5.1 Day 1   Extreme Values of Functions

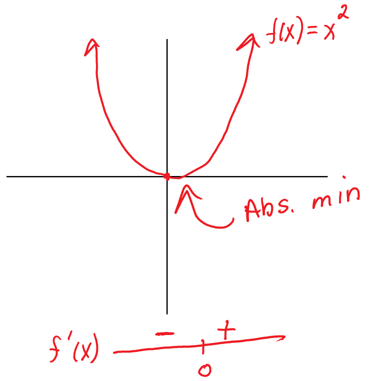
Monday, October 22, 2018   9:39 AM

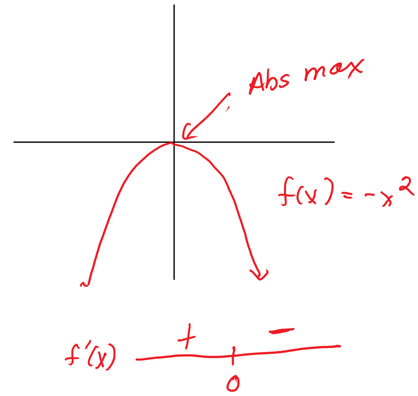
Absolute (Global) Extreme Value

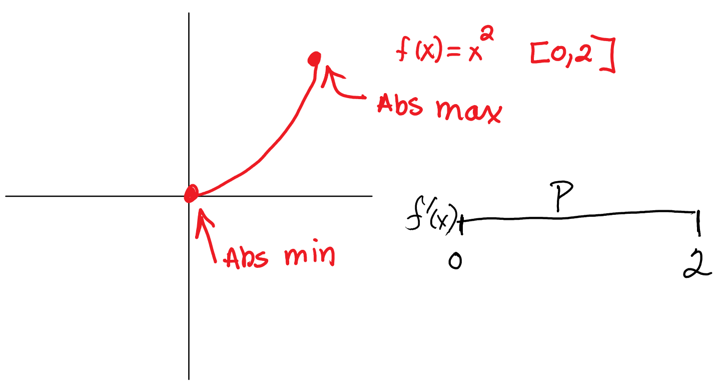
Let f be a function with Domain D

Then $f(c)$ is the

- Absolute max on D iff $f(x) \le f(c)$ for all x in D
- Absolute min on D iff $f(x) \ge f(c)$ for all x in D





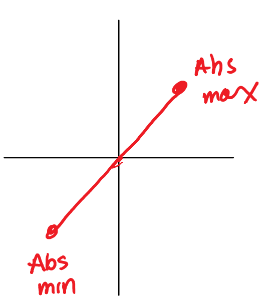


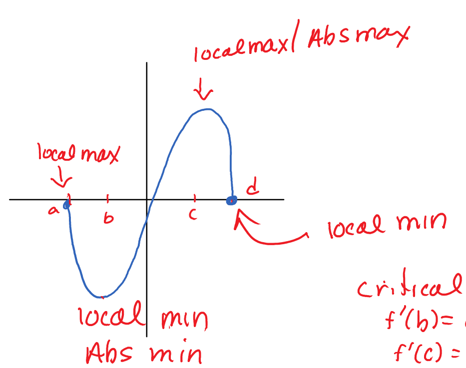
Extreme Value Theorem EVT

If $f(x)$ is a continuous on a closed interval $[a,b]$, then f has both a maximum and a minimum value on the interval.

local / relative

Abs / Global

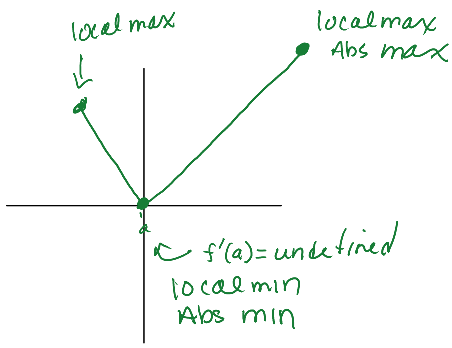




critical points

$f'(b)=0$

$f'(c)=0$



Local / Relative Extreme Values

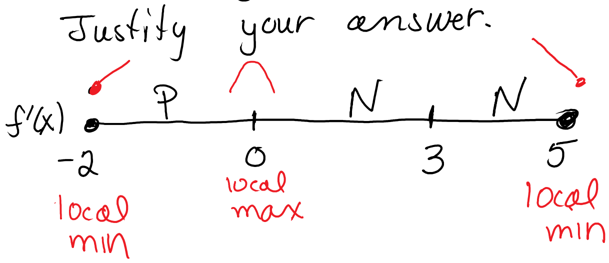
where can extrema occur?

* critical values (points)

$f'(x) = 0$ or $f'(x) =$ undefined ☆ however x must be in the domain of $f(x)$.

potential for extrema

$f(x)$ is a continuous function on $[-2, 5]$. Use the given information to determine where any local extrema occur. Justify your answer.



- $f(x)$ has a local min @ $x = -2$ b/c $x = 2$ is an endpt. and $f'(x) > 0$ to the right of $x = -2$.
- $f(x)$ has a local max @ $x = 0$, b/c $f'(x)$ goes from $+$ to $-$ @ $x = 0$.
- $f(x)$ has a local min @ $x = 5$, b/c $x = 5$ is an endpt. and $f'(x) < 0$ to the left of $x = 5$.

☆ Find the Abs. max. of $f(x) = 3x^4 + 8x^3 - 48x^2 + 12$ $[-5, 3]$.

☆ Find the Abs. max. of $f(x) = 3x^4 + 8x^3 - 48x^2 + 12$ $[-5, 3]$.
Justify your answer.

Endpoints

$f'(x) = 12x^3 + 24x^2 - 96x$

$12x(x^2 + 2x - 8) = 0$

$12x(x+4)(x-2) = 0$

$x = 0$ $x = -4$ $x = 2$ crit. points

using f' to determine what is happening to f

f': N, P, N, P

-5	$- \cdot - \cdot -$	-4	$- + -$	0	$+ + -$	2	$+ + +$	3
local max		local min		local max		local min		local max

x	$f(x)$
-5	-313
-4	-500
0	12
2	-68
3	39 ☆

must show you have considered all candidates!

$f(x)$ has an Abs max of 39 @ $x = 3$ b/c $x = 3$ is an end pt. and $f'(x) > 0$ to the left of $x = 3$.

Find all local extrema on $f(x)$ and justify your answer.

$f(x) = x^3 - 2x + 4$

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

$3x^2 - 2 = 0$

$x = \pm\sqrt{2/3}$

$$3x^2 - 2 = 0 \qquad x = \pm\sqrt{2/3}$$

f': $+$ | $-\sqrt{2/3}$ | $-$ | $\sqrt{2/3}$ | $+$

$f(x)$ has a local max @ $x = -\sqrt{2/3}$

b/c $f'(x)$ goes from $+$ to $-$ @ $x = -\sqrt{2/3}$.

$f(x)$ has a local min @ $x = \sqrt{2/3}$

b/c $f'(x)$ goes from $-$ to $+$ @ $x = \sqrt{2/3}$