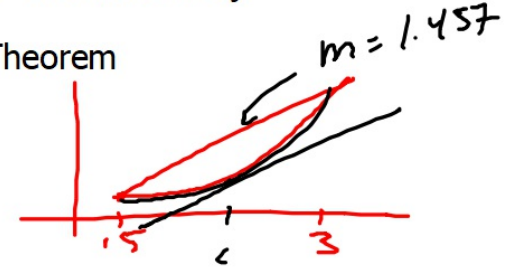
Good afternoon: warm up in notebooks

next assess: Wednesday

Find the value of **c** guaranteed to exist by the Mean Value Theorem for f(x)= xln(x) on the interval [0.5, 3]

a b



Avg. Rate

$$\frac{f(3)-f(0.5)}{3-0.5} = \frac{3\ln 3 - \frac{1}{2}\ln\frac{1}{2}}{2.5} = 1.457$$

Instant: Rate

$$f'(x) = 1\cdot\ln(x) + x\cdot\frac{1}{x}$$

$$f'(x) = \ln(x) + 1$$

$$\ln(x)+1 = 1.457$$

$$\ln(x) = 0.457$$

$$\log_e x = 0.457$$

ln

$\log_e$

$\log_b x = a \Leftrightarrow b^a = x$

$$e^{0.457} = x$$

$$1.579 \approx x$$

Visibly Random Grouping

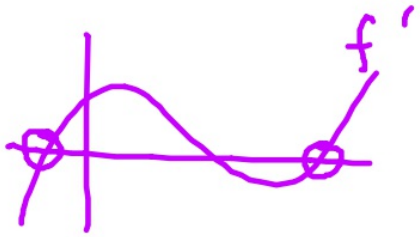
HW

31. not continuous @ x=2, so not diff over (0,6)
32. not diff. @ x=2, so not diff over (0,6)
33. f is not cont @ x=3 (inf. disc.) so f is not diff on (0,6)
34. f is not diff @ x=3 (corner) so f is not diff on (0,6)
35. a y-4=-1(x+1)
    b c=1/2
    c. $y - \frac{19}{4} = -\left(x - \frac{1}{2}\right)$

36 a y-0=1(x-4)
   b c=1
   c. y+12=1(x-1)

37. c=-1/2
38. c=sqrt(12)
39. c= $\pm\frac{1}{\sqrt{3}}$
40. $c = \sqrt[3]{2}$

How to find where a function has relative extrema



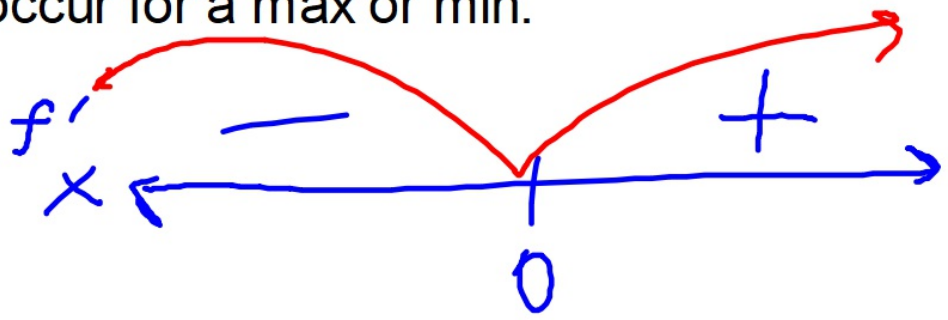
1. Take the derivative of y, y'
2. Find C.N.
   ↳ Set y' equal to zero, solve; consider where it is undefined.
3. Plot C.N. on number line, do bunnyhops for signage
4. A sign change must occur for a max or min.

$f(x) = 3x^2$

$f'(x) = 6x = 0$

$x = 0$

C.N.



f has a rel min @ x=0

b/c f' changes from − to +.

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

① Take deriv.

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

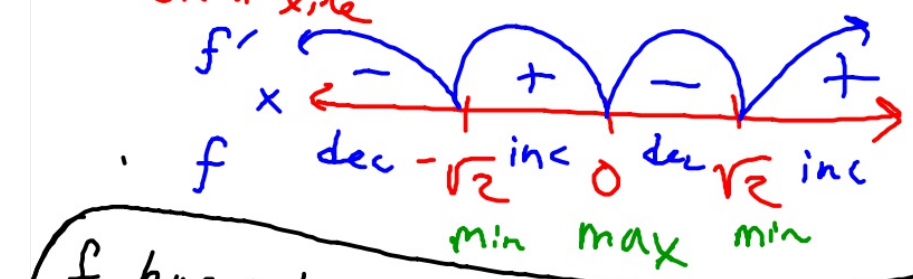
② Find C.N.

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

$4x(x-\sqrt{2})(x+\sqrt{2})$ — $4x(x^2-2) = 0$

$x = 0$ ↑ C.N. → $x^2 - 2 = 0$, $x^2 = 2$, $x = \pm\sqrt{2}$

③ Plot C.N. on # line

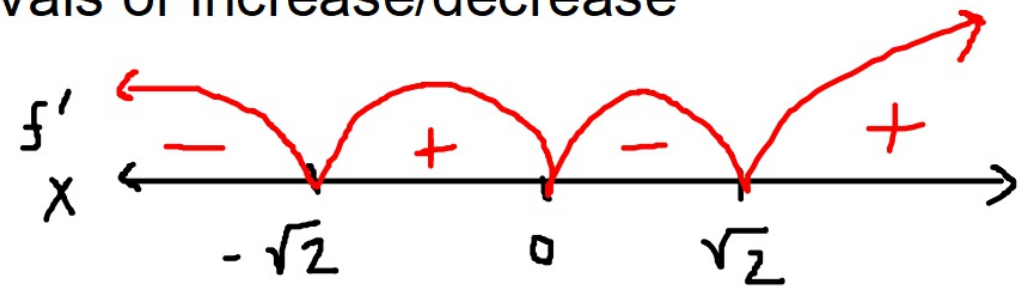


f has rel. max @ $x = 0$ b/c f' changes $+ \to -$

f has rel min @ $x = \pm\sqrt{2}$ b/c f' changes $- \to +$.

This sign chart tells you 2 things:

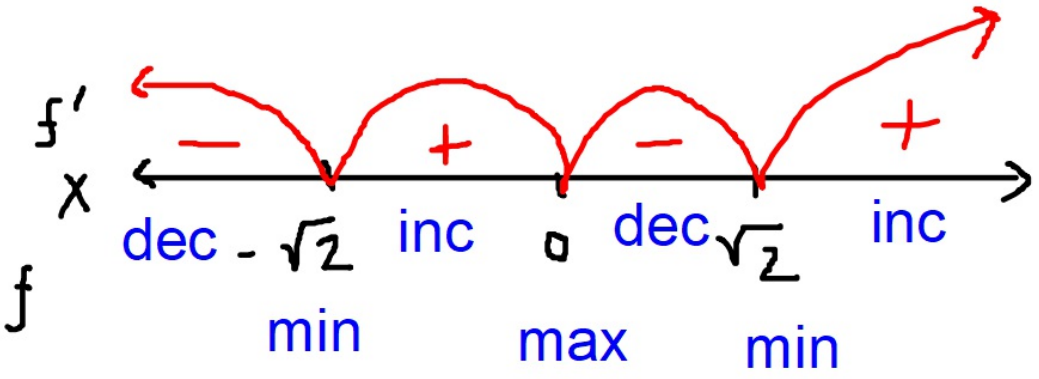
- locations of extrema
- intervals of increase/decrease

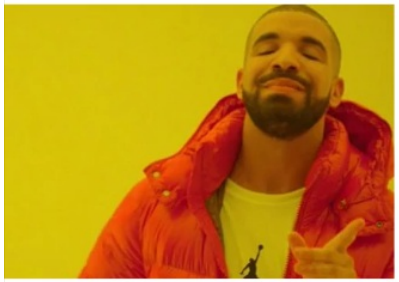


A sign chart is not sufficient for getting credit on assessment/AP test

Must explain verbally!

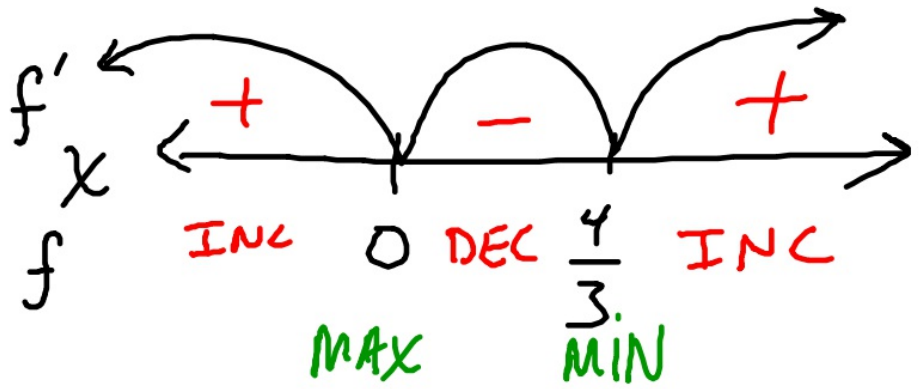
max @ x=0





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

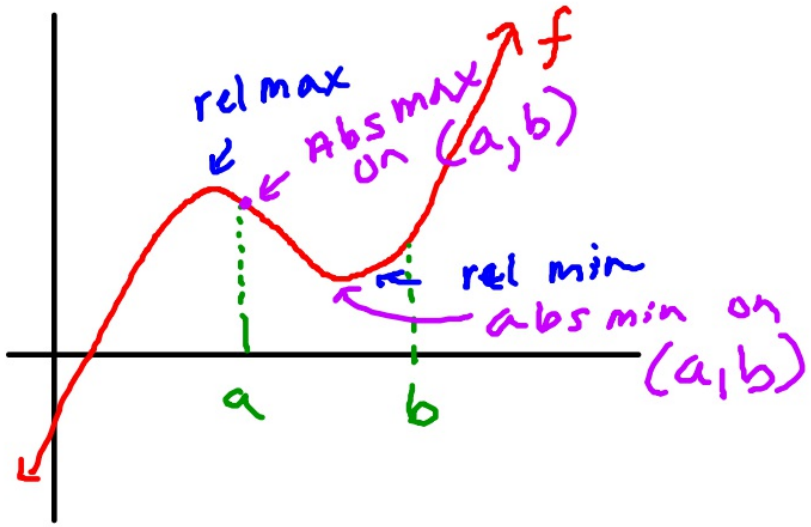
Find the x-coordinate(s) where $y= x^3-2x^2-1$ has relative extrema. Justify your classifications.



f has a rel max @ x=0 because f ' changes from positive to negative
f has a rel min @ x=4/3 because f' changes from negative to pos

Share with your face/elbow partner
something you've learned so far today

Absolute (Global) Extrema



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

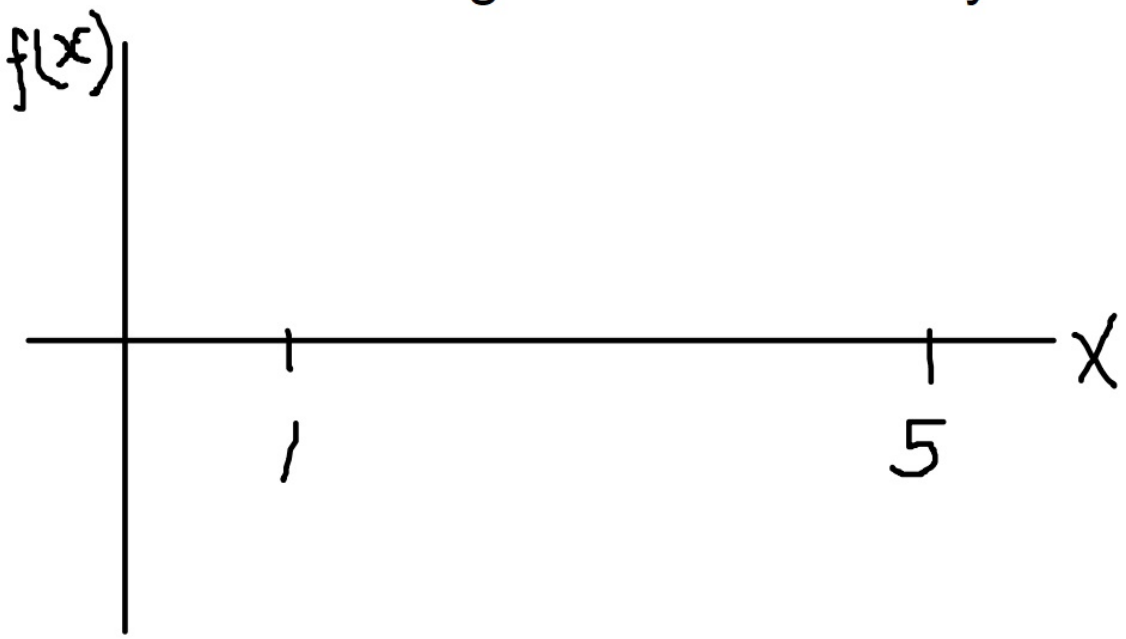
They occur at relative ext. OR at endpoints!

The Extreme Value Theorem (EVT)
If F is continuous on [a,b], then F has both a max and min on [a,b].

f(c) is a max if for all x in [a,b], $f(x) \leq f(c)$

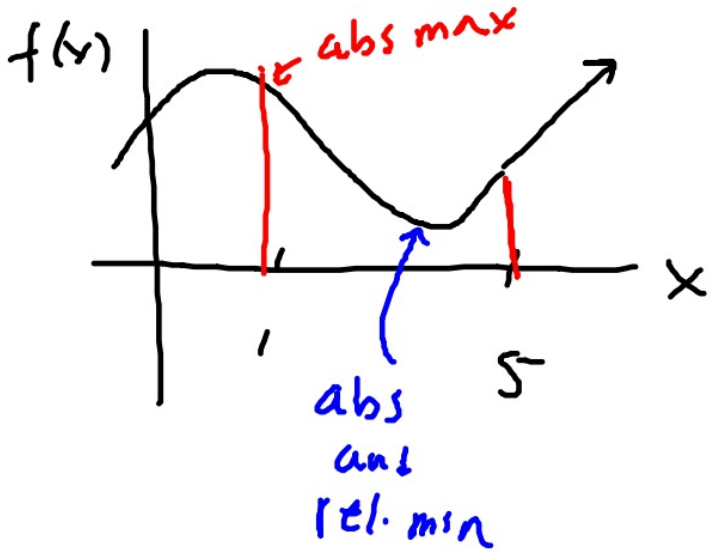
f(c) is a min if for all x in [a,b], $f(x) \geq f(c)$

Whiteboards:
- alternate who has board/pen with partner
- make sure you agree on what's being drawn
- discuss/work out disagreements verbally/visually



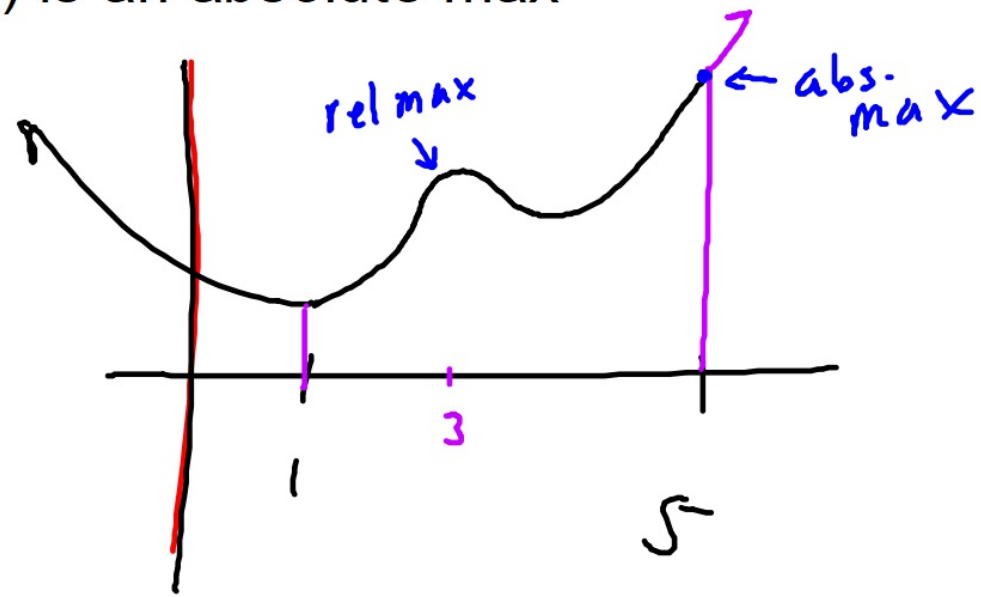
Sketch a continuous function on [1, 5] where

f(1) is an absolute max but not a relative maximum,
and the absolute minimum is also a relative min



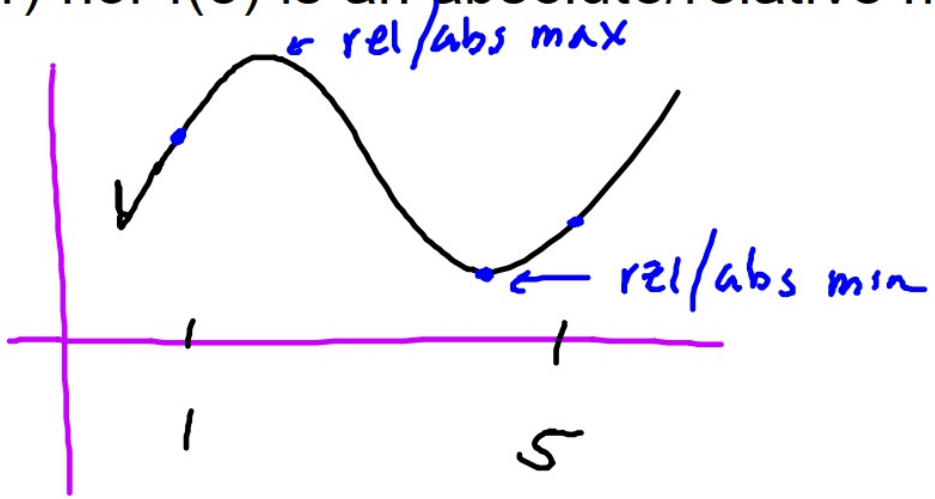
Sketch a continuous function on [1, 5] where

f(3) is an relative max but not an absolute max
and f(5) is an absolute max



Sketch a continuous function on [1, 5] where

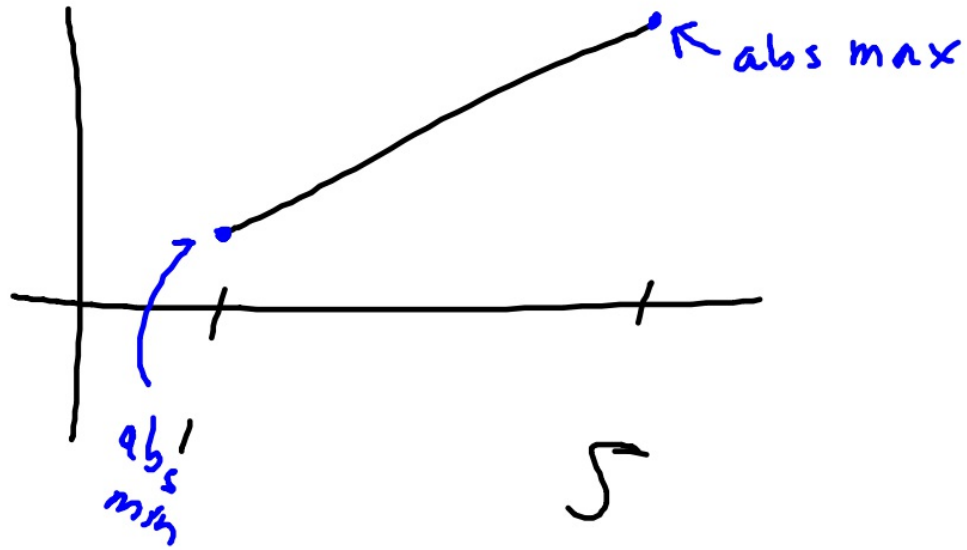
neither f(1) nor f(5) is an absolute/relative max or min



Sketch a continuous function on [1, 5] where

f has no relative max/min but has absolute max/min

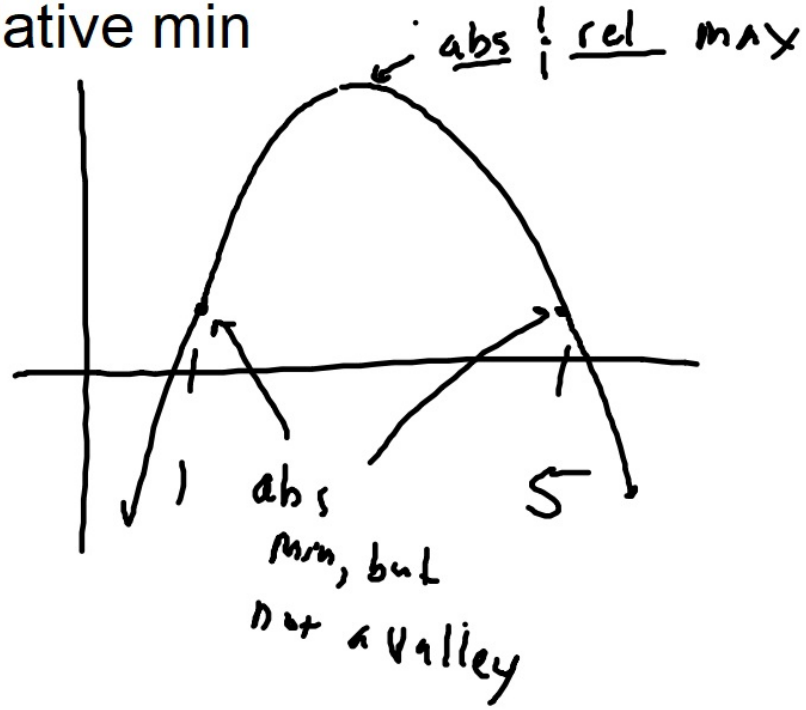
no peaks/valleys



Sketch a continuous function on [1, 5] where

the absolute max is a relative max, but the absolute min is not a relative min

Bonus Content!



Send a partner to return board/pen please

Due Monday:
p. 183 #13-39 (mult of 3)
ignore book instructions, just find/classify/justify rel ext and find/justify intervals of increase/decrease

Due Wednesday
p. 167 # 17-27 (odd), 52