

Name: _____.

Mini-Exam 2

CM 3110

September 17, 2008

Note:

Significant figures count.

Please box your final answers.

Please be neat.

- (50 points) We are designing a flow loop for water (density = $62.4 \text{ lb}_m/\text{ft}^3$, viscosity = $6.7197 \times 10^{-4} \text{ lb}_m/(\text{ft s})$) using 1/4 inch schedule 40 standard steel pipe (inner diameter = 0.364 in). To ensure good mixing in the pipe, we need the flow to be turbulent. What is the minimum flow rate at which we can run the flow and still get turbulent flow? Please give your answer in gallons per minute (gpm).
- (50 points) Consider the flow depicted in the schematic below. Flow takes place in the narrow space between two very wide and very long plates. The flow is driven by an imposed pressure, which is higher upstream (P_0) than a distance L downstream (P_L). The flow is steady, well developed, and we are considering the region only far from all edges. The fluid is an incompressible, Newtonian fluid. For full credit you will need to correctly indicate the assumptions you used in arriving at your answers.
 - What is the differential equation you need to solve to calculate the velocity as a function of position in this flow?
 - What are the velocity and pressure boundary conditions for this flow?

