

Problem 17-1Drag analysis on a flat plate

As a boundary layer develops on a flat plate, the velocity profile gradually changes from zero velocity (no-slip boundary condition) at the plate surface to some finite free-stream value far away from the plate surface (free-stream matching). If the velocity profile measured at a downstream station, say $x = L$, is modeled by the 1/7 power law:

$$\frac{u(y)}{U_\infty} = \left(\frac{y}{\delta}\right)^{1/7}.$$

Determine the total skin friction drag on the flat plate between $x = 0$ and $x = L$ assuming the width of the plate is w into the page.

