Day 22 is Tuesday, March 12, 2013

The 1st Derivative Test for Local Extrema

If a function f passes all three of these tests at $x=c$

- $f'(c)=0$ or $f'(c)$ DNE } $x=c$ is partition number for f'
- $f(c)$ exists
- f' changes sign at $x=c$

} $x=c$ is a critical value for f

then the graph of f will have either a local max or a local min at $x=c$.

Fancy terminology

$f'(c)=0$ or $f'(c)$ DNE $\Longleftrightarrow$ "$x=c$ is a partition number for f'"

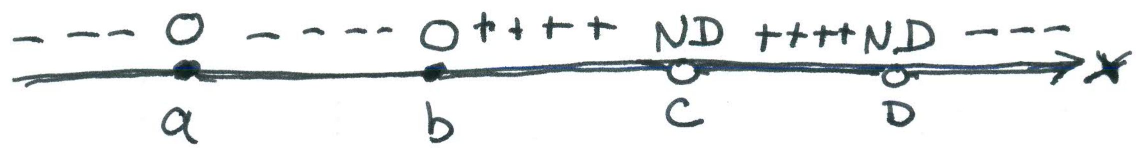
$f'(c)=0$ or $f'(c)$ DNE) and $f(c)$ exists } $\Longleftrightarrow$ "$x=c$ is a critical value for f"

Example 5-1 #10

sign chart for f' $\Rightarrow$ local extrema for f

A function $f(x)$ is continuous for all x-values, and has the following sign chart for f':

sign of f'



(A) Find partition numbers for f'

(B) Find critical values for f

(C) Find x-values where f has local max or min.

Solution

(A) $x = a, b, c, d$ because $f'(a) = 0$, $f'(b) = 0$, $f'(c)$ DNE, $f'(d)$ DNE.

(B) The fact that f is continuous everywhere tells us that $f(x)$ exists for all x-values. So $f(a)$, $f(b)$, $f(c)$, $f(d)$ all exist.

So all $x = a, b, c, d$ qualify to be called critical values for f.

(C) Local min at $x = b$ because f' changes from neg to pos.

Local max at $x = d$ because f' changes from pos to neg.