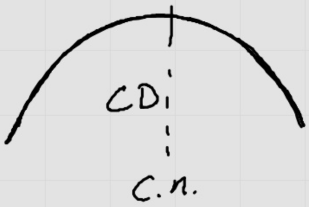
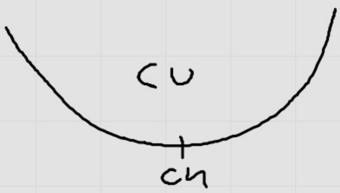
The Second Derivative Test for Relative Extrema



If $x=c$ is a c.n and
$f''(c)<0 \longrightarrow f(c)$
is a rel. max.



If $x=c$ is a c.n. and
$f''(c)>0 \longrightarrow f(c)$
is a rel min.

SDT does not work
$f''(c) \nexists$ or $f''(c)=0$.
(Go back to FDT)

$f(x) = 12 + 2x^2 - x^4$ rel. ext.?

$f'(x) = 4x - 4x^3$

$f' \; \exists \; \forall x$

$f'(x) = 0 \Rightarrow x = -1 \wedge x = 0 \wedge x = 1$

$f''(x) = 4 - 12x^2$

f has a rel max of 13 at $x=-1$ because $f''(-1) = -8 < 0 \rightarrow f$ CD.

f has a rel min of 12 at $x=0$ because $f''(0) = 4 > 0 \rightarrow f$ is CU.

f has a rel max of 13 at $x=1$ because $f''(1) = -8 < 0 \rightarrow f$ is CD.

$f(x) = x\sqrt{x+3}$

D_f $[-3, \infty)$

$$f'(x) = \frac{3x+6}{2\sqrt{x+3}}$$

$f' \nexists$ when $x \leq -3$

$f'(x) = 0 \Rightarrow x = -2$

$$f''(x) = \frac{3x+12}{4\sqrt{(x+3)^3}}$$

f has rel min of -2 at $x=-2$ because

$f''(-2) = \frac{3}{2} > 0 \rightarrow f$ is C.U.