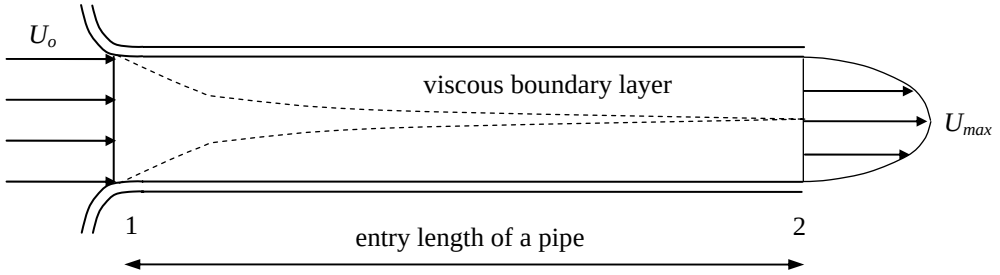
Supplementary Homework Problem (HW Set 21)

Due at the beginning of Lecture 23

Drag analysis over the entry length of a circular pipe
At the entrance of a circular pipe, a flow develops from a uniform velocity, U_o, at the inlet station (1) to a fully-developed parabolic profile

$$u(r) = U_{\max}\left(1 - \frac{r^2}{R^2}\right)$$ at outlet station (2).

In this problem, your goal is to determine the total drag force on the pipe over this entry length section. The solution strategy will follow a 3-step guided approach.



a) Express U_{max} in terms of U_o.

b) Determine the pressure drop from Station 1 to Station 2, *i.e.* $P_1 - P_2$.

c) Determine the total drag force on the pipe over the entry length section.