4.2 MVT

Inc/Dec

f cont on [a, b] + diff'able on (a,b)

$f'(x) > 0$ means f increasing

$f'(x) < 0$ means f decreasing

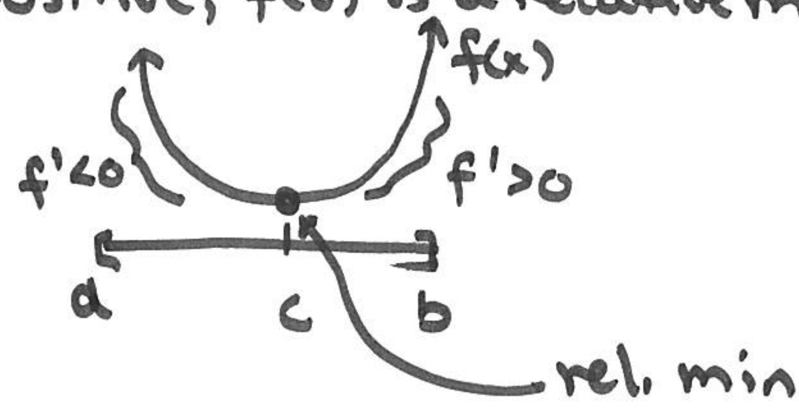
$f'(x) = 0$ means f neither inc nor dec

1st Derivative Test

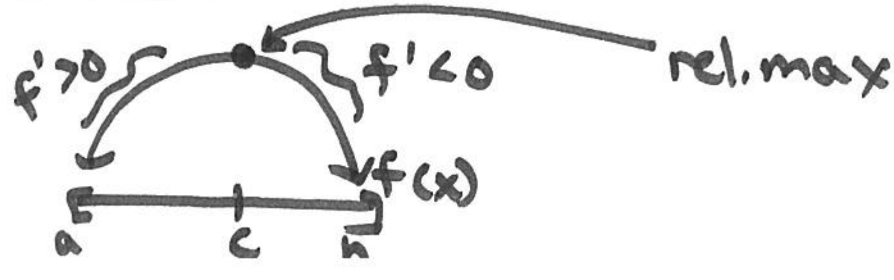
f cont on [a,b] and c is a critical #,

$f' = 0$
f' DNE

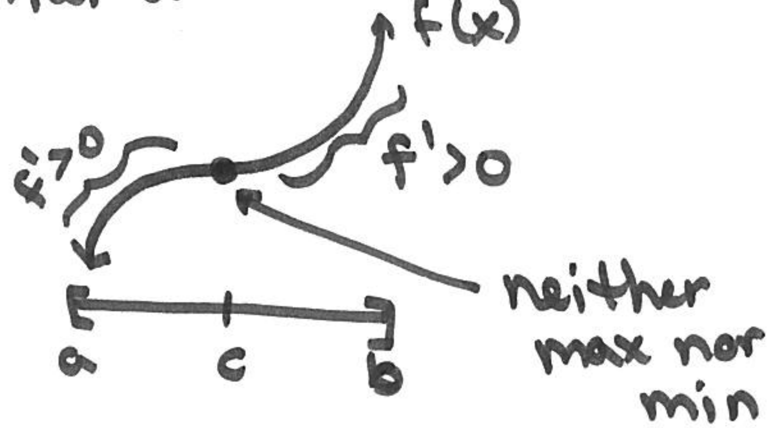
① If $f'(x)$ changes from negative to positive, $f(c)$ is a relative min



② If $f'(x)$ changes from positive to negative, $f(c)$ is a rel. max



③ If $f'(x)$ doesn't change signs @ $x = c$, $f(c)$ is neither a max nor min



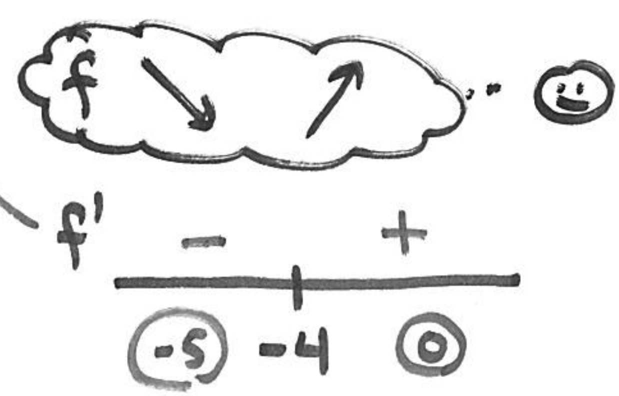
Find where $f(x)$ inc/dec and has rel max/min.

ex: $f(x) = x^2 + 8x + 10$

$f'(x) = 2x + 8$

$2x + 8 = 0$ ← get crit's

$x = -4$ ← critical #



- make f' # line
- put crit # on f' # line
- pick test #s to test into f'

$f' > 0 \rightarrow +$

$f' < 0 \rightarrow -$

$f(x)$ inc on $(-4, \infty)$ b/c $f'(x) > 0$ on that interval

$f(x)$ dec on $(-\infty, -4)$ b/c $f'(x) < 0$ on that interval

$f(x)$ has Rel. min @ $x = -4$ b/c $f'(x)$ changes from neg. to pos. @ $x = -4$

pt for rel. min $\rightarrow (-4, -6)$

$f(-4) = (-4)^2 + 8(-4) + 10$ ...

ex: $f(x) = x^3 - 6x^2 + 15$

$f'(x) = 3x^2 - 12x$

$0 = 3x^2 - 12x$ ← get crit's

$0 = 3x(x-4)$

$x = 0, \; x = 4$ ← crit's

$f \quad \nearrow \quad \searrow \quad \nearrow$ ...

f': $(-)(-)$ $+$ | $(+)(-)$ $-$ | $(+)(+)$ $+$

$-1 \quad 0 \quad 1 \quad 4 \quad 5$

f inc on $(-\infty, 0) \cup (4, \infty)$ b/c $f' > 0$ on those intervals

f dec on $(0, 4)$ b/c $f' < 0$ on $(0, 4)$

f has rel. min @ $x = 4$ b/c f' changes from neg. to pos

min pt. $(4, -17)$

f has rel. max @ $x = 0$ b/c f' changes from pos. to neg.

max pt $(0, 15)$