Lec. 19-b-Rules for differentiation

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let $x_0 \in (a,b)$, f, g are diffrentiable @ x_0

then

"sum rule" 1.) $\forall \alpha, \beta \in \mathbb{R}$ $(\alpha f, \beta g)' = \alpha f'(x_0) + \beta g'(x_0)$

"product rule" 2.) $(f \cdot g)'(x_0) = \dfrac{f'(x_0)g(x_0) - g'(x_0)f(x_0)}{g(x)^2}$

"Quotient Rule" 3.) $(f/g)'(x_0) = \dfrac{f'(x_0)g(x_0) - g'(x_0)f(x_0)}{g(x_0)^2}$

$g(x_0) \neq 0$

(Chain Rule) 4.)

$$[a,b] \xrightarrow{g} [c,d] \xrightarrow{f} \mathbb{R}$$

let $x_0 \in (a,b)$ assume $g(x_0) \in (c,d)$

Then $f(g(x))'(x_0) = f'(g(x_0)) \cdot g'(x_0)$

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let $f: [a,b] \longrightarrow \mathbb{R}$ a point C is called a <u>local max</u> provided that $\exists \varepsilon > 0$

s.t. $\forall x \in (C-\varepsilon, C+\varepsilon) \cap [a,b]$

$f(C) \geq f(x)$

A 'local min' is similarly defined

$f(c) \leq f(x)$

Theorem: let $f \in C^0([a,b])$ s.t. $f'(x)$ exists $\forall x \in (a,b)$

if $\exists$ local max or local min $c \in (a,b) \Rightarrow$

$f'(c) = 0$ you prove this

consider proving 1 sided diffrentiation