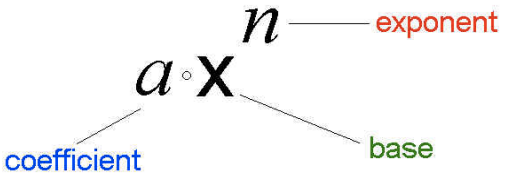
1-2: Exponent Rules



Coefficient: The number in front of the variable

Base: The number/variable being multiplied - attached to the exponent

Exponent (power): how many times the base is multiplied by itself.

Example:

2^3 could be re-written 2 x 2 x 2 = 8

3^5 could be re-written 3 x 3 x 3 x 3 x 3 = 243

a^7 could be re-written a x a x a x a x a x a x a

******DO NOT confuse 2^3 with 2 x 3******

They are NOT the same!

Product Rule for exponents

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

Simplify: Watch base/coefficient!

$2^2 \cdot 2^3$

$3z^2 \cdot 4z^4$

You try

$(-3)^2 \cdot (-3)^3$

$5x^2 \cdot (-2x^5)$

Quotient Rule for exponents

$$\frac{a^m}{a^n} = a^{m-n} \quad \text{if } a \neq 0$$

Simplify: Watch base vs coefficient. Write all out and cancel

$$\frac{8^5}{8^3} \qquad \frac{27z^9}{12z^4}$$

You try

$$\frac{y^8}{y^6} \qquad \frac{-24b^5}{16b^3}$$

Zero-exponent Rule

$$a^0 = 1 \qquad \text{if } a \neq 0$$

Simplify

3^0 π^0 $3x^0$ $(\partial\theta + \Phi\Omega - \wp^{\Diamond})^0$

Negative-exponent Rule

$$a^{-n} = \frac{1}{a^n} \quad \text{or} \quad \frac{1}{a^{-n}} = a^n \qquad \text{if } a \neq 0$$

Simplify: only move base, not coefficient!

3^{-4} $4x^{-5}$ $\dfrac{1}{3^{-2}}$

You try

5^{-3}

$\dfrac{5}{y^{-3}}$

Simplify

$\dfrac{-24b^5}{16b^{-3}}$

$\dfrac{50s^2t}{15s^5t^{-4}}$

How do YOU think we do this?
(hint: write it all the way out!)

$$(3^2)^4$$

Power rule for exponential expressions

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

Simplify

$$(4^3)^5 \qquad [(-3)^3]^2 \qquad (6^3)^0$$

You try

$(2^2)^3$ $(z^3)^{-6}$ $(s^{-3})^{-7}$

Product to a power

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

Simplify.This case happens with PARENTHESES

$(3z)^4$ $(3y^{-2})^{-3}$ $(-3a^2)^2$

You try

$(5y)^3$

$(4a^3)^{-2}$

Quotient to a power

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \quad \text{if } b \neq 0$$

$$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n \quad \text{if } a \neq 0,\ b \neq 0$$

Simplify

$$\left(\frac{w}{4}\right)^3 \qquad \left(\frac{2w^2}{y^3}\right)^4 \qquad \left(\frac{x}{2}\right)^{-5}$$

You try

$$\left(\frac{z}{3}\right)^4 \qquad \left(\frac{4}{3}\right)^{-2} \qquad \left(\frac{3a^{-2}}{b^4}\right)^3$$

Rules

$a^0 = 1 \quad \text{if } a \neq 0$

$a^{-n} = \frac{1}{a^n} \quad \text{or} \quad \frac{1}{a^{-n}} = a^n \quad \text{if } a \neq 0$

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

$\frac{a^m}{a^n} = a^{m-n} \quad \text{if } a \neq 0$

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

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

$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \quad \text{if } b \neq 0$

$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n \quad \text{if } a \neq 0,\ b \neq 0$

Simplify

$$\frac{a^3 b^{-1}}{(a^2 b)^3}$$

Simplify

$$\left(\frac{3xy}{x^2y^{-2}}\right)\cdot\left(\frac{9x^2y^{-3}}{x^3y^2}\right)^{-1}$$