

ChE 4400, Spring 2001
Quiz #3
Closed Book, Closed Notes
Allowed Time: 15 minutes

1. Write the unsteady-state material balance for the liquid (water) storage tank below to derive a differential equation for the time behavior of height, $h(t)$. The inlet flowrate q_i is an independent variable.
2. Determine the steady-state value of h corresponding to the steady-state inlet flowrate of $0.5\text{m}^3/\text{min}$.
3. Linearize the differential equation at the calculated steady-state values and derive a transfer function between q_i and h .
4. Suppose you poured a beaker containing 0.1 m^3 of water into the tank at $t=0$. This was done almost instantaneously such that the time duration of pouring can be approximated to be infinitesimally small. Using the linearized model (the transfer function), calculate the time response of the height as function of time. ($h(t)$?)

