ET 438a
Continuous and Digital Control
Integral Process Homework

A tank is drained by a pump that removes liquid at a fixed rate of 0.027 m^3/sec. The full scale flow rate of the pump is 0.075 m^3/sec. The tank has a diameter of 5 meters and is 7.5 meters high. This height is considered the full scale level that the tank can hold. The current level (t=0) in the tank is 35% of it full scale value. The input flow rate into the tank varies due to system demand and is modeled with the following equation:

$$q_{in}(t)=0.0097\sin(0.25t)+0.022 \ m^3/sec$$

Assuming that q_{out} is constant find: 1.) percent q_{in} in terms of full scale pump flow, 2.) the integral time constant for the system, Ti, 3.) a function that gives the tank height as a function of time, h(t), with the initial height of liquid level set at t=0. 4.) Find the height of liquid in the tank after 5 minutes has elapsed from t=0.