DIFFERENTIATION

LIMIT:-

(1) Significant of $\lim_{x\to a} f(x) = l$

$\lim_{x\to a} f(x) = l$ *indicates that the variable* x *takes the values* $> a$ *or* $< a$ *but* $\neq a$.

l *is the limiting value of* $f(x)$.

(2) '$\lim_{x\to a+} f(x)$' *is called the right hand limit of* $f(x)$ *at* $x = a$.

(3) '$\lim_{x\to a-} f(x)$' *is called the left hand limit of* $f(x)$ *at* $x = a$.

(4) Existence of $\lim_{x\to a} f(x)$

$\lim_{x\to a} f(x)$ *exists if both* $\lim_{x\to a+} f(x)$ & $\lim_{x\to a-} f(x)$ *exists and*
$\lim_{x\to a+} f(x) = \lim_{x\to a-} f(x)$.

(5) <u>Fundamental Theorems:-</u>

(1) $\lim_{x\to a}[f1(x) \pm f2(x) \pm f3(x) \pm \cdots \ldots] = \lim_{x\to a} f1(x) + \lim_{x\to a} f2(x) + \ldots\ldots$

(2) $\lim_{x\to a}[f1(x).f2(x)\ldots..] = \lim_{x\to a} f1(x).\lim_{x\to a} f2(x)\ldots..$

(3) $\lim_{x\to a}\left[\frac{f(x)}{\emptyset(x)}\right] = \frac{\lim_{x\to a} f(x)}{\lim_{x\to a} \emptyset(x)}$ $\quad [where,\ \lim_{x\to a} \emptyset(x) \neq 0]$

(4) $\lim_{x\to a} \emptyset\{f(x)\} = \emptyset\{\lim_{x\to a} f(x)\}$

<u>(6) Formulae</u>

(1) $\lim_{x\to a} \frac{x^n - a^n}{x-a} = na^{n-1}$

(2) $\lim_{x\to 0} \frac{\sin x}{x} = 1 \quad [x\ in\ radian]$

(3) $\lim_{x\to 0} \frac{\{1+x\}^n - 1}{x} = n$

(4) $\lim_{x\to 0} \frac{e^x - 1}{x} = 1$

(5) $\lim_{x\to 0} \frac{\log_e(1+x)}{x} = 1$

(6) $\lim_{x\to 0}(1+x)^{\frac{1}{x}} = e$

(7) $\lim_{x\to \infty}\left(1 + \frac{1}{x}\right)^x = e$

(8) $\lim_{x\to 0} \frac{a^x - 1}{x} = \log_e a \quad (a > 0)$

(7) Some Substitution:-