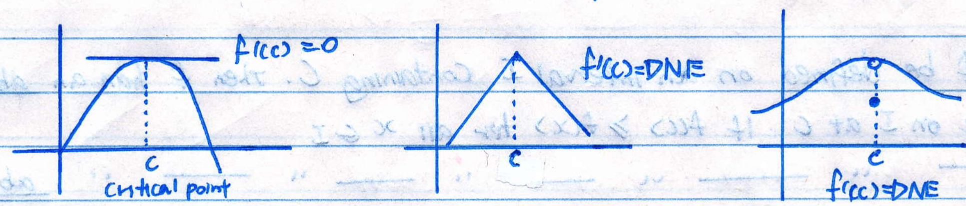
Theorem : (Local Extreme Point Theorem) If f has a local minimum value or maximum value at c, and $f'(c)$ exist, then $f'(c) = 0$

Def: (critical point) An interior point c of the domain of f at which $f'(c) = 0$ or $f'(c)$ fails to exist is called a critical point of f



Locating Abs max & Abs min

Given that f is continuous on $[a,b] = I$

(i) Find the critical point in I

(ii) Evaluate f at critical points and at the end points

(iii) Choose the largest and smallest value from (ii), this gives the abs max & abs min respectively.

Eg) Find the critical points, of the following functions on the given interval

a) $f(x) = 3x^2 - 4x + 2$ on $[0,15]$

$f'(x) = 6x - 4$, $f'(x) = 0 \Rightarrow 6x - 4 = 0 \Rightarrow x = \frac{2}{3}$ is a critical point

b) $(e^x + \frac{e^{-x}}{2})$ on $[-1,1]$ $f(x) = \left(\frac{e^x + e^{-x}}{2}\right)$; $f'(x) = \frac{e^x - e^{-x}}{2}$

$f'(x) = 0 \Rightarrow e^x = e^{-x} \Rightarrow x = -x \Rightarrow x = 0$ //

Eg) Find the critical point of $f(x) = xe^{-x/2}$ in $[0,5]$ and the absolute extrema values of f on this interval

Ans : $f(x) = xe^{-\frac{x}{2}}$, $f'(x) = e^{-x/2} + x(-\frac{1}{2})e^{-\frac{x}{2}} = e^{-\frac{x}{2}}(1 - \frac{x}{2})$

$f'(x) = 0 \Rightarrow (1 - \frac{x}{2}) = 0 \Rightarrow x = 2$ // Therefore the critical point is $(2, \frac{2}{e})$

$f(0) = 0$, $f(2) = \frac{2}{e} \approx 0.736$, $f(5) \approx 0.41$

Abs max of f in $[0,5]$ is $\frac{2}{e}$, abs min value $= 0$ //