

Lesson 44 POWER TO POWER RULE

Date: _____

III. RAISING A POWER TO A POWER

$$(5^3)^2 = (5 \cdot 5 \cdot 5)^{\boxed{2}} = \underbrace{(5 \cdot 5 \cdot 5) \cdot (5 \cdot 5 \cdot 5)}_{5^6} = 5^6$$

How did you get from the first expression to the last expression?

Rule #3: When raising a power to a power, keep the base and **multiply** the exponents.

Ex:

$$(4^2)^5 = 4^{10}$$

$$(x^3)^7 = x^{21}$$

Directions: Write an equivalent expression for the following problems.

1) $(8^5)^9 = 8^{45}$

3) $\left(\frac{2}{3}\right)^4 = \frac{2^4}{3^4}$

5) $(x^3)^6 = x^{18}$

2) $(3^6)^2 = 3^{12}$

4) $(7^{-6})^{-8} = 7^{48}$

6) $\left(\frac{1}{5}\right)^3 = \frac{1}{5^3}$

7) Fill in the box with the missing number: $(n^{\boxed{9}})^4 = n^0$

8) Sarah wrote that $(3^5)^7 = 3^{12}$. Correct her mistake. Write an exponential expression using a base of 3 and exponents of 5, 7, and 12 that would make her **answer correct**.

$$3^5 \cdot 3^7 = 3^{12} \quad \left| \quad \frac{3^{12}}{3^5} = 3^7$$

Bases with Variables and Numbers:For any numbers x and y , and positive integer n ,

$$(xy)^n = x^n y^n$$

Try these:

Ex: $(4x^2)^3 = 64x^6$

$$(4)^3 (x^2)^3$$

$$64x^6$$

$$(x^3 y^4)^2 = x^6 y^8$$

Directions: Write an equivalent expression for the following problems.

9) $(2x^5)^4 = \frac{16x^{20}}{(2^4)(x^5)^4}$

10) $(x^2 y^4)^3 = \frac{x^6 y^{12}}$

11) $(9x)^2 = \frac{81x^2}{9^2(x^2)}$

12) $(ab^3)^2 = \frac{9^2 b^6}$

13) $(5x^2 y z^3)^2 = \frac{25^2 x^4 y^2 z^6}{(5^2)(x^2)^2 (y^2) (z^3)^2}$

14) Simplify the following expression completely. **Apply exponent rules.** Show work.

$$(4 - 1)^7 \div 3^5 + (2^3)^2 - 1^{10}$$

$$3^7 \div 3^5 + 2^6 - 1$$

$$3^2 + 2^6 - 1$$