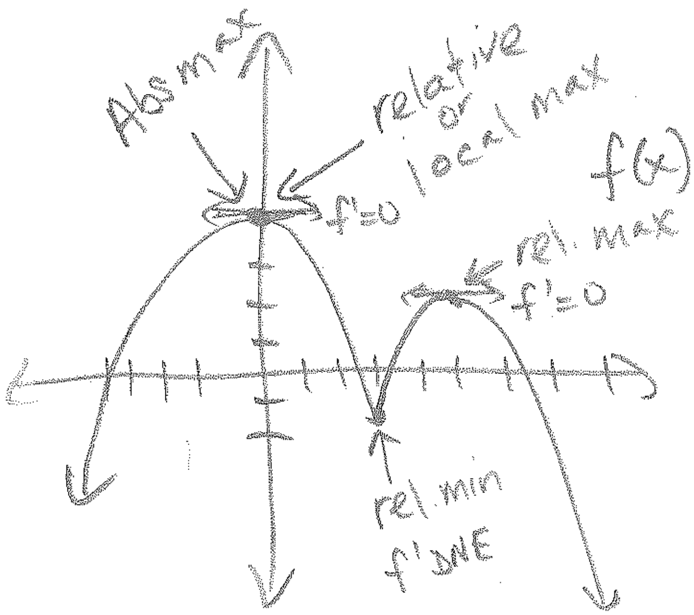


Absolute extrema

largest (max) y value
smallest (min) y value on
<u>entire</u> domain
* <u>y value</u> that exists

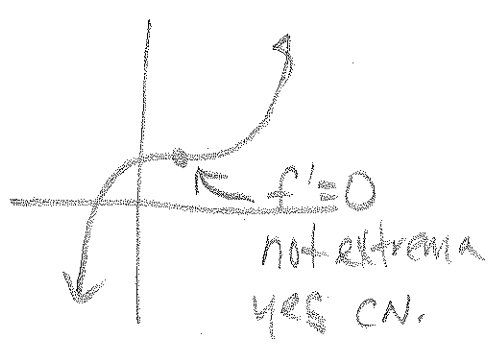
Abs max value = 4 "locate" → give point (0,4)
Abs min value = none

If have local extrema at $x=c$, then $f'(c)=0$ or $f'(c)$ DNE.

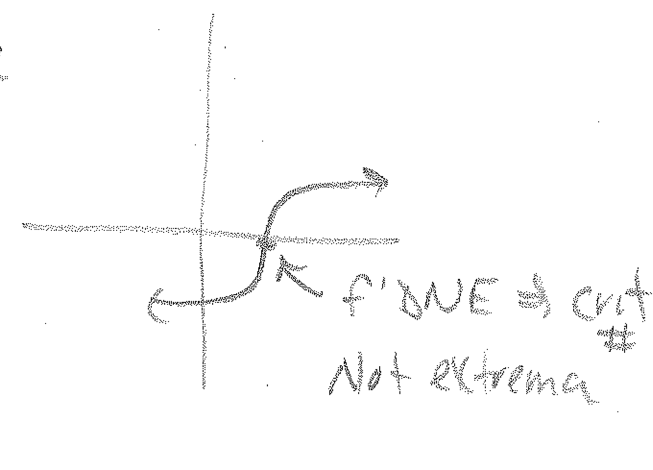
<u>Critical</u> <u>numbers</u> ⇒ x values (c) where $f'(c)=0$ or $f'(c)$ DNE

Not all crit #s give extrema

Ex.



Ex



Extreme Value Theorem = If $f(x)$ is continuous on $[a,b]$, then f has both a minimum and a maximum on interval.

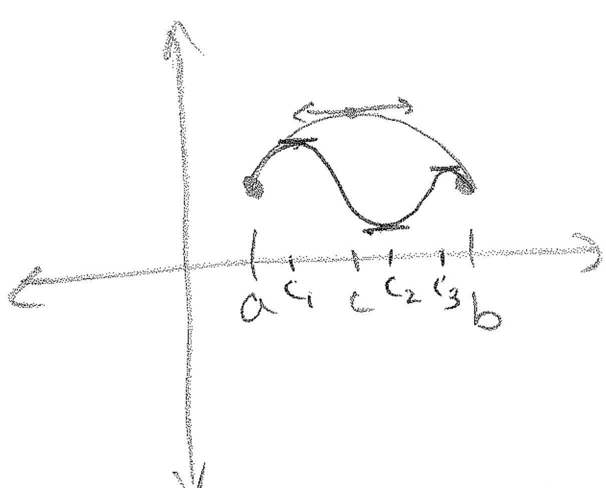
CRIT #S $\Rightarrow$ $f' = 0$ OR f' DNE $\Rightarrow$ must be in domain

Ex. $f(x) = 3x^2 - 2x + 4$ Find crit #s.

$$f'(x) = 6x - 2 = 0$$

$$\boxed{x = \frac{1}{3}}$$

Rolle's Thm $\Rightarrow$ If f is cont on $[a,b]$, differentiable on (a,b), and $f(a) = f(b)$ then there exists at least one c in (a,b) such that $f'(c) = 0$.



* Must show (state) that all 3 conditions are met!

Ex. $f(x) = x^4 - 2x^2$ $[-2, 2]$. Determine if Rolle's Thm applies, and if so, find c that satisfies conclusion.

$f(x)$ is cont $[-2,2]$ and diff. on $(-2,2)$

$f(-2) = 8 = f(2)$ so Rolle's Thm applies.

$f' = 4x^3 - 4x = 4x(x^2 - 1) = 0$ $\boxed{x = -1, 0, 1}$

Book

$f'(0) = 0$

$f'(\pm 1) = 0$

$f(x) = \sqrt[3]{x} \qquad [-1, 1]$

$f(x)$ is cont on $[-1, 1]$

$f'(x) = \frac{1}{3}x^{-2/3} = \frac{1}{3x^{2/3}} \rightarrow f'$ DNE @ $x=0$

So $f(x)$ is not diff on $(-1, 1)$

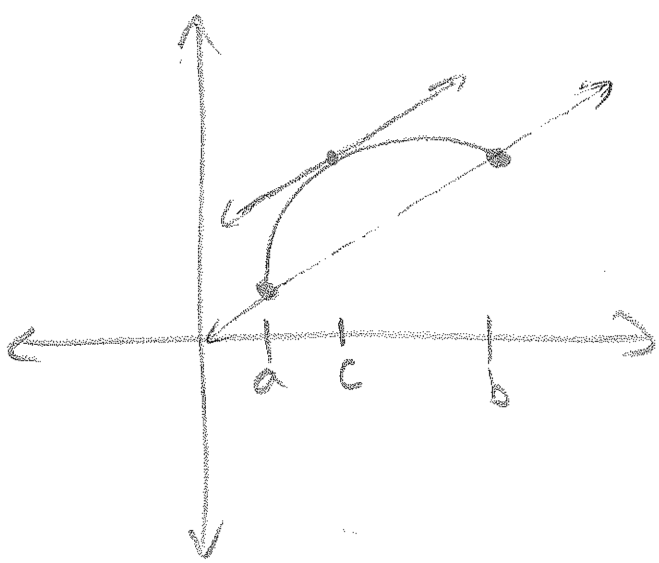
So Rolle's Thm doesn't apply.

Mean Value Thm: If f is cont on $[a, b]$ and differentiable on (a, b), then there exists at least one value c in (a, b) such that

$$f'(c) = \frac{f(b) - f(a)}{b - a}$$

slope of tangent
inst. rate

slope of secant line
avg. rate change



$f(x) = x^2 - 3x + 2 \quad [1,4]$

Determine if MVT applies & if so, find c to satisfy conclusion.

f(x) is cont on [1,4] and diff (1,4) so MVT applies

$$f'(x) = 2x - 3 = \frac{f(4) - f(1)}{4 - 1}$$

$$2x - 3 = \frac{6 - 0}{3}$$

$$2x - 3 = 2$$

$$2x = 5$$

$$\boxed{x = \frac{5}{2}} \qquad f'\left(\frac{5}{2}\right) = 2$$

$$c = \frac{5}{2}$$