

Ex:  $f(x) = 3x(x+2)^{1/3} + 2$

(1)

Find all local extrema of  $f$ .

Soln: Find c.p.'s  $\Rightarrow$  product rule  $(fg)' = f'g + fg'$

$$f'(x) = 3 \frac{d}{dx} [x(x+2)^{1/3}]$$

$$\frac{1}{3} - 1 = -\frac{2}{3}$$

$$= 3 \left[ \frac{d}{dx}[x] (x+2)^{1/3} + x \frac{d}{dx} [(x+2)^{1/3}] \right]$$

$$= 3 \left[ (x+2)^{1/3} + x \frac{d(x+2)}{dx} \frac{d}{d(x+2)} (x+2)^{1/3} \right]$$

$$(x+2)^{1/3} + \frac{x}{3} (x+2)^{-2/3} = 0$$

$$(x+2)^{1/3} + \frac{x}{3(x+2)^{2/3}} = 0$$

$$x^a x^b = x^{a+b}$$

TRAVBLE

when  $x+2=0$

$$x = -2$$

$f'$  not defined here  $\sim$  c.p.!

if  $x \neq -2$   
 $\left\{ \begin{array}{l} \text{mult by } (x+2)^{2/3} \end{array} \right.$

$$(x+2)^{1/3+2/3} + \frac{x}{3} = 0$$

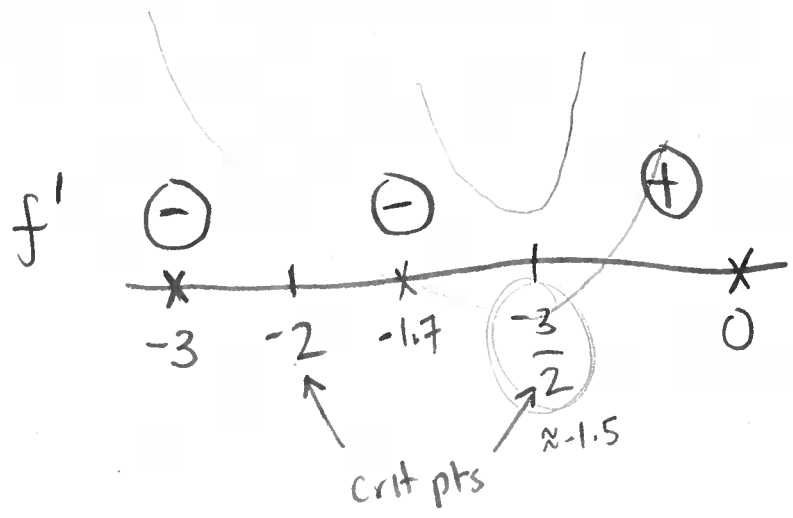
$$x+2 + \frac{x}{3} = 0$$

$$\frac{4}{3}x = -2$$

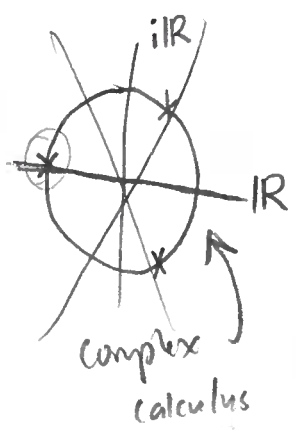
$$x = -\frac{6}{4} = -\frac{3}{2} \leftarrow \text{crit pt}$$

crit pts

$$x = -2, -\frac{3}{2}$$



$\sqrt[3]{-1} = -1$   
 because  
 $(-1)^3 = \overbrace{(-1)(-1)(-1)}^{=1}$   
 $= -1$



$\Rightarrow$  local min at  $x = -3/2$   
 with value  $f(-3/2) \approx -1.57$

Data Sci Minor — open to all

one sem [ Comp 1110 — low level programming (Python)  
 MATH 1550 — basic stats (R programming) (satisfies Tech GenEd) ]

$\rightarrow$  [ two 2000-level math/cs classes ] "Intro to Data Sci"  
 [ two classes — Data Mining + capstone ]

Find local extrema of  
Ex:  $f(x) = x \ln(5x)$

$$\frac{d}{dx} \ln(x) = \frac{1}{x}$$

(3)

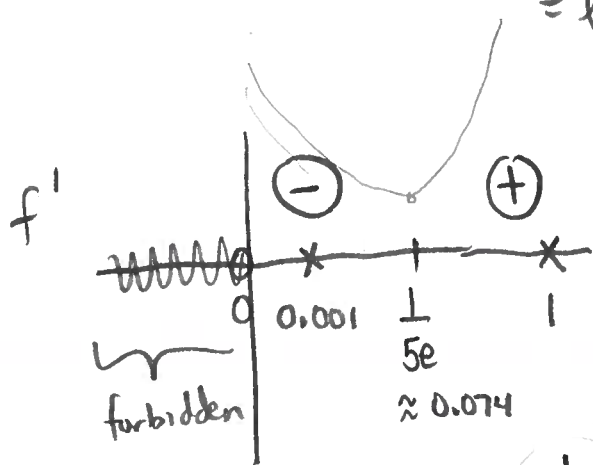
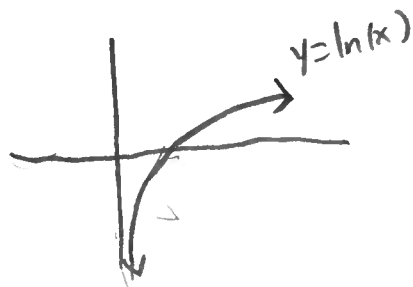


$$f'(x) = \frac{d}{dx} [x] \ln(5x) + x \frac{d}{dx} [\ln(5x)]$$

$$= \ln(5x) + x \frac{d(5x)}{dx} \frac{d}{d(5x)} \ln(5x)$$

$$= \ln(5x) + \frac{5x}{5x}$$

$$= \ln(5x) + 1 \stackrel{\text{SET}}{=} 0$$



$$\ln(5x) = -1$$

↓ plug into  $e^x$

$$e^{\ln(5x)} = e^{-1} = \frac{1}{e}$$

⇒ local min of  $\frac{1}{5e}$

$$5x = \frac{1}{e}$$

occurring at  $x = \frac{1}{5e}$

$$\boxed{x = \frac{1}{5e}}$$

← crit pt

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Inflection points — place where concavity changes from one kind to another