PRINCIPLES - LESSON 10A
MULTIPLYING POWERS WITH LIKE BASES

Recall:

Multiplication = Sped-Up Addition

ADDITION

$2 + 2 + 2 + 2 + 2$

MULTIPLICATION

$2 \cdot 5$

Exponents = Sped-Up Multiplication

MULTIPLICATION

$3 \cdot 3 \cdot 3 \cdot 3$

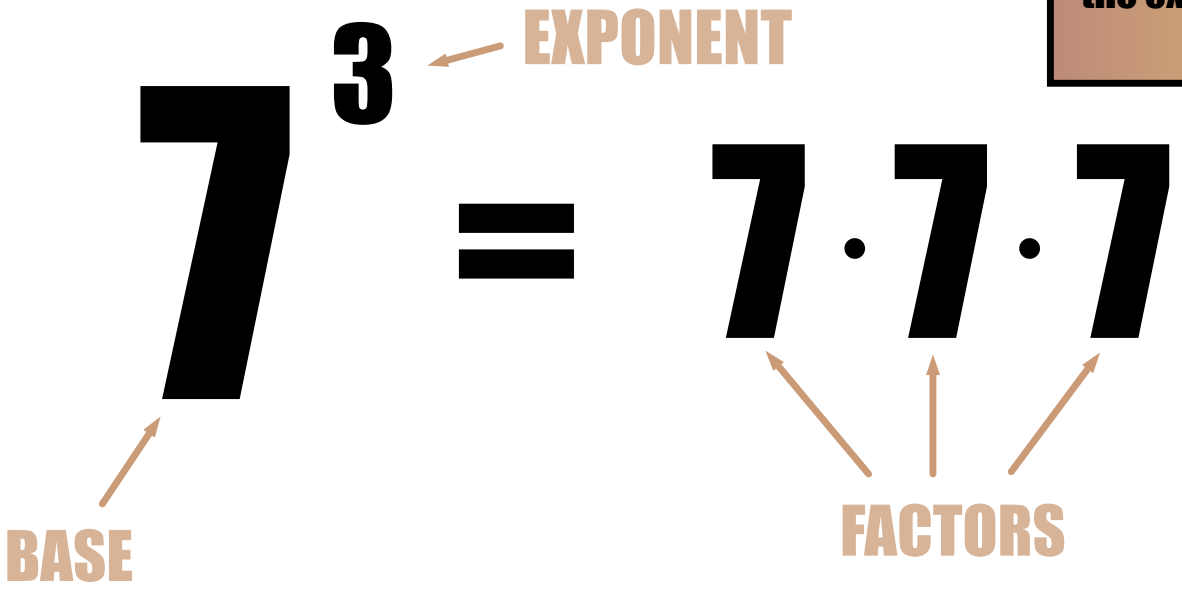
EXPONENTS

3^4

PARTS OF A POWER

When two or more numbers are multiplied, each number is called a **factor**. An **exponent** is used to show how many times the factor, or **base**, is multiplied.

When all of the factors are written out separately, the expression has been **EXPANDED.**



EXPONENT REVIEW

Expand and then simplify.

ex1) 3^4

$= \underbrace{3 \cdot 3 \cdot 3 \cdot 3}_{\text{expanded}} = \underbrace{\boxed{81}}_{\text{simplified}}$

ex2) 5^3

$= \underbrace{5 \cdot 5 \cdot 5}_{\text{expanded}} = \underbrace{\boxed{125}}_{\text{simplified}}$

ex3) x^6

$= \underbrace{x \cdot x \cdot x \cdot x \cdot x \cdot x}_{\text{expanded}} = \underbrace{\boxed{x^6}}_{\text{simplified}}$ (This expression was simplified from the start!)

FIND THE RULE

Expand and then simplify.

ex4) $2^3 \cdot 2^4$

$= 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^7 = \boxed{128}$

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ex5) $x^5 \cdot x^3$

$= x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x = \boxed{x^8}$

MULTIPLYING POWERS WITH THE SAME BASE

Shortcut to multiplying powers with like bases: ADD EXPONENTS

Exponent Rule 1: Multiplying Powers with Like Bases

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

MULTIPLYING POWERS WITH THE SAME BASE

Simplify.

ex6) $y^8 \cdot y^{15} = y^{8+15} = \boxed{y^{23}}$

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ex7) $k^{13} \cdot k^1 = k^{13+1} = \boxed{k^{14}}$

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ex8) $a^6 \cdot b^4 = \boxed{a^6 b^4}$

Our rule only works when we have LIKE bases.
We cannot add the exponents on different variables.

MULTIPLYING POWERS WITH THE SAME BASE

Simplify.

We can use the commutative property to change the order of multiplication.

ex9) $5a^3b^7 \cdot 3a^2b^4c^9$

$= 5 \cdot 3 \cdot a^3 \cdot a^2 \cdot b^7 \cdot b^4 \cdot c^9$

$= 15 \cdot a^{3+2} \cdot b^{7+4} \cdot c^9$

$= \boxed{15a^5b^{11}c^9}$

When multiplying two expressions, always MULTIPLY COEFFICIENTS FIRST.

MULTIPLYING POWERS WITH THE SAME BASE

Simplify.

ex10) $(-2x^2y^4)(-5x^6y^1)$

$= -2 \cdot (-5) \cdot x^2 \cdot x^6 \cdot y^4 \cdot y^1$

$= 10 \cdot x^{2+6} \cdot y^{4+1}$

$= \boxed{10x^8y^5}$

MULTIPLYING POWERS WITH THE SAME BASE

Simplify.

ex11) $(m^6n^{13}p^{10})(-mn^4)$

$= 1 \cdot (-1) \cdot m^6 \cdot m^1 \cdot n^{13} \cdot n^4 \cdot p^{10}$

$= -1 \cdot m^{6+1} \cdot n^{13+4} \cdot p^{10}$

$= \boxed{-m^7 n^{17} p^{10}}$

MULTIPLYING POWERS WITH THE SAME BASE

Simplify.

ex12) $(-4a^3b^2)(a^5b^4)(-3a^5)$

$= -4 \cdot 1 \cdot (-3) \cdot a^3 \cdot a^5 \cdot a^5 \cdot b^2 \cdot b^4$

$= 12 \cdot a^{3+5+5} \cdot b^{2+4}$

$= \boxed{12a^{13}b^6}$