

8. [13 points] Use the family of functions of the form

$$f(x) = ax - \ln(1 + e^{bx})$$

to answer the following questions. The constants a and b are both positive.

- a. [4 points] Use the given formula for $f(x)$ to give an explicit expression for the limit definition of $f'(x)$. Check your expression carefully, as **no partial credit** will be given on this part of the problem. Do not evaluate your expression.

- b. [4 points] Compute $f'(x)$ using the rules of differentiation. Do not try to evaluate your expression from (a).

- c. [5 points] When $a < b$, the function $f(x)$ has a critical point at

$$x = \frac{1}{b} \ln \left(\frac{a}{b-a} \right).$$

Using the **second-derivative test**, determine whether this critical point is a local maximum, local minimum, or neither.