Important formulas of Limits: -

- $\lim_{x\to 0}(1+x)^{1/x} = e$
- $\lim_{x\to\infty}\left(1+\frac{a}{x}\right)^x = e^a$
- $\lim_{x\to\infty} a^x = \begin{cases}\infty, & if \quad a>1 \\ 0, & if \quad a<1\end{cases}$

i.e., $a^\infty = \infty$, if $a > 1$ and $a^\infty = 0$, if $a < 1$.

- $\lim_{x\to 0}\frac{(1+x)^n-1}{x} = n$
- $\lim_{x\to 0}\frac{\sin^{-1}x}{x} = 1 = \lim_{x\to 0}\frac{\tan^{-1}x}{x}$
- $\lim_{x\to a}\sin^{-1}x = \sin^{-1}a,\ |a|\le 1$
- $\lim_{x\to a}\cos^{-1}x = \cos^{-1}a,\ |a|\le 1$
- $\lim_{x\to a}\tan^{-1}x = \tan^{-1}a,\ -\infty < a < \infty$
- $\lim_{x\to e}\log_e x = 1$
- $If \lim_{x\to a} f(x) = +\infty$, then $\lim_{x\to a}\frac{1}{f(x)} = 0$

Let $\lim_{x\to a} f(x) = l$ and $\lim_{x\to a} g(x) = m$, then $\lim_{x\to a}(f(x))^{g(x)} = l^m$

- If $f(x) \le g(x)$ for every x in the deleted neighbourhood (nbd) of a, then $\lim_{x\to a} f(x) \le \lim_{x\to a} g(x)$.
- If $f(x) \le g(x) \le h(x)$ for every x in the deleted nbd of a and $\lim_{x\to a} f(x) = l = \lim_{x\to a} h(x)$. then $= l$.

Theorems on Limits: If f(x) and g(x) are two functions, then

(i) $\lim_{x\to a}[f(x)\pm g(x)] = \lim_{x\to a} f(x) \pm \lim_{x\to a} g(x)$

(ii) $\lim_{x\to a}[f(x).\, g(x)] = \lim_{x\to a} f(x).\lim_{x\to a} g(x)$

(iii) $\lim_{x\to a}\left[\frac{f(x)}{g(x)}\right] = \frac{\lim_{x\to a} f(x)}{\lim_{x\to a} g(x)}$ if $\lim_{x\to a} g(x) \ne 0.$

(iv) $\lim_{x\to a}[k f(x)] = \lim_{x\to a} f(x)$, where k is constant.

(v) $\lim_{x\to a}\sqrt{f(x)} = \sqrt{\lim_{x\to a} f(x)}$

(vi) $\lim_{x\to a}\{f(x)\}^{p/q} = \left(\lim_{x\to a} f(x)\right)^{p/q}$ where p and q are integers.
