Upcoming Calendar

M Nov 28: practice assessment

W Nov 30: <u>Assess</u>, Mean Value Theorem (D-C8)

F Dec 2: Absolute and Relative Extrema + Critical Numbers (AD789)

→ M Dec 5: First Derivative Test, Justifying Extrema

W Dec 7: <u>Assess</u> on D-C8 an AD789; Concavity and F'' (AD10-12)

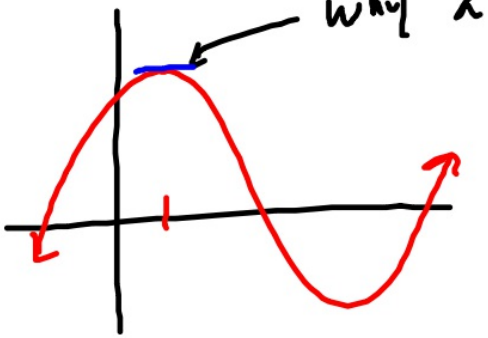
F Dec 9: Related Rates (AD14-15)

[assessment on this topic is in Jan]

M Dec 12: <u>Assess</u> on Concavity/Extremes (AD7-12)

W Dec 14: Reassessment Day

How to find and justify relative extrema



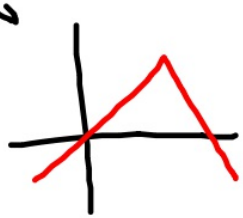
why a max?

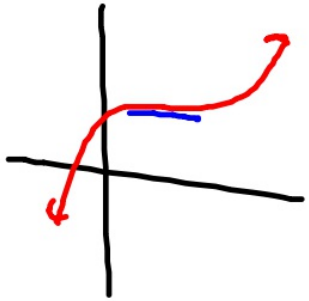
① slope of 0 [or undef.]

② f: inc → dec

or

f': pos → neg





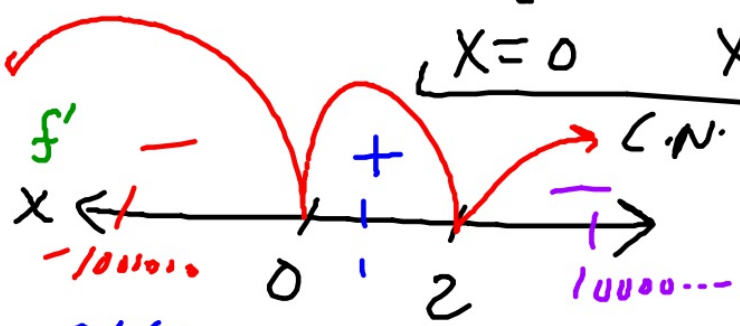
Find and classify the relative extrema for $f(x) = -x^3+3x^2+1$

Justify your classifications.

$$f'(x) = -3x^2 + 6x = 0$$

$$-3x(x-2) = 0$$

$$x = 0 \qquad x = 2$$



$$f'(1) = (-)(-) = +$$

$x=0$ is a rel. min because f' changes from neg → pos. (or f changes from dec → inc.)

$x=2$ is a rel. max because f' changes from positive to negative

Number line does not count as justification!

Find and classify all relative extrema for

$$y = -\frac{25x}{x^2+25}$$

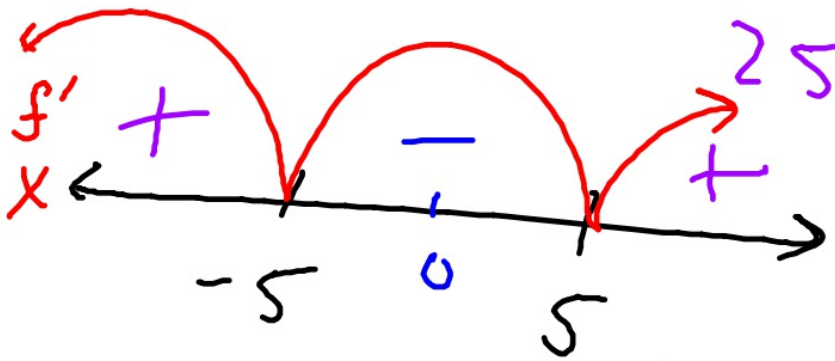
Justify your classifications.

$$f' = \frac{25x^2-625}{(x^2+25)^2} = 0$$

$$25(x^2-25)=0$$

$$25(x+5)(x-5)=0$$

$$\underline{x=\pm 5} \quad \text{C.N.}$$



$x=-5$ rel max b/c. f' changes from $+ \to -$

$x=5$ is a rel. min b/c f' changes from neg $\to$ pos.

Find and classify all relative extrema for

$$y = \frac{1}{x^2-1} \quad \begin{matrix} f \\ g \end{matrix}$$

Justify your classifications.

$$\frac{f'g - fg'}{g^2}$$

$$y' = \frac{\cancel{0\cdot(x^2-1)} - 1\cdot(2x)}{(x^2-1)^2}$$

$$y' = \frac{-2x}{(x^2-1)^2}$$

[critical numbers: when $y'=0$ or undefined]

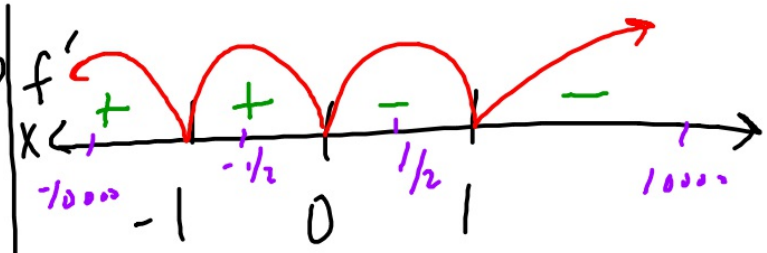
$-2x = 0$

$\underbrace{x=0}_{\text{C.N.}}$

$(x^2-1)^2 = 0$

$x^2-1=0$

$\underbrace{x=\pm 1}_{\text{C.N.}}$



(Note that denominator of f' is always positive)

$x=0$ is a rel. max because f' changes from pos $\to$ neg.

Summary

1 Find critical numbers (f'=0 or f' undefined)
2 Populate number line with C.N., indentify intervals
3 Pick test values in each interval, plug them into f' to find whether result is + or -
4. Sign changes yield relative extrema
5. Justify in words with numerical evidence!

Homework

Complete practice assessment