1.2 & 8.1 Exponents

Exponent

$$a^b$$

= Power

base

b is called the Exponent and it represents the number of times a, the base is used as a factor

Powers represent repeated multiplication

$$4^6 = 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4$$

Exponential Form	Words	Meaning
10^1	ten to the first power	10
4^2	four squared	$4 \cdot 4 = 16$
x^n	x to the nth power	$\underbrace{x \cdot x \cdot x \cdot x \cdots x}_{n \text{ times}}$

Evaluating Exponents

What does it mean to evaluate? plug in & simplify: Get a # answer

Evaluate x^3 for $x = 5$

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

Remember when you have parenthesis you must evaluate parenthesis FIRST:

Evaluate $2x^3$ and $(2x)^3$ for $x = 4$

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

$2 \cdot 64 = 128$

$(2 \cdot 4)^3 = 8^3 = 8 \cdot 8 \cdot 8$

512

1. Write out the multiplication for $6^3 \cdot 6^5$

$6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6$

2. How many times did you write down 6? (How many factors of 6 are there?) 8

3. What do you notice about the factors and the exponents? if you add 3+5=8 exponents

4. Write out the multiplication for $(6^2)^4$

$(6 \cdot 6)(6 \cdot 6)(6 \cdot 6)(6 \cdot 6)$

5. How many factors of six did you write?

8

6. What do you notice about the factors and the exponents?

if you multiply the exponents $2 \cdot 4 = 8$

MULTIPLICATION PROPERTIES OF EXPONENTS

PRODUCT OF POWER PROPERTY

To multiply powers having the same base, add the exponents.

$$a^m \cdot a^n = a^{m+n}$$

Example: $3^2 \cdot 3^7 = 3^{2+7} = 3^9 = 19618$

simplified Evaluated

POWER OF A POWER PROPERTY

To find a power of a power, multiply the exponents.

$$\left(a^m\right)^n = a^{m \cdot n}$$

Example: $\left(5^3\right)^7 = 5^{3 \cdot 7} = 5^{21}$

POWER OF A PRODUCT PROPERTY

To find a power of a product, find the power of each factor and multiply

$$(a \cdot b)^m = a^m \cdot b^m$$

Example: $(2 \cdot 3)^6 = 2^6 \cdot 3^6$

***The power of a product property only works for PRODUCTS it does not work when addition is the operation used.**

$$(a+1)^3 = (a+1)(a+1)(a+1)$$

$$(a+1)^3 \neq a^3 + 1^3$$

Examples: Simplify the following:

$x^2 \bullet x^3 \bullet x^4$	$(-2)^1(-2)^4$	$(y^2)^5$
x^9	$(-2)^5$	$2 \cdot 5 = 10$ y^{10}

Examples: Simplify the following: Evaluate #'s simplify variables

$[(-3)^3]^2$	$(4yz)^3$	$(4x^2y)^3 \bullet x^5$
-27^2 $(-3)^6$	$4^3 \cdot y^3 \cdot z^3$ $64y^3z^3$	$4^3x^6y^3x^5$ $4^3x^{11}y^3$ $64x^{11}y^3$

$1^6 = 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 = 1$

$10^3 = 10 \cdot 10 \cdot 10 = 1000$

$10^{12} = 1{,}000{,}000{,}000{,}000$