APPLICATIONS TO FINANCE AND IMPROPER INTEGRALS

Tutorial 19.1. Suppose the rate of flow of money in dollars per year is given by the function
\[ f(t) = 200e^{0.04t} \]
Assume a 10-year period at 8% compounded continuously and find the present value, and the accumulated amount of money flow at \( t = 10 \).

Tutorial 19.2. Suppose we have a model given by
\[ S = N \int_{0}^{\infty} \frac{a(1 - e^{-kt})}{k} e^{-bt} \, dt \]
where \( a, b \) and \( k \) are positive constants. Find the value of \( S \).

Tutorial 19.3. For each of the following integrals, determine whether the integral converges or diverges, and if it converges, find the value of the integral:
(a) \( \int_{0}^{\infty} \frac{dx}{(x + 1)^2} \)
(b) \( \int_{-\infty}^{-1} \frac{2x - 1}{x^2 - x} \, dx \)

Tutorial 19.4. Exponential growth
The population of the world in the year 1650 was about 500 million and in the year 2010 was 6756 million.
(a) Assuming that the population of the world grows exponentially, find the equation for the population \( P(t) \) in millions in the year \( t \).
(b) Use your answer from part (a) to find the population of the world in the year 1.