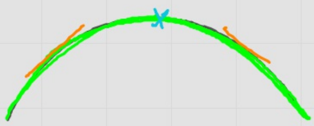
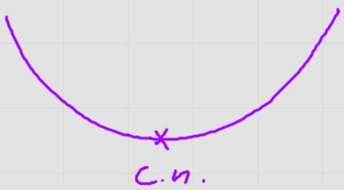
The Second Derivative Test for Relative Extrema



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



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

☆ SDT does not work if
$f''(c)=0$ or $f''(c)\nexists$
(go back to FDT)

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

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

$f' \exists \forall x$

$f'(x) = 0 \to x = -1$ or $x = 0$ or $x = 1$

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

f has a rel max of 13 at $x = -1$

because $f''(-1) = -8 < 0 \to$ f C.D.

f has a rel min of 12 at $x = 0$

because $f''(0) = 4 > 0 \to$ f CU.

f has rel max of 13 at $x = 1$ because

$f''(1) = -8 < 0 \to$ f CD.

$f(x) = x\sqrt{x+3}$ D: $[-3, \infty)$

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

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

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

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

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

because $f''(-2) = \frac{3}{2} > 0 \rightarrow f$ CU.