1. The equation
\[ \varepsilon u'' + (1 + x)u' + u = 0 \]
\[ u(0) = 0 \]
\[ u(1) = 1, \]
has a boundary layer at \( x = 0 \). Find the composite solution (valid everywhere) to leading order as \( \varepsilon \to 0 \).

2. Assume that the similarity solution for flow in the boundary layer over a semi-infinite flat plate holds for a plate of finite length, \( L \). How does the drag force scale with the length of the plate?

3. A two-dimensional (uniform in \( z \)) jet emerges from a narrow slit in a wall at \( x = 0 \) into a fluid which is at rest. Assume that the velocity varies much more rapidly across the jet than along it. Thus one can use the Prandtl equations to find the flow in the jet.

(a) Show that the integral \( M = \int_{-\infty}^{\infty} u^2 \, dy \) is a constant, independent of \( x \).

(b) Show that there is a similarity solution for the streamfunction of the form \( \psi = x^\alpha f(\eta) \) where \( \eta = y/x^\beta \), and identify \( \alpha \) and \( \beta \).

(c) Derive the ODE for the function \( f(\eta) \) and associated boundary conditions.

(d) How does the width of the jet vary as a function of \( x \)? How does the speed in the center of the jet vary as a function of \( x \)?