Exponent Rules

Definition
An exponent means repeated multiplication of the same number.
In this example, x is the "base" and 5 is the "exponent".
\[ x^5 = x \cdot x \cdot x \cdot x \cdot x \]

Properties
If something doesn’t have an exponent, then it has an unwritten exponent of 1.
Anything with an exponent of one is just itself.
\[ x = x^1 \quad 463^1 = 463 \]

Any number to the zero power is one. One to any power is still one.
\[ 267^0 = 1 \quad 1^{173} = 1 \]

Product Rule:
Add the exponents.
\[ x^3x^5 = x^{3+5} = x^8 \]

Quotient Rule:
Subtract the exponents.
\[ \frac{x^7}{x^4} = x^{7-4} = x^3 \]

Power Rule: Multiply the exponents.
\[ (x^3)^4 = x^{3\cdot4} = x^{12} \quad (a^3b^5)^2 = a^6b^{10} \]
\[ \left(\frac{x^2}{y^5}\right)^3 = \frac{x^6}{y^{15}} \]

Negative Exponents
A negative exponent flips the base to the other side of the fraction with a positive exponent.
\[ x^{-7} = \frac{1}{x^7} \quad \frac{1}{x^{-3}} = x^3 \]
\[ a^{-2} = \frac{b^3}{a^2} \quad \frac{3x^{-2}}{y^{-1}z^7} = \frac{3y}{x^2z^7} \]