Problem 241Ea

Examine the solution for potential flow of a uniform stream (velocity U_∞) past a cylinder of radius, R. Determine an approximate expression for the velocity, U, of the flow outside the boundary layer near the front stagnation point. This approximate expression has the form $U = Ax^n$ where x is the distance from the front stagnation point measured along the surface of the cylinder. Determine appropriate values for the constants A and n.

Then use the chart of the Falkner-Skan solutions to find an expression for the laminar boundary layer thickness (defined as the distance from the wall at which $u/U = 0.99$) at the location x on the surface of the cylinder. Denote the kinematic viscosity of the fluid by ν.