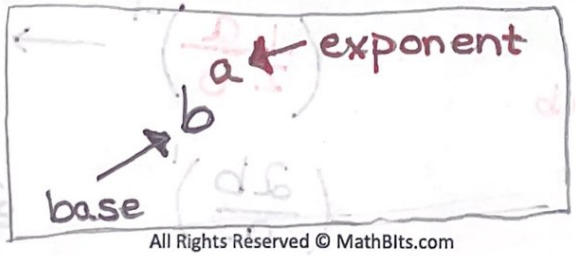
Chapter 5: Exponential and Logarithmic Functions.
Note sheet: Exponent Properties review.

# Exponent Rules Chart

For any Real number $x$ and $y$, and for all integer $m$ and $n$ (unless otherwise stated).

| Exponent Rule: | Symbolism: | In plain English ... |
|---|---|---|
| Zero Exponent | $x^0 = 1$ | All numbers **(not zero)** raised to the zero power equal one. |
| Negative Exponent | $x^{-n} = \frac{1}{x^n}$ | A negative exponent tells you that the factor is on the wrong side of the fraction bar. **($x$ not zero, $n$ positive).** |
| Product Rule | $x^m \bullet x^n = x^{m+n}$ | When multiplying, and the bases are the same, ADD the exponents. |
| Quotient Rule | $\frac{x^m}{x^n} = x^{m-n}$ | When dividing, and the bases are the same, SUBTRACT the exponents, top exponent subtract bottom exponent. **($x$ not zero)** |
| Power to a Power | $\left(x^m\right)^n = x^{mn}$ | When raising a power to a power, MULTIPLY the exponents. |
| Product to a Power | $(xy)^n = x^n y^n$ | When raising a product to a power, EACH factor gets raised to the new power. |
| Quotient to a Power | $\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}$ | When raising a quotient to a power, BOTH top and bottom get raised to the new power. **($y$ not zero)** |






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

base $(-3)$ base $3$

$(-3)(-3) \quad -1 \cdot 3 \cdot 3$

$9 \quad \neq \quad -9$

Examples:

① $(2xy^4)^2$

$2^2 x^2 (y^4)^2$

$4x^2y^8$ ← 4·2

② $(-x)^4$

$(-1)^4 x^4$

$x^4$

$(-x)(-x)(-x)(-x)$

③ $3a^{-2} \cdot 2a^4$

$3 \cdot 2\, a^{-2} a^4$

$6a^2$ ← $-2+4$

④ $\left(\frac{2x}{5z^2}\right)^2$

$\frac{2^2 x^2}{5^2 (z^2)^2}$

$\frac{4x^2}{25z^4}$

⑤ $z^{ab} \cdot (z^{2b})^a$

$z^{ab}\ z^{2ab}$

same base $z$

$z^{3ab}$ ← $1ab + 2ab$

⑥ $\left(\frac{2a^2}{4ba}\right)^{-1}$

$\left(\frac{1}{2}\frac{a}{b}\right)^{-1} \longrightarrow \frac{a^{-1}}{2^{-1}b^{-1}}$

$\left(\frac{2b}{a}\right)$ $\quad \frac{2b}{a}$

$\frac{2b}{a}$