Midterm Test

(9:30-10:45 am on November 19, 2009)

Problem 1 (10). The sluice gate in figure 1 controls flow in open channels. At sections 1 and 2, the flow is uniform and the pressure is hydrostatic. Neglecting bottom friction and atmospheric pressure, derive a formula for the horizontal force F required to hold the gate. Express your final formula in terms of the inlet velocity V_2, eliminating V_1.

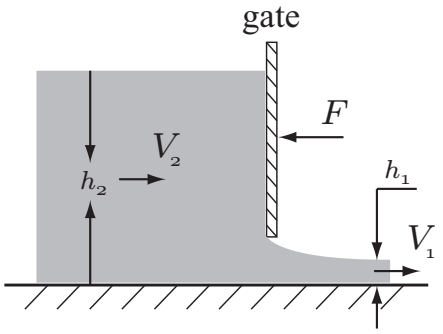

Figure 1: Flow in open channels.

Problem 2 (10). Consider a rocket moving straight up in the gravity field, as in figure 2. Let the initial mass be M_0, and assume a steady exhaust mass flow $\dot{m}$ and exhaust velocity V_e relative to the rocket, as shown. If the flow pattern within the rocket motor is steady and air drag is neglected, derive the differential equation of vertical rocket motion $V(t)$ and integrate using the initial condition $V = 0$ at $t = 0$.

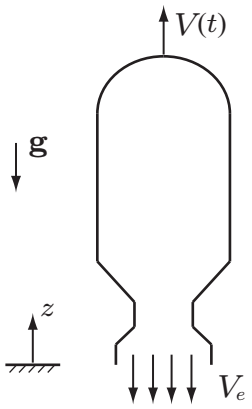

Figure 2: Rocket moving straight up.