

Properties of Exponents

Exponent - also called powers or degrees

- tells how many times the base multiplies itself.

Ex: x^5 ← power
 ↑
 base

$$= x \cdot x \cdot x \cdot x \cdot x$$

Property	symbols	example
Product Rule (Product of Powers) - same base, add exponents	$a^m \cdot a^n = a^{m+n}$	$x^5 \cdot x^3 = x^{5+3}$ $= x^8$
Quotient Rule (Quotient of Powers) - Dividing same base, subtract exponents	$\frac{a^m}{a^n} = a^{m-n}$	$\frac{x^5}{x^3} = \frac{\cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot x \cdot x}{\cancel{x} \cdot \cancel{x} \cdot \cancel{x}}$ $= x^{5-3} = x^2$
Power Rule I (Power of a Power) - Power raised to a power, multiply	$(a^m)^n = a^{mn}$	$(x^3)^2 = x^3 \cdot x^3$ $= x^{2 \cdot 3} = x^6$

Power Rule II

(Power of a Product)

- Distribute the power to each base

$$(ab)^m = a^m b^m$$

$$(4x^3)^2$$

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

$$= 16x^6$$

Negative Exponent I

- Flip it

$$a^{-m} = \frac{1}{a^m}$$

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

Neg Exp II

- Flip it

$$\frac{1}{a^{-m}} = a^m$$

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

Zero Exponent

$$a^0 = 1$$

$$(-4x^5)^0 = 1$$

Practice:

$$\left(\frac{p^{-4}}{r^{-3}} \right)^{-3}$$

$$\frac{p^{-4 \cdot -3} \quad q^{-3}}{r^{-3 \cdot -3}}$$

$$= \frac{p^{12} \quad q^{-3}}{r^9}$$

$$= \frac{p^{12}}{q^3 r^9}$$

$$(2x^{-3}yz^5)^3$$

$$= 2^3 \cdot (x^{-3})^3 \cdot (y)^3 \cdot (z^5)^3$$

$$= 8x^{-9}y^3z^{15}$$

$$= \frac{8y^3z^{15}}{x^9}$$

