1) [25 points] Let supply be an increasing function of wage,
\[ S = \ln (a + bw), \]
and demand be a decreasing function of wage,
\[ D = \ln (\beta - \alpha w). \]
What is the equilibrium level of employment and equilibrium wage?

2) A firm has a production function of \( f (L, K, E) \) where \( L \) is labor, \( K \) is capital, and \( E \) is energy. It maximizes profits.
   a) [30 points] How much of each input does it use and what is the level of output and profits if profits are
   \[ \pi = pf (L, K, E) - wL - rK - zE \]
   and the production function is
   \[ f (L, K, E) = \beta L^{\alpha_1} K^{\alpha_2} E^{\alpha_3} \]
   with
   \[ \alpha_1 + \alpha_2 + \alpha_3 < 1? \]
   b) [10 points] What is the elasticity of labor with respect to
      i) the wage;
      ii) the price of capital; and
      iii) the price of energy?
   c) [10 points] Is labor a gross substitute or compliment with capital?
   d) [25 points] What would happen to employment in an industry with 10 firms each maximizing the same profit function in part (a) if the price of energy doubled? Assume that the quantity of energy used can be adjusted quickly.