1. [11 points] There is a classic result in mathematics, which states that the number of prime numbers less than any number \( x \geq 2 \) is approximated by the function \( \text{li}(x) = \int_2^x \frac{dt}{\ln t} \).

a. [3 points] Is \( \text{li}(x) \) increasing, decreasing, or neither for \( x \geq 2 \)? Provide justification for your answer.

b. [3 points] Is \( \text{li}(x) \) concave up, concave down, or neither for \( x \geq 2 \)? Provide justification for your answer.

c. [5 points] Using Integration by Parts, put \( \text{li}(x) \) into the form

\[
\text{li}(x) = f(x) + \int_2^x \frac{dt}{(\ln t)^2}.
\]

What is \( f(x) \)?