

Laws of Exponents

R4

Product of Powers Property: (multiplying)

$$a^b \cdot a^c = a^{b+c}$$

when multiplying and the bases are same, add the exponents

Proof:

$$\begin{array}{c}
 3^3 * 3^5 \\
 3 \cdot 3 \cdot 3 * 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \\
 \textcircled{3^8}
 \end{array}$$

ex:

$$\begin{array}{c}
 x^5 * x^{12} = x^{17} \\
 \cancel{x \cdot x \cdot x} \cdot \cancel{x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x} \\
 x^5 \cdot x^y = x^{y+5}
 \end{array}$$

Power of a Power Property:

$$(a^b)^c = a^{bc}$$

when raising a power to an exponent, multiply the exponents

proof:

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

Ex:  $(2x^5)^3 = 8x^{15}$

$$2^3 \cdot x^{5 \cdot 3} = 8x^{15}$$

Power of a Product Property:

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

when multiplying and the exponents are same, multiply the bases

Proof:

$$\begin{array}{c} 2^3 * 5^3 \\ 2 \cdot 2 \cdot 2 * 5 \cdot 5 \cdot 5 \\ \swarrow \quad \downarrow \quad \searrow \\ 10 \cdot 10 \cdot 10 \\ \textcircled{10^3} = \textcircled{1,000} \end{array}$$

Ex:  $x^4 \cdot y^4 = (xy)^4$

Order of Magnitude:

the power of 10 nearest the quantity  
used to estimate & perform rough calculations

$10^1 = 10$	ten
$10^2 = 100$	one hundred
$10^3 = 1,000$	one thousand
$10^4 = 10,000$	ten thousand
$10^5 = 100,000$	one hundred thousand
$10^6 = 1,000,000$	one million
$10^7 = 10,000,000$	ten million
$10^8 = 100,000,000$	one hundred million
$10^9 = 1,000,000,000$	one billion