EXPONENT RULES & PRACTICE

1. PRODUCT RULE: To multiply when two bases are the same, write the base and ADD the exponents.

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

Examples:

A.
$$x^3 \cdot x^8 = x^{11}$$

B.
$$2^4 \cdot 2^2 = 2^6$$

C.
$$(x^2y)(x^3y^4) = x^5y^5$$

2. QUOTIENT RULE: To divide when two bases are the same, write the base and SUBTRACT the exponents.

$$\frac{x^m}{x^n} = x^{m-n}$$

Examples:

A.
$$\frac{x^5}{x^2} = x^3$$

B.
$$\frac{3^5}{3^3} = 3^2$$

$$C. \quad \frac{x^2y^5}{xy^3} = xy^2$$

3. ZERO EXPONENT RULE: Any base (except 0) raised to the zero power is equal to one.

$$x^0 = 1$$

Examples:

A.
$$v^0 = 1$$

B.
$$6^0 = 1$$

C.
$$(7a^3b^{-1})^0 = 1$$

4. POWER RULE: To raise a power to another power, write the base and MULTIPLY the exponents.

$$(x^m)^n = x^{m \cdot n}$$

Examples:

A.
$$(x^3)^2 = x^6$$

B.
$$(3^2)^4 = 3^8$$

C.
$$(z^5)^2 = z^{10}$$

5. EXPANDED POWER RULE:

$$(xy)^m = x^m y^n$$
 $\left(\frac{x}{y}\right)^m = \frac{x^m}{y^m}$

Examples:

A.
$$(2a)^3 = 2^3a^3 = 8a^3$$

C.
$$\left(\frac{x^2}{y}\right)^4 = \frac{(x^2)^4}{y^4} = \frac{x^8}{y^4}$$

B.
$$(6x^3)^2 = 6^2(x^3)^2 = 36x^6$$

D.
$$\left(\frac{2x}{3y^2}\right)^3 = \frac{(2x)^3}{(3y^2)^3} = \frac{2^3x^3}{3^3(y^2)^3} = \frac{8x^3}{27y^6}$$

6. NEGATIVE EXPONENTS: If a factor in the numerator or denominator is moved across the fraction bar, the sign of the exponent is changed.

$$x^{-m} = \frac{1}{x^m}$$
 $\frac{1}{x^{-m}} = x^m$ $\left(\frac{x}{y}\right)^{-n} = \left(\frac{y}{x}\right)^n$

Examples:

A.
$$x^{-3} = \frac{1}{x^3}$$

B.
$$4^{-2} = \frac{1}{4^2} = \frac{1}{16}$$

C.
$$-4x^5y^{-2} = \frac{-4x^5}{y^2}$$

D.
$$\left(\frac{x^2}{y}\right)^{-3} = \left(\frac{y}{x^2}\right)^3 = \frac{y^3}{x^6}$$

E.
$$(3x^{-2}y)(-2xy^{-3}) = -6x^{-1}y^{-2} = \frac{-6}{xy^2}$$

$$F. \quad \frac{a^{-2}b^3}{c^{-4}d^{-1}} = \frac{b^3c^4d}{a^2}$$

G.
$$(-2x^2y^{-4})^{-2} = \left(\frac{-2x^2}{y^4}\right)^{-2} = \left(\frac{y^4}{-2x^2}\right)^2 = \frac{y^8}{4x^4}$$

CAUTION: $-x \neq \frac{1}{x}$ For example: $-3 \neq \frac{1}{3}$

REMEMBER: An exponent applies to <u>only</u> the factor it is directly next to *unless* parentheses enclose other factors. Examples:

A.
$$(-3)^2 = (-3)(-3) = 9$$

B.
$$-3^2 = -9$$