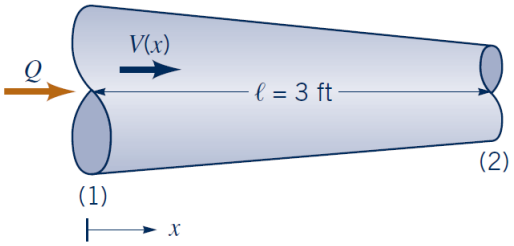
Homework set 5

Due: 2:10 PM – October 5, 2018

Problem 1

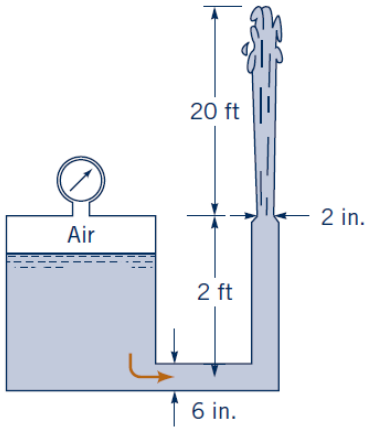
Water flows steadily through the variable area horizontal pipe shown in the figure below. The centerline velocity is given by $\boldsymbol{V} = 10(1+x)\hat{i}$ ft/s, where x is in feet.
(a) Determine the pressure gradient, $\partial P/\partial x$, as a function of x) needed to produce this flow.
(b) If the pressure at section (1) is 50 psi, determine the pressure at (2) by (i) integration of the pressure gradient obtained in (a), (ii) application of the Bernoulli equation.

Note: Viscous effects are neglected.



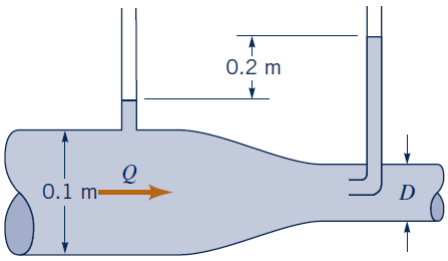
Problem 2

Water flows from a pressurized tank, through a 6-in.-diameter pipe, exits from a 2-in.-diameter nozzle, and rises 20 ft above the nozzle as shown in the figure below. Determine the pressure in the tank if the flow is steady, frictionless, and incompressible.



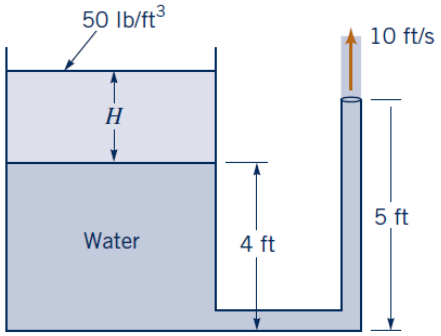
Problem 3

Water flows through the pipe contraction shown in the figure. For the given 0.2-m difference in the manometer level, determine the flowrate as a function of the diameter of the small pipe, D.



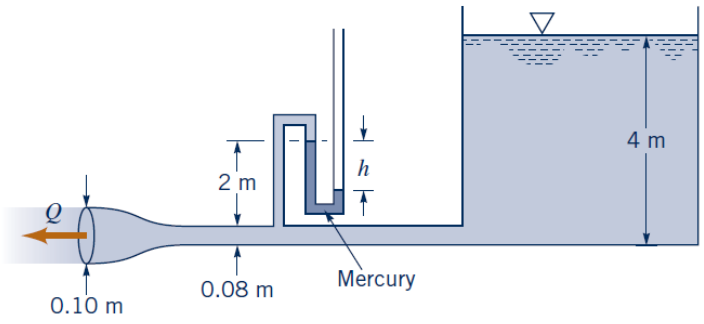
Problem 4

Water (assumed inviscid and incompressible) flows steadily with a speed of 10 ft/s from the large tank shown in the figure below. Determine the depth, H, of the layer of light liquid (Specific weight = 50 lb/ft^3) that covers the water in the tank.



Problem 5

Water flows steadily from the large open tank shown in the figure below. If viscous effects are negligible, determine (a) the flowrate, Q, and (b) the manometer reading, h.



TEXTBOOK

Munson, B.R., Okiishi, T.H., Huebsch, W.W., and Rothmayer, A.P., "Fundamentals of Fluid Mechanics", 7th Edition, 2013, John Wiley & Sons.