8. The function $L(x) = \dfrac{1}{\ln(x)}$ is differentiable over its domain.

(a) (2 points) What is the domain of L?

The domain of L is $x > 0$, excluding $x = 1$.

(b) (4 points) Write the formula for the derivative of L at $x = a$ using the *limit definition* of the derivative.

$$L'(a) = \lim_{h \to 0} \frac{\frac{1}{\ln(a+h)} - \frac{1}{\ln a}}{h}$$

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(c) (4 points) Given $\dfrac{dL}{dx}|_{x=2} = -1.0407$ and $\dfrac{dL}{dx}|_{x=2.5} = -.4764$ and given that the derivative is *monotonic* (meaning the derivative does not change behavior from decreasing to increasing or vice versa) for all $x > 1$, what does this information tell you about the graph of L for x near 2? Explain your reasoning using words and symbols (*i.e.*, **not** by drawing a graph).

The graph of L near $x = 2$ must be concave up, since the derivative is increasing and monotonic. The function is decreasing, since the derivative is negative. (Also, we know that the graph of $\ln x$ is increasing, and L is defined as the reciprocal of $\ln x$, so L is decreasing).