

Problem 1. *Compute the following limits:*

(a) $\lim_{x \rightarrow 0^+} \frac{(\ln x)^2}{x}$

(b) $\lim_{x \rightarrow \infty} \sqrt{x}e^{-x/2}$

(c) $\lim_{x \rightarrow \infty} e^x/x^n$ for any positive integer n .

Problem 2. *Suppose you are writing code for Google that will take a list of words and alphabetize them. Wikipedia says that the Bubble Sort method can sort n words in roughly n^2 amount of time. On the other hand, Merge Sort takes roughly $n \log n$ time for the same n words, and Stupid Sort takes longer than n^n . Which algorithm should you use? (Hint available.)*

Problem 3. *Coulomb's Law states that the force of attraction between two charged particles is directly proportional to the product of the charges, and inversely proportional to the square of the distance between them. Suppose you have two particles of charge $+1$, located two units apart; and another particle of charge -1 between them.*

(a) *Draw a picture of the situation.*

(b) *Write down the total force $F(x)$ on the middle particle, as a function of its position x .*

(c) *Graph $F(x)$, pointing out any interesting features.*