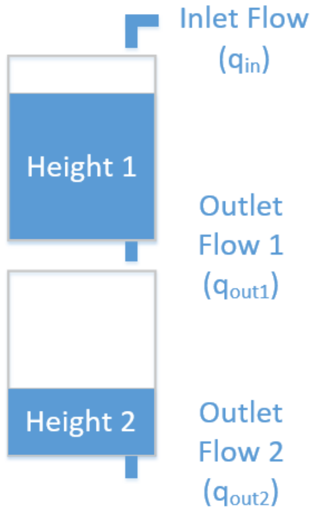
Cylindrical dual gravity drained tanks with a constant cross sectional area (A_c=2 m^2) and maximum height of 1 *m*. If the tank overfills, the excess fluid is lost. There is an inlet flow q_{in}, an intermediate outlet flow from tank 1 to tank 2 as q_{out1}, and a final outlet flow as q_{out2}. All flows are in units of m^3/hr and heights are reported in units of *m*.



A mass balance on each tank is used to derive the following equations that relate inlet flow to the height of the tanks.

$$A_c \frac{dh_1}{dt} = q_{in} - q_{out1} \qquad A_c \frac{dh_2}{dt} = q_{out1} - q_{out2}$$

The outlet flow rate for each tank depends on the height in the tank according to Bernoulli's equation for incompressible fluids as:

$$q_{out1} = c_1\sqrt{h_1} \qquad q_{out2} = c_2\sqrt{h_2}$$

The tanks are initially empty when the inlet to tank 1 starts to flow at a rate of 0.5 m^3/hr.

a) **Solve** for the heights (h_1 and h_2) as functions of time with c_1=0.13 and c_2=0.20. Use a timestep size of **dt=0.5 *hr*** and solve to **t=10 hr**.

b) **Plot** the predicted heights h_1 and h_2 and the measured height h_2 as functions of time on the same plot. Label the axes as "time (hr)" and "height (m)".

Hint: use an explicit Euler's equation applied to each *dh/dt* above: $dh/dt = f(h,t)$ -> $h_{n+1} = h_n + dt*f(h_n,t_n)$. Don't forget to add an IF statement to check for overfill conditions such as =IF(predicted height>1.0,1.0,predicted height).