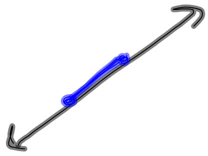
4.1 Extreme Values

max/min

Every Fnc: NO!



Restrictions: closed interval

Extreme Value Thm:

Any fnc. over a closed interval has an absolute min & max.

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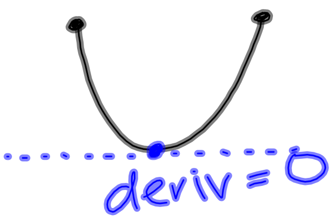
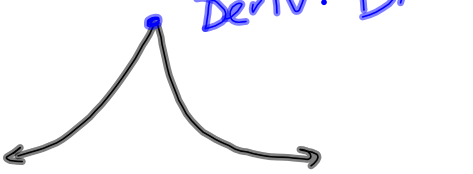
Critical Points





$f'(c) = 0$ or $f'(c)$ DNE

Critical Point: a value c in the domain of f such that $f'(c) = 0$ or $f'(c)$ DNE.

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1. c is in the domain of f
2. $f'(x) = 0 \rightarrow$ solve

If a fnc. has a local min or max @ $x = c$ and $f'(c)$ exists, then $f'(c) = 0$.

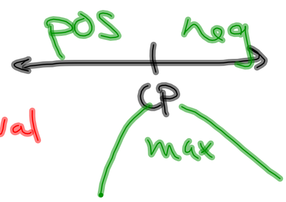
Converse: ✓

How to Tell:

$f'(x) = 0$ solve

$x = CP$

test each interval



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

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

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

$x = -3 \quad x = 1$

max: $x = -3$

min: $x = 1, x = -6$

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Steps

1. Find critical points and end pts.
2. Make a sign chart.
3. Interpet Results

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

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

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

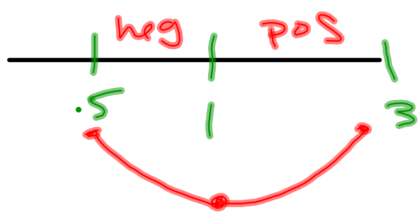
$\quad -x \qquad -x$

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

$-x^3 = -1$

$x^3 = 1$

$x = 1$



min: $x = 1$

max: $x = .5, 3$

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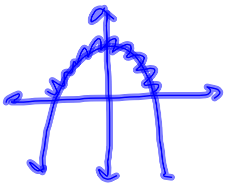
3. $f(x) = \frac{1}{\sqrt{4-x^2}} = (4-x^2)^{-\frac{1}{2}}$ $(-\infty, \infty)$

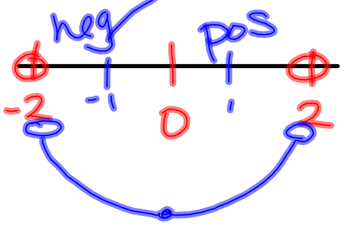
D: $4-x^2 > 0$

$(-2, 2)$



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

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



$x = 0$

min: $x = 0$

max: none

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

$y' = \frac{1}{\cos x} \cdot -\sin x = \frac{-\tan x}{-1} = \frac{0}{-1}$

$\tan x = 0$

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

$x = \pi n,\ n \in \mathbb{Z}$

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

$$g'(x) = x\left(\frac{1}{2\sqrt{x+2}} \cdot 1\right) + \sqrt{x+2} \cdot 1$$

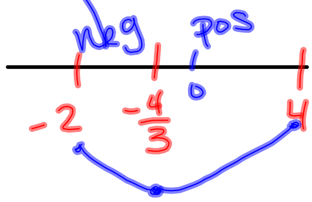
$$= \frac{x}{2\sqrt{x+2}} + \frac{\sqrt{x+2}}{1}\left(\frac{2\sqrt{x+2}}{2\sqrt{x+2}}\right)$$

$$= \frac{x}{2\sqrt{x+2}} + \frac{2(x+2)}{2\sqrt{x+2}}$$

$$= \frac{3x+4}{2\sqrt{x+2}} = 0$$

$$3x+4=0$$

$$x = -\frac{4}{3}$$



min: $x = -\frac{4}{3}$

max: $x = -2, 4$

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