2. **Surface Adsorption**

   Consider a 3-dimensional gas of spinless, non-relativistic, non-interacting bosons of mass m at pressure P and temperature T. The pressure of this 3D ideal Bose gas is low enough so that it is in the classical limit where the quantum statistics of the bosons may be neglected. The bosons can be adsorbed onto a 2-dimensional surface layer, where they are bound with energy $-\epsilon_0 < 0$, but retain their translational degrees of freedom in 2 dimensions. The ideal 3D Bose gas is in equilibrium with the ideal 2D adsorbed Bose gas. Treating the 2D adsorbed gas fully quantum mechanically with the proper Bose statistics, compute the surface density of this 2D gas as a function of the given parameters and fundamental constants.

   (You may need: $\int \frac{dx}{ae^x+1} = \ln \frac{e^x}{1+ae^x}$.)