4.1 Extreme Values

Objectives:

- I can find extreme values of any function

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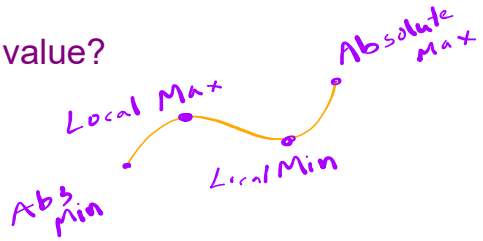
I. Extreme Values

What is an extreme value?

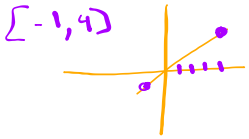
Max
Min



Does every function have an extreme value?

What restrictions could you put on any function to make sure it has an extreme value?

Dom Restrictions



Extreme value theorem

Any func over closed int [a,b] will have a max or min on [a,b]

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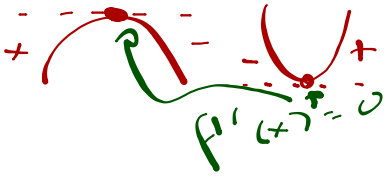
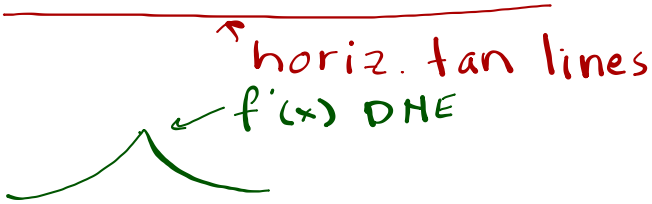
II. Critical Points

What can be said of the derivative of extreme values on interior points?





If c is an extreme value on an interior point of f(x) then, f '(c)=0 or f '(c)= DNE

Critical Point

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RS #33 How to find critical points

1. C is in the domain of f

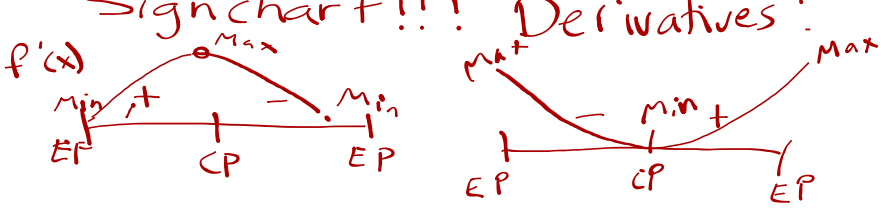
2. f '(x)=0, solve

*If a functions has a local max or min at x=c and f '(c) exists then f '(c)=0

Is the converse true?

[2, 6)

*How do you know if a critical point is an extreme value?



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III. Practice

Find all extreme values of the following functions.

1. $y = \frac{1}{3}x^3 + x^2 - 3x - 5, [-6,4]$

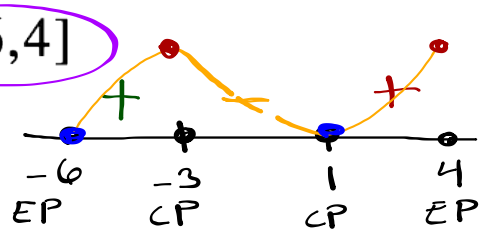
$y' = x^2 + 2x - 3 = 0$

$(x+3)(x-1) = 0$

$x = -3, 1$

Max at $x = -3, 4$

Min at $x = -6, 1$



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

$(0)^2 + 2(0) - 3 = -$

$(2)^2 + 2(2) - 3 = +$

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*** Steps for finding extreme values***

1. Find critical points and closed endpoints
   - deriv = 0, solve
2. Make a sign chart
3. Interpret results

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2. $y = \frac{1}{x} + \frac{x^2}{2}$, $[.5, 3]$

$y = x^{-1} + \frac{1}{2}x^2$

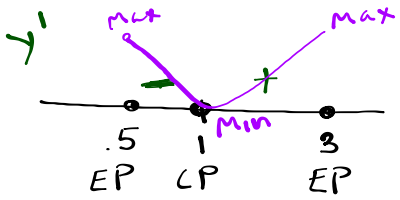
$y' = -1x^{-2} + x$

$y' = -\frac{1}{x^2} + x = 0$

$x^2 \cdot x = \frac{1}{x^2} \cdot x^2$

$\sqrt[3]{x^3} = \sqrt[3]{1}$

$x = 1$



$-\frac{1}{(.8)^2} + .8 = -$

$-\frac{1}{2} + 2 = +$

Max at $x = \frac{1}{2}, 3$

Min at $x = 1$

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3. $f(x) = \frac{1}{\sqrt{4 - x^2}}$, $(-\infty, \infty)$

Dom restrictions:

$4 - x^2 \geq 0$

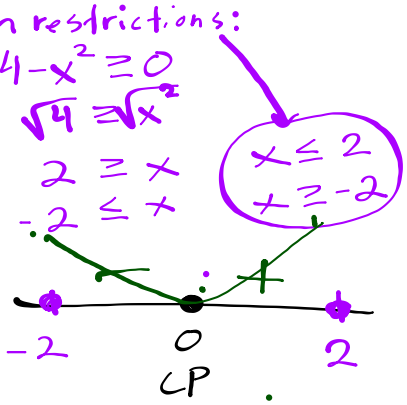
$\sqrt{4} \geq \sqrt{x^2}$

$2 \geq x$

$-2 \leq x$

$x \leq 2$

$x \geq -2$



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

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

$(4-x^2)^{3/2} \cdot 0 = \frac{x}{(4-x^2)^{3/2}} \cdot (4-x^2)^{3/2}$

$\frac{-1}{(4-(-1)^2)^{3/2}} \quad \frac{-1}{3^{3/2}} = -$

CP $0 = x$

Max at $x = -2, 2$

Min at $x = 0$

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4. $y = \ln|\cos x|$

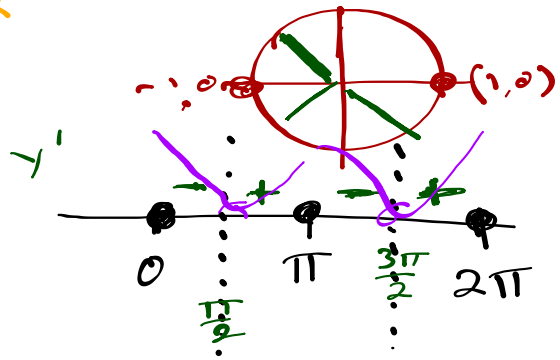
$y' = \frac{1}{\cos x} \cdot -\sin x$

$= -\frac{\sin x}{\cos x}$

$y' = -\tan x = 0$

$\tan x = 0$

$x = 0, \pi, 2\pi$



max at $x = 0, \pi, 2\pi$

None Min ~~at~~

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5. $g(x) = x\sqrt{x+2}, \ [-2,4]$

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