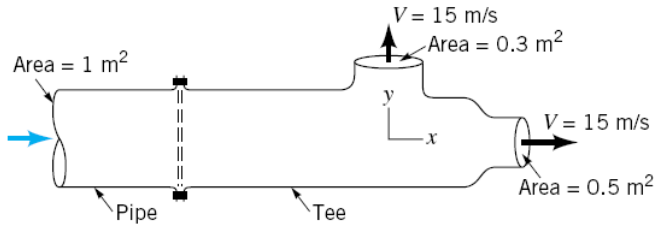


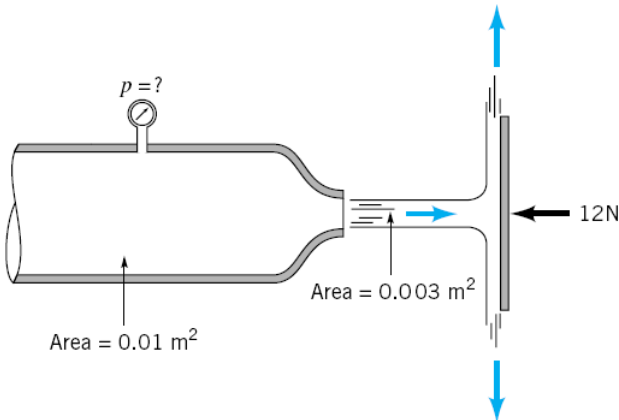
HOMEWORK 3 Assignment date: April 08, 2008 Quiz date: April 15, 2008

5.33 Water flows as two free jets from the tee attached to the pipe shown in Fig. P5.33. The exit speed is 15 m/s. If viscous effects and gravity are negligible, determine the x and y components of the force that the pipe exerts on the tee.



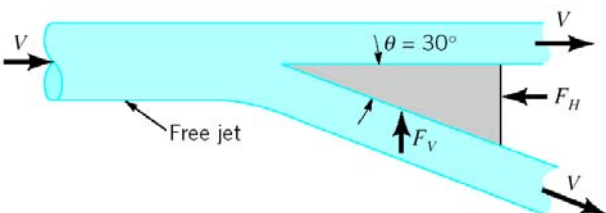
■ FIGURE P5.33

5.52 Air flows into the atmosphere from a nozzle and strikes a vertical plate as shown in Fig. P5.52. A horizontal force of 12 N is required to hold the plate in place. Determine the reading on the pressure gage. Assume the flow to be incompressible and frictionless.



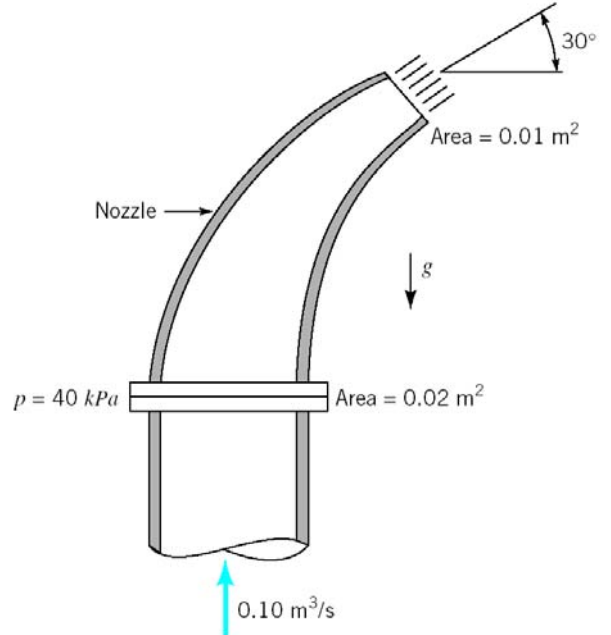
■ FIGURE P5.52

5.47 A free jet of fluid strikes a wedge as shown in Fig. P5.47. Of the total flow, a portion is deflected 30°; the remainder is not deflected. The horizontal and vertical components of force needed to hold the wedge stationary are F_H and F_V , respectively. Gravity is negligible, and the fluid speed remains constant. Determine the force ratio, F_H/F_V .



■ FIGURE P5.47

5.31 A nozzle is attached to a vertical pipe and discharges water into the atmosphere as shown in Fig. P5.31. When the discharge is 0.1 m³/s, the gage pressure at the flange is 40 kPa. Determine the vertical component of the anchoring force required to hold the nozzle in place. The nozzle has a weight of 200 N, and the volume of water in the nozzle is 0.012 m³. Is the anchoring force directed upward or downward?



■ FIGURE P5.31

6.13 The stream function for a certain incompressible flow field is

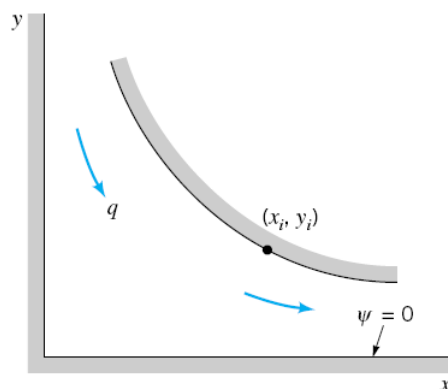
$$\psi = 10y + e^{-y} \sin x$$

Is this an irrotational flow field? Justify your answer with the necessary calculations.

6.33 Consider the incompressible, two-dimensional flow of a nonviscous fluid between the boundaries shown in Fig. P6.33. The velocity potential for this flow field is

$$\phi = x^2 - y^2$$

(a) Determine the corresponding stream function. (b) What is the relationship between the discharge, q (per unit width normal to plane of paper), passing between the walls and the coordinates x_i, y_i of any point on the curved wall? Neglect body forces.



■ FIGURE P6.33