \cdot x^2$		

Compare the original product in the first column to the exponential form you found in the third column. What pattern do you see?

Use the pattern to create a <u>general rule</u> for the multiplication property of exponents.

$$x^a \cdot x^b = \underline{\hspace{4cm}}$$

Test your rule on the following expressions to check that it works:

a) $4^3 \cdot 4^2$

b) $5^2 \cdot 5^4$

II.   Power Property of Exponents

Complete the table below and answer the questions that follow.

Power	Expanded Form	Exponential Form
$(3^2)^3$	$(3^2) \cdot (3^2) \cdot (3^2) =$ $(3 \cdot 3) \cdot (3 \cdot 3) \cdot (3 \cdot 3)$	3^6
$(2^3)^4$		
$(4^5)^2$		
$(x^7)^3$		
$(2 \cdot 3)^2$	$(2 \cdot 3) \cdot (2 \cdot 3) \cdot (2 \cdot 3) =$ $(2 \cdot 2 \cdot 2) \cdot (3 \cdot 3 \cdot 3)$	$2^3 \cdot 3^3$
$(3 \cdot 5)^3$		
$(xy)^3$		

Compare the original power in the first column to the exponential form you found in the third column. What patterns do you see?

Use the pattern to create a general rule for the power properties of exponents.

$$(x^a)^b = \underline{\hspace{4cm}}$$

$$(xy)^b = \underline{\hspace{4cm}}$$

Test your rule on the following expressions to check that it works:

a) $(4^3)^4$

b) $(5 \cdot 2)^2$

III.   Division Property of Exponents

Complete the table below and answer the questions that follow.

Division	Expanded Form	Exponential Form
$\dfrac{3^5}{3^2}$	$\dfrac{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3}{3 \cdot 3} = 3 \cdot 3 \cdot 3$	3^3
$\dfrac{2^4}{2^1}$		
$\dfrac{5^{12}}{5^8}$		
$\dfrac{4^7}{4^5}$		
$\dfrac{x^3}{x^1}$		

Compare the original division in the first column to the exponential form you found in the third column. What patterns do you see?

Use the pattern to create a general rule for the power properties of exponents.

$$\frac{x^a}{x^b} = \underline{\hspace{6cm}}$$

Test your rule on the following expressions to check that it works:

a) $\dfrac{x^6}{x^3}$

b) $\dfrac{2^9}{2^7}$

IV.   Zero and Negative Exponents

Use the property of division from part III to show why $x^0 = 1$ is true.

Hint: What is $\dfrac{2^4}{2^4}$ *?*

Use the property of division from part III to make a **<u>conjecture</u>** about negative exponents.

Hint: Write each of the following divisions using expanded form then use your rule from part III. Look for patterns in your answers.

a) $\dfrac{3^2}{3^4}$

b) $\dfrac{2}{2^5}$

c) $\dfrac{x^3}{x^6}$

Practice: Properties of Exponents   Name: _____

Use the properties of exponents to rewrite each expression in as few terms possible.

(1) $3^4 =$

(4) $3^{-2} =$

(7) $\dfrac{1}{2^{-3}} =$

(2) $(-2)^3 =$

(5) $(-2)^{-3} =$

(8) $\left(\dfrac{2}{3}\right)^{-3} =$

(3) $(-4)^4 =$

(6) $\left(\dfrac{3}{4}\right)^3 =$

(9) $(-25)^0 =$