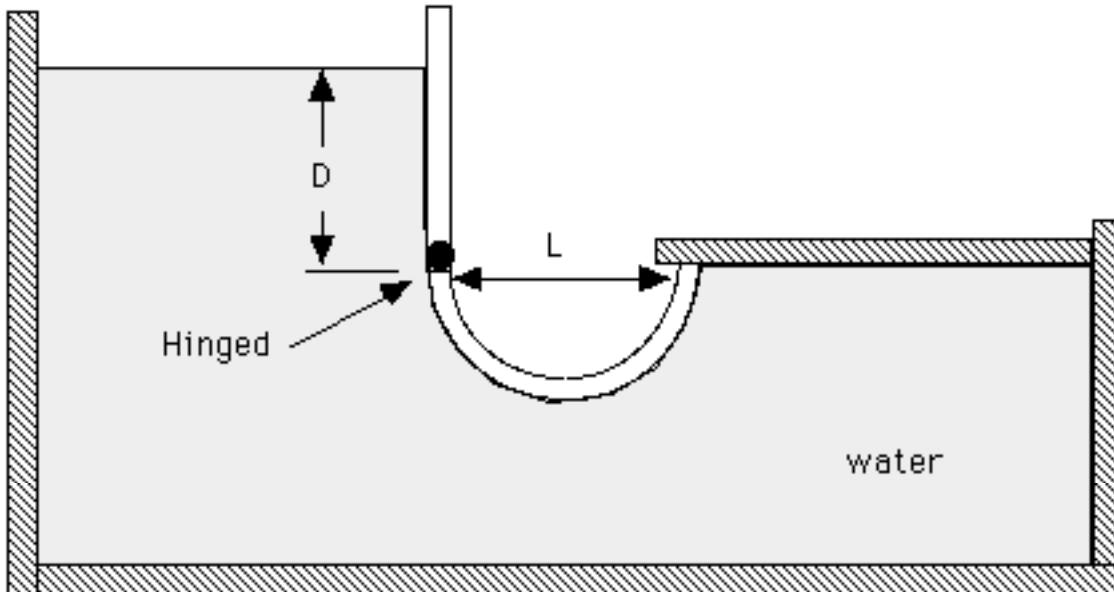


MAE 222
Mechanics of Fluids
First Mid-Term, Fall 199X

One hour, closed book. Make sure you write and sign the honor code pledge. There must be adequate prose in your work to explain what you are doing.

1. What is Reynolds number? What does it mean? What is substantial derivative? Write the substantial derivative of a scalar (such as temperature T) in Cartesian coordinates (velocity components are u, v, w). (15 points)
2. State the momentum equation (Newton's Second Law of Motion) for inviscid, steady flow problems using a control volume fixed in space in *English*. Then translate it into a mathematical expression involving integrals. (15 points)
3. What are the assumptions required for the validity of the Bernoulli's equation? The Bernoulli's equation is: $p/\rho + V^2/2 + gz = \text{constant}$. (10 points)
4. Find D when the hinged (weightless) gate is on the verge of rotating. (40 points)



5. Find the x -component of the force exerted by the reducing elbow on the supply pipe. Flow is inviscid, steady, and density is constant. (20 points)

