Good afternoon: no warm up, we'll randomize and go over hw, then learn more about maxima and minima

Assessment: Monday

HW solutions at mcalc.weebly.com

any in particular you had trouble with??

59b.) $\underbrace{3x}_{f} \cdot \underbrace{\csc 2x}_{g}$

$3\csc 2x + 3x \cdot -\csc 2x \cot 2x \cdot 2$

$\underline{3\csc 2x - 6x \csc 2x \cot 2x}$

Find the x-coordinate(s) where y= x^4-4x^2+1 has relative extrema. Justify your classifications.

$$y' = 4x^3 - 8x = 0$$

$$4x(x^2-2) = 0$$

$x = 0$ | $x^2 = 2$

$x = \pm\sqrt{2}$

C.N.

① Find C.N.

② Look for sign changes

f': $-$ | $+$ | $-$ | $+$

x: $-\sqrt{2}$ | 0 | $\sqrt{2}$

f: min | max | min

DEC

Where do those signs come from?

Pick numbers in each interval. Plug into f'. Find sign of result.

$f'(1) = -4$

$f'(-1) = 4$

$f'(1000) = +$

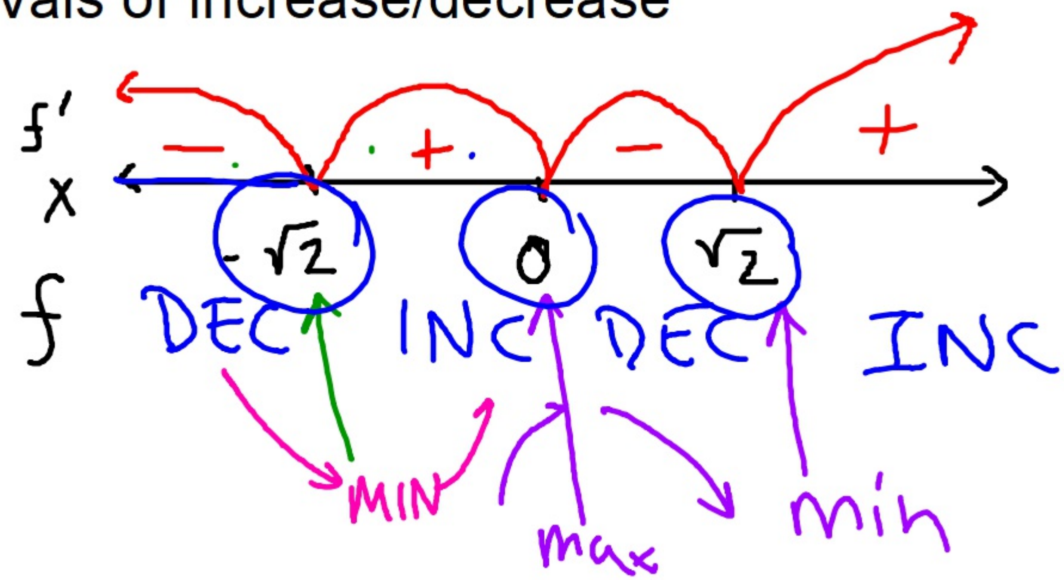
$f'(-1000) = -$

How to find where a function has relative extrema

1. Take the derivative of y, y'
2. Find C.N.
   Set y' equal to zero, solve; consider where it is undefined.
3. Plot C.N. on number line, do bunnyhops for signage
4. A sign change <u>must</u> occur for a max or min.

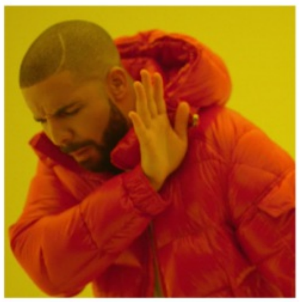
This sign chart tells you 2 things:

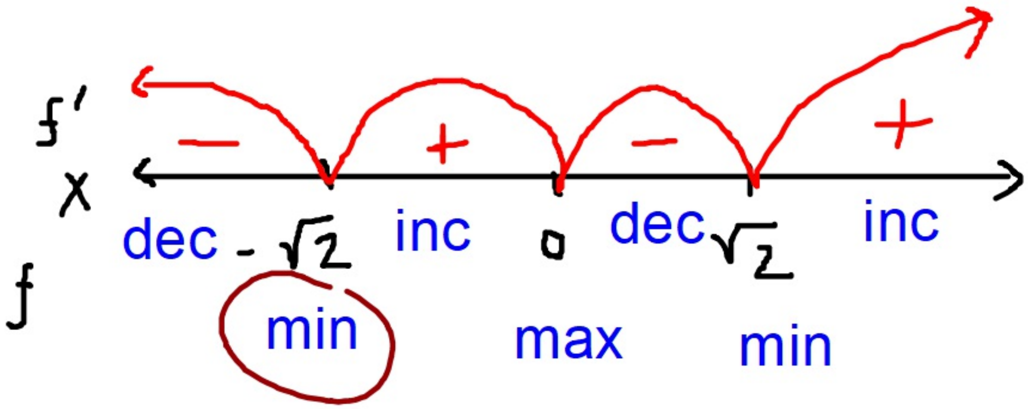
- locations of extrema
- intervals of increase/decrease

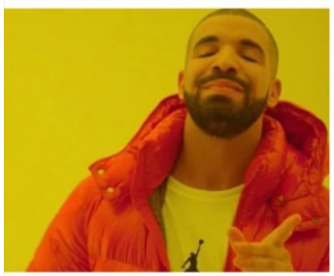


A sign chart is not sufficient for getting credit on assessment/AP test

Must explain verbally!







"F has a relative maximum at x=0 BECAUSE F' changes sign from positive to negative"

f has a rel min @ $x=-\sqrt{2}$ and $x=\sqrt{2}$ BECAUSE F' changes from $- \to +$.

Find the x-coordinate(s) where y= x^3-2x^2-1 has relative extrema. Justify your classifications.

① Find C.N.

$$\frac{dy}{dx} = 3x^2 - 4x = 0$$

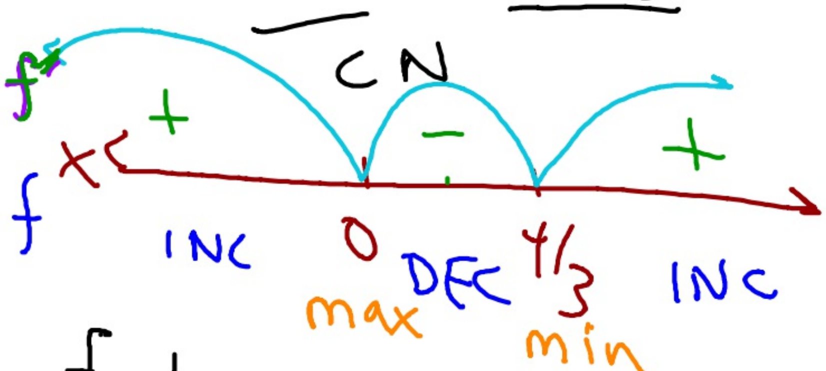
$$x(3x-4) = 0$$

$x = 0$ $x = 4/3$

CN

② Plot on sign chart

③ Pick test values plug into f'



f has rel max @ $x=0$ b/c f' changes from pos to neg

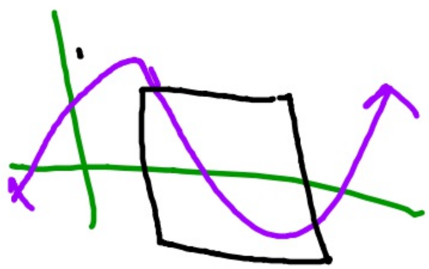
f has rel min @ $x=4/3$ b/c f' changes from − → +

Practice...

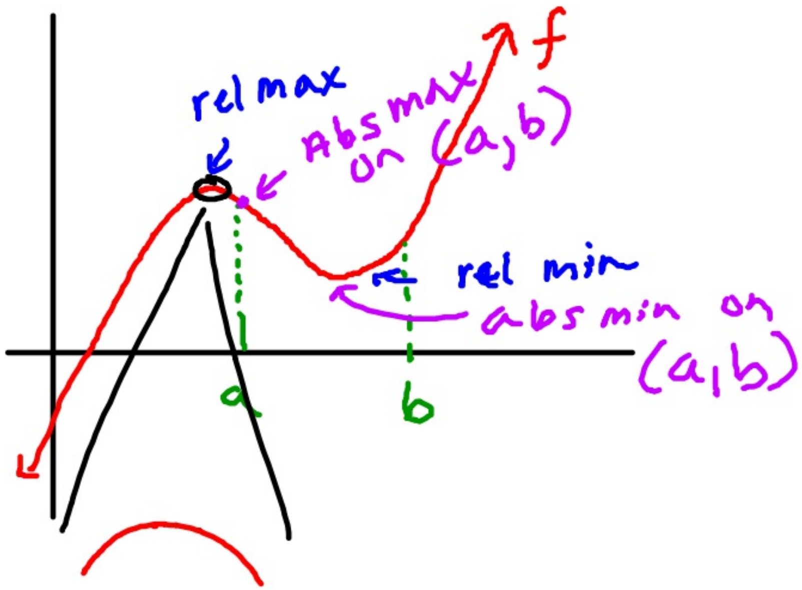
Kahoot!

Absolute Extrema...a bit of a misnomer

- (Global max/min)
- must occur on an interval



Absolute (Global) Extrema



Absolute Extremes
occur on <u>intervals</u>

They occur at relative ext.
OR at endpoints!

[redacted]

Every function continuous on an interval has an absolute max and absolute min (extreme value theorem)

it either occurs at an endpoint, or at a relative max/min

How to find absolute extrema over an interval

$g(t) = 2t^3+3t^2-12t+4$ on the interval [-4,2]

$g'(t) = 6t^2+6t-12 = 0$

$6(t^2+t-2) = 0$

$6(t+2)(t-1) = 0$

$t=-2, \quad t=1$

$g(-4) = 2(-4)^3+3(-4)^2-12(-4)+4 = -28$

$g(2) = 2(2)^3+3(2)^2-12(2)+4 = 8$

$g(1) = 2(1)^3+3-12+4 = -3$

$g(-2) = 2(-2)^3+3(-2)^2-12(-2)+4 = 24$

1. Find C.N.
2. Plug endpts and any C.N. into f
3. Abs max: biggest output

   Abs min: smallest output

Abs max	min
@ x = -2	@ x = -4

Find the x-coordinates where f(x) has an absolute max and absolute min on [-3,1] for f(x)= $\frac{1}{4}x^4 - \frac{1}{3}x^3 - 3x^2$

$f' = x^3 - x^2 - 6x = 0$

$x(x^2 - x - 6) = 0$

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

$x = 0$

$\cancel{x = 3}$

not in interval

$x = -2$

$f(0) = 0$

$f(-2) = -10\,2/3$

$f(-3) = 2\,1/4$

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

$-\frac{1}{12} - 3$

$-3\,1/12$

Max @ $x = -3$

Min @ $x = -2$

Skills on assessment

D-AD7: interpreting an F' graph for inc/dec and rel max/min
D-AD8: finding relative and absolute extrema algebraically
D-AD9: finding intervals of inc/dec algebraically
D-AD5: implicit derivatives

D-DC2: Interpeting derivatives