

Eg 2

$$y = xe^x$$

$$f'(x) = (1+x)e^x \quad \{ \text{PRODUCT RULE} \}$$

$$f''(x) = (2+x)e^x \quad \{ \text{PRODUCT RULE} \}$$

A. DOMAIN
NO ISSUES
 \Rightarrow ALL OF \mathbb{R}

B. INTERCEPTS
 $(x,y) = (0,0)$ [BOTH x & y INTERCEPTS]

C. SYMMETRY \rightarrow NONE

D. ASYMPTOTES $\rightarrow \{ y=0 \}$

$y_i = \text{NOT FINITE}$; $y_i = 0$
 $x \rightarrow +\infty$; $x \rightarrow -\infty$

E. INTERVALS OF INCREASE / DECREASE
 $(-1, \infty) \nearrow$
 $(-\infty, -1) \searrow$

F. LOCAL MAXIMA & LOCAL MINIMA
 $x = -1$ (LOCAL MIN)

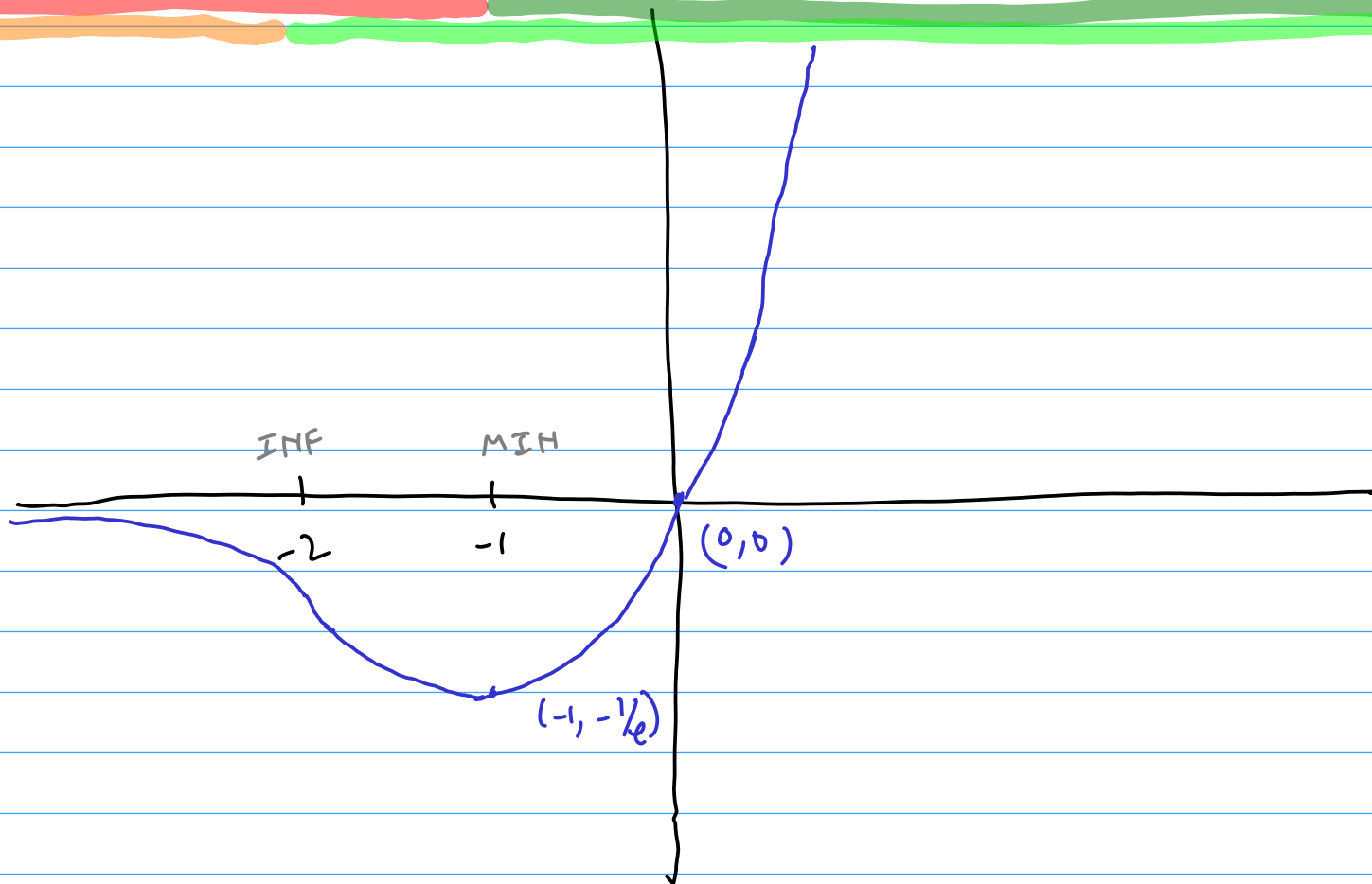
G. CONCAVITY AND POINTS OF INFLECTION
 $(-2, \infty) \cup$
 $(-\infty, -2) \cap$
 $x = -2$ (INFLECTION)

DECREASING \downarrow

INCREASING \nearrow

CONC DOWN \wedge

CONC UP \vee



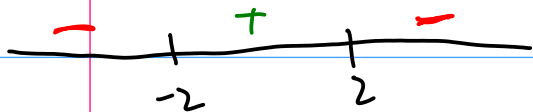
$$y = x e^x$$

Eg. 3

$$y = \ln(4 - x^2)$$

A. DOMAIN $\rightarrow (-2, 2)$

$$4 - x^2 > 0 \Leftrightarrow (2 - x)(2 + x) > 0$$



B. INTERCEPTS

y-INT $\rightarrow f(0) = \ln 4$

x-INT $\rightarrow f(x) = 0 \Rightarrow \ln(4 - x^2) = 0$
 $\Rightarrow 4 - x^2 = 1 \Rightarrow x = \pm\sqrt{3}$

C. SYMMETRY \rightarrow EVEN!

D. ASYMPTOTES $\rightarrow x = 2$
 $\rightarrow x = -2$ (NEXT PAGE)

$$f(x) = \ln(4 - x^2)$$

$$f'(x) = \frac{-2x}{4 - x^2}$$

[CHAIN RULE]

$$f''(x) = \frac{-8 - 2x^2}{(4 - x^2)^2}$$

[QUOTIENT RULE]

E. INTERVALS OF INCREASE / DECREASE $(-2, 0) \uparrow$
 $(0, 2) \downarrow$

F. LOCAL MAXIMA & LOCAL MINIMA $x = 0$ IS A MAX.

G. CONCAVITY AND POINTS OF INFLECTION $(-2, 2) \wedge$

FOR ASYMPTOTES, RECALL

$$\lim_{z \rightarrow 0^+} \ln z = -\infty$$

$$\therefore \lim_{x \rightarrow -2^+} \ln(4-x^2) = \lim_{x \rightarrow 2^-} \ln(4-x^2) = -\infty$$

$$\therefore x = -2 \quad \& \quad x = 2$$

CONCAVE DOWN

UNDEFINED

INCREASING ↗

DECREASING ↘

