|| Basic Mathematics and log ||

* Properties of Log

① Product Formula of log
↳ $\log_a(mn) = \log_a^m + \log_a^n$

② Quotient Formula
↳ $\log_a^{(m/n)} = \log_a^m - \log_a^n$

③ Power Formula
↳ $\log_a(m^n) = n \cdot \log_a^m$

④ change of Base formula
↳ $\log_b^a = \dfrac{\log_c^a}{\log_c^b}$

⑤ Log of Power
↳ $\ln(x^y) = y\ln(x)$

⑥ Natural log of e
↳ $\boxed{\ln(e) = 1}$

* Various other log Formulas are-

- $\log_b(a\sqrt{n}) = \dfrac{1}{a\log_b^n}$
- $\log$ of $1 = 0$
- $\log_a^a = 1$ (Identity Rule)
- $\log_b^a = \log_b^c \Rightarrow a = c$ (Equality Rule)
- $a^{\log_a^x} = x$ (Raised to log)
- $\left(\dfrac{a}{b}\right)^{\frac{m}{n}} = \left(\dfrac{b}{a}\right)^{\frac{m}{n}}$
- $a^m \div b^{-n} = a^m \times b^n$

* Imp Properties of Log :-

① $\log_e(ab) = \log_e^a + \log_e^b$

② $\log_e\left(\dfrac{a}{b}\right) = \log_e^a - \log_e^b$

③ $\log_e a^m = m\log_e^a$

④ $\log_a^a = 1$

⑤ $\log_{b^m}^a = \dfrac{1}{m}\log_b^a$

⑥ $\log_b^a = \dfrac{1}{\log_a^b}$

⑦ $\log_b^a = \dfrac{\log_m^a}{\log_m^b}$

⑧ $a^{\log_a^m} = \boxed{m}$

⑨ If $\log_a f(x) > \log_a g(x)$ & $a>1$
↳ $\boxed{\begin{array}{l} g(x) \geq 0 \\ f(x) > 0 \\ f(x) > g(x) \end{array}}$

⑩ If $\log_a f(x) > \log_a g(x)$ & $a<1$
↳ $\boxed{\begin{array}{l} g(x) > 0 \\ f(x) > 0 \\ f(x) < g(x) \end{array}}$

Properties of modulus :-

(i) $|x| = a \Rightarrow x = \pm a$

(ii) $|x| \leq a \Rightarrow -a \leq x \leq a$

(iii) $|x| \geq a \Rightarrow x \geq a$ (or) $x \leq -a$

(iv) $a \leq |x| \leq b \Rightarrow x \in [-b, -a] \cup [a, b]$

(v) $a < |x| < b \Rightarrow x \in (-b, -a) \cup (a, b)$

(vi) $|x+y| \leq |x|+|y| \rightarrow$ when $xy \geq 0$

(vii) $|x+y| \geq ||x|-|y|| \rightarrow$ when $xy \leq 0$

(ix) $|x-y| \geq ||x|-|y|| \rightarrow$ when $xy \geq 0$

(x) $|x-y| \leq |x|+|y| \rightarrow$ when $xy \geq 0$