Calculus Study Guide: section 4.3

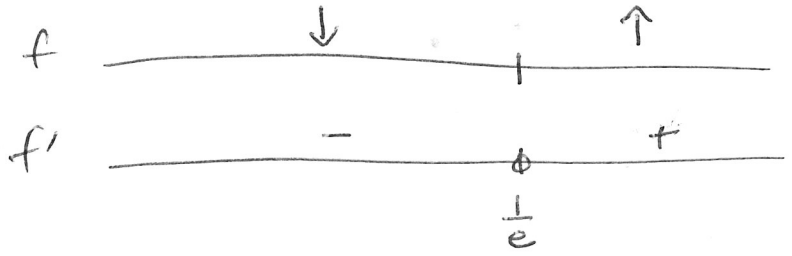
1) Verify the Mean Value Theorem for f(x) = ln x on [1, 4].

average rate of change $= \frac{\ln 4 - \ln 1}{4-1} = 0.462$

$f'(x) = \frac{1}{x} = 0.462$ $\quad x = 2.164$

2) Find the function's critical point(s) and use the First Derivative Test to classify them as a max or min: f(x) = x ln(x) $\quad f'(x) = 1 \cdot \ln x + \frac{x}{x} = \ln x + 1$

$\ln x + 1 = 0 \quad \ln x = -1 \quad e^{-1} = x$ is a critical point

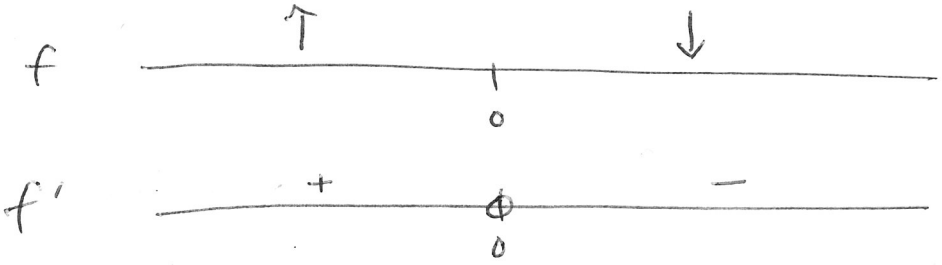


$x = \frac{1}{e}$ is a MIN on $f(x)$

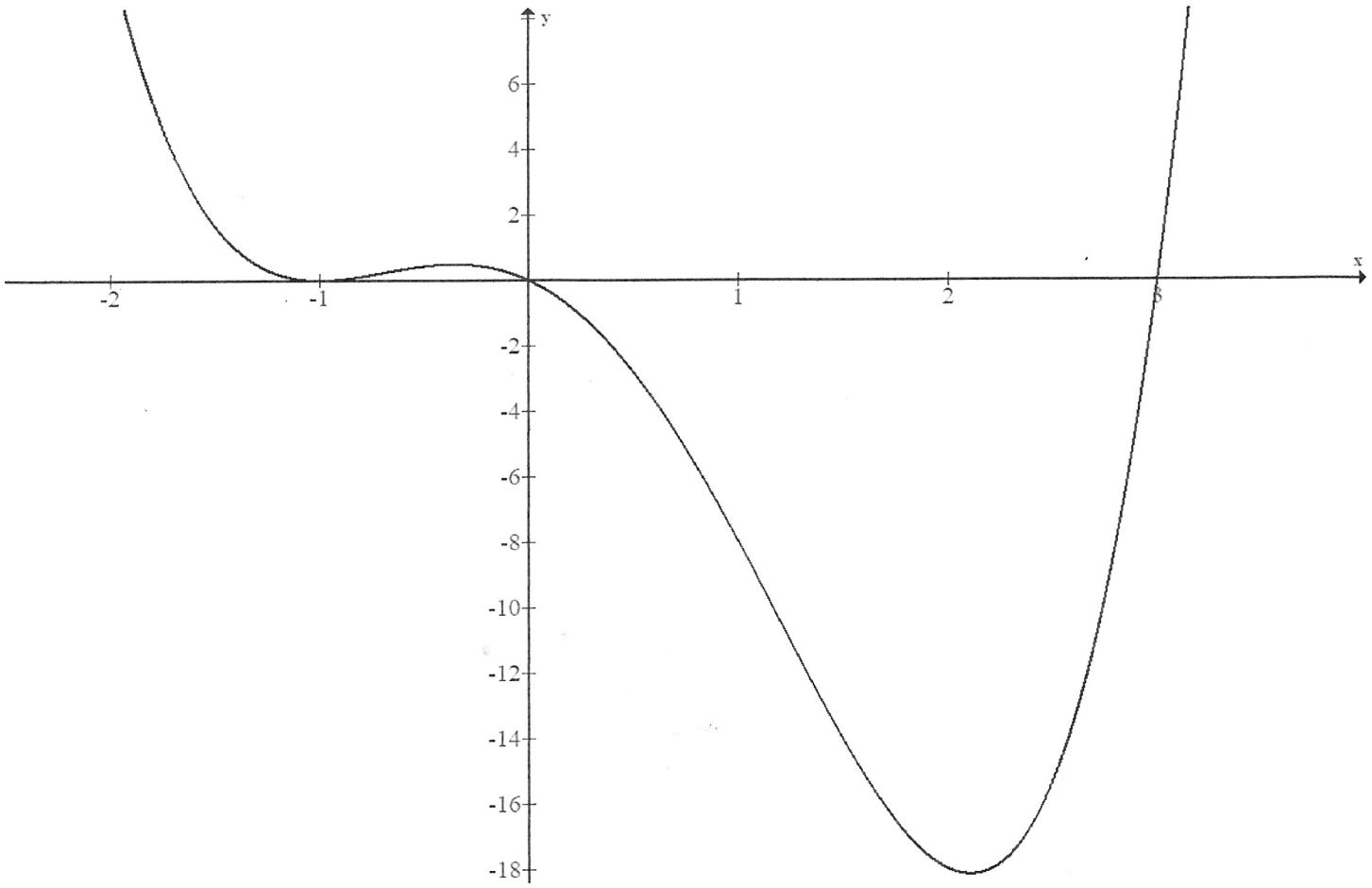
3) Find the critical points and the intervals on which the function is increasing or decreasing, and apply the First Derivative Test to analyze each critical point.

$y = \frac{1}{x^2+1} \quad \frac{dy}{dx} = \frac{(x^2+1)(0) - 1(2x)}{(x^2+1)^2} = -\frac{2x}{(x^2+1)^2}$

$\frac{-2x}{(x^2+1)^2} = 0$ critical point at $x = 0$



$x = 0$ is a MAX on y



4) Assume that the graph above is of the **derivative** function $f'(x)$.

With regards to the original function f(x):

On which x-interval(s) is f(x) increasing?

$(-2,-1) \cup (-1,0) \cup (3,4)$

On which interval(s) is f(x) decreasing?

$(0,3)$

At which x-value(s) does f have a max?

$x=0$

At which x-value(s) does f have a min?

$x=3$