Name _____ Date _____

Mr. Tallman

Do Now

Convert the following into exponential form.

1) $5 \cdot 5 \cdot 5$	2) $x \cdot x \cdot x$	3) $(-9) \cdot (-9)$	4) $1 \cdot 1 \cdot 1 \cdot 1$
5^3	x^3	$(-9)^2$	1^4

Write the following exponents in expanded form.

5) 6^3	7) y^5	8) $(-2)^3$	9) 8^1
$6 \cdot 6 \cdot 6$	$y \cdot y \cdot y \cdot y \cdot y$	$(-2)(-2)(-2)$	8

Lesson #43 – Rules of Exponents (Part 1)

Parts of a number in Exponential Form:

Base → 5^4 ← Exponent

The **BASE** is the number being multiplied.

The **EXPONENT** is the amount of time the base is being multiplied.

Example 1) Identify the base and the exponent in the following numbers:

A) 6^3	B) 8^{26}	C) x^3	D) $4x^2$
Base 6	Base 8	Base X	Base X
Exponent: 3	Exponent: 26	Exponent: 3	Exponent: 2

Consider the following example:

Evaluate $3^2 \cdot 3^4$. Write your answer in exponential form.

- Are the **bases** the same? yes What is the base? 3
- Let's write each exponent in expanded form.

  $3^2 =$ $3 \cdot 3$ $3^4 =$ $3 \cdot 3 \cdot 3 \cdot 3$

  Therefore, the expanded form of $3^2 \cdot 3^4$ is $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$.
- How many "threes" are being multiplied in the expanded form? 6
- So, in exponential form, $3^2 \cdot 3^4 =$ 3^6.
- What do you notice about the exponents in the original expression and the exponents in the new expression?

Rule #1: When multiplying powers with the **same base**, keep the base, add the exponents.

Ex: Number base: $2^5 \bullet 2^1 \bullet 2^3 = 2^9$ Variable base: $x^2 \bullet y^2 \bullet y^4 \bullet x^5 = x^7 \cdot y^6$

Directions: Write an equivalent expression for the following problems.

1) $8^2 \bullet 8^4 = 8^6$

2) $14^3 \bullet 14^{-7} = 14^{-4}$

3) $x^1 \bullet x^6 = x^7$

4) $3^7 \bullet 9 = 3^9$ ($9 = 3^2$)

5) $2^{-3} \bullet 2^{-4} = 2^{-7}$

6) $(2x^3)(7x^7) = 14x^{10}$

7) Fill in the box with the missing number: $b^{\boxed{6}} \bullet b^2 = b^8$

8) Simplify: $2^3 \bullet 5^2 =$

9) Are these expressions the same? No

$x + x =$ $2x$ **vs** $x \bullet x =$ x^2

II. DIVIDING POWERS WITH THE SAME BASE

$\frac{5}{5} = 1$

$\frac{5^2}{5}$ $\frac{5 \cdot 5}{5} = 5$

$\frac{5^5}{5^3}$ $\frac{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5}{5 \cdot 5 \cdot 5} = 5^2$

$\frac{5^9}{5^4}$ $\frac{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5}{5 \cdot 5 \cdot 5 \cdot 5} = 5^5$

Rule #2: When dividing powers with the **same base**, Keep the base,

Subtract the exponents

Ex: Number base: $\frac{3^6}{3^2} = 3^4$ Variable base: $\frac{x^8}{x^2} = x^6$

Directions: Use properties of exponents to write an equivalent expression. Leave answers in exponential form.

1) $\frac{12^8}{12^2} = 12^6$

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

3) $\frac{3^{-4}}{3^2} = x^{-6}$

4) $\frac{9^{10}}{9^{-8}} = 9^{18}$

5) $\frac{3^4}{3^6} = 3^{-2}$

6) $\frac{x^4 \cdot x^6}{x^2} = \frac{x^{10}}{x^2} = x^8$

7) Fill in the box with the missing number: $\frac{b^{\boxed{8}}}{b^3} = b^{11}$

8) $\frac{x^6 y^{14}}{x\, y^9} = x^7 y^5$

9.) Simplify: $\frac{2^4}{4^2}$ $\frac{4^2}{4^2} = 1$

10.) Simplify: $\frac{5}{x^3}(3x^8) = \frac{15x^8}{x^3} = 15x^5$