

Name: Key

Class: \_\_\_\_\_

M8-U6: Notes #1 – Exponent Operations: vocab, like bases, non like bases, power to a power, evaluating

Date: \_\_\_\_\_

**Vocabulary:**

Ex.  $5^3 = 5 \cdot 5 \cdot 5 = 125$

**Algebraic Rule:**  $x^n = x \cdot x \cdot x \dots n$  times

**Exponent:** A number that shows repeated multiplication

**Base:** A number that is multiplied repeatedly

**Power:** The value of the exponent

**Evaluate:** Substitute (if necessary) and perform calculations to simplify

$\wedge$ : Caret key, how exponents are represented on some graphing calculators ex.  $7^6 = 7^6$

**Example 1: Writing in exponential notation**

Expanded Form	Exponential Notation	Evaluate (Fraction or Decimal)
$3 \cdot 3 \cdot 3 \cdot 3$	$3^4$	81
$(-4)(-4)(-4)$	$(-4)^3$	-64
$(-2)(-2)(-2)(-2)$	$(-2)^4$	16
$(\frac{2}{3})(\frac{2}{3})$	$(\frac{2}{3})^2$	$\frac{4}{9}$
$(-5)(-5)$	$(-5)^2$	25
$(-1)(-5)(-5)$	$-5^2$	-25

**Try-It!**

a. How would we write  $(-3)^2$  in expanded form?  $(-3)(-3)$

b. How would we write  $-3^2$  in expanded form?  $(-1)(3)(3)$

c. Explain whether or not  $(-3)^2$  is equivalent to  $-3^2$ .

No because  $(-3)^2 = 9$  and  $-3^2 = -9$ .

**Try Its:**

Tell whether each statement is correct. Show work to support your answer.

a)  $2 \cdot 2 \cdot 2 = 6^3$

No.  $6^3 = 6 \cdot 6 \cdot 6$

b)  $23^4 = 23^2 \cdot 23^2$

$23^4 = 23 \cdot 23 \cdot 23 \cdot 23$   
 $23^2 \cdot 23^2 = 23 \cdot 23 \cdot 23 \cdot 23$   
yes.

c)  $(-5)^4 = (-5)(-5)(-5)(-5)$

No  
 $(-5)^4 = -1(5)(5)(5)(5)$   
which is a negative number  
 $(-5)(-5)(-5)(-5)$  is a positive number

d)  $(-\frac{4}{5})^2(-\frac{4}{5}) = (-\frac{4}{5})^3$  yes

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

e)  $3^4 \cdot 5^4 = 15^4$

$3^4 \cdot 5^4 = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 5 \cdot 5 \cdot 5 \cdot 5$   
 $= 3 \cdot 5 \cdot 3 \cdot 5 \cdot 3 \cdot 5 \cdot 3 \cdot 5$   
 $= 15 \cdot 15 \cdot 15 \cdot 15$   
 $= 15^4$  yes!

f)  $5^2 \cdot 6^3 = 30^5$

$5^2 \cdot 6^3 = 5 \cdot 5 \cdot 6 \cdot 6 \cdot 6$   
 $= 5 \cdot 6 \cdot 5 \cdot 6 \cdot 6$   
 $= 30 \cdot 30 \cdot 6$   
 $= 30^2 \cdot 6$   
No.

**Example 2: Product of Powers Property**

Write the product in expanded form:  $3^3 \cdot 3^4 = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$

Now write the product with a single base:  $3^7$

Write the product in expanded form:  $(-4)^2 \cdot (-4)^7 = (-4)(-4)(-4)(-4)(-4)(-4)(-4)(-4)(-4)$

Now write the product with a single base:  $(-4)^9$

Rule:  $X^a \cdot X^b = X^{a+b}$  when multiplying like bases, terms with like bases add the exponents.

**Try Its: Rewrite each item as an equivalent expression in exponential notation.**

a)  $5^6 \cdot 5^9 = 5^{15}$

b)  $(-8)^5 \cdot (-8)^3 = (-8)^8$

c)  $\left(\frac{1}{3}\right)^8 \cdot \left(\frac{1}{3}\right) = \left(\frac{1}{3}\right)^9$

d)  $x^3 \cdot x^7 = x^{10}$

e)  $3^4 \cdot 4^3 = 12^3 \cdot 3$

f)  $x^2y \cdot x^6y^2 = x^8y^3$

Tell whether each statement is correct. Show work to support your answer.

g)  $3^2 \cdot 9 = 3^4$

$3^2 \cdot 9 = 3^2 \cdot 3^2 = 3^4$   
yes.

h)  $8 \cdot 2^{10} = 16^{10}$

$8 \cdot 2^{10} = 2^3 \cdot 2^{10} = 2^{13}$   
= No.

★ Find an equivalent expression if not equal

### Example 3: Power to a Power

Write the product in expanded form:  $(3^3)^4 = (3^3)(3^3)(3^3)(3^3)$   
 $= 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$

Now write the product with a single base:  $3^{12}$

Write the product in expanded form:  $\left(\left(\frac{2}{7}\right)^2\right)^3 = \left(\frac{2}{7}\right)^2 \cdot \left(\frac{2}{7}\right)^2 \cdot \left(\frac{2}{7}\right)^2$   
 $= \frac{2}{7} \cdot \frac{2}{7} \cdot \frac{2}{7} \cdot \frac{2}{7} \cdot \frac{2}{7} \cdot \frac{2}{7}$

Now write the product with a single base:  $\left(\frac{2}{7}\right)^6$

Rule:  $(X^a)^b = X^{a \cdot b}$  When raising a base with an exponent to another exponent, multiply the 2 exponents.

**Try Its:** Rewrite each item as an equivalent expression in exponential notation.

a)  $(5^6)^9 = 5^{54}$

b)  $((-8)^5)^3 = (-8)^{15}$

c)  $\left(\left(\frac{1}{3}\right)^8\right)^4 = \left(\frac{1}{3}\right)^{32}$

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

e)  $(x^2y)^6 = x^{12}y^6$

Tell whether each statement is correct. Show work to support your answer.

f)  $(3^5)^7 = 3^{12}$

$(3^5)^7 = 3^{35}$

No

g)  $\left(\left(\frac{2}{3}\right)^2\right)^4 = \frac{2^8}{3}$

$\left(\left(\frac{2}{3}\right)^2\right)^4 = \left(\frac{2}{3}\right)^8 = \frac{2^8}{3^8}$

No