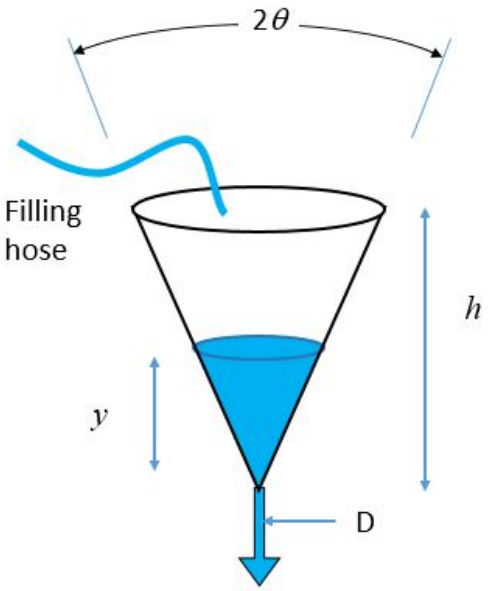
MEE 340 Design Project: Task #2
April 17, 2023

1. Salt water ($\rho = 1065$ kg/m^3, $\nu = 1.05 \times 10^{-6}$ m^2/s) is drained from a large conical reservoir with large diameter of 1.5 meters at the top, 0.8 meters at the bottom, with height of 0.75 meters. It is connected to two horizontal plastic ($\varepsilon \approx 0$ mm) pipes connected in series. The first pipe is is 8 m long and has a 5 cm diameter, while the second pipe is 12 m long and has a 3 cm diameter. The water level in the reservoir is 90% of the overall height of the container with the outlet at the bottom of the reservoir. Incorporate the minor losses where the entrance to the pipe is sharp-edged, is controlled by a ball valve, and the contraction between the two diameter sizes is sudden. Assume that the volume flow rate is constant over 2% change in fluid height ($dh = 1.5$ cm); determine the volume flow rate for each height of water from 67.5 cm deep to 3.0 cm deep. Estimate the total time to empty the reservoir between these two fill levels.



2. Adjust the team's analysis method to consider a rectangular reservoir that has length, width, and height of 1.2, 0.7, and 0.6 m, respectively. How does the total time to drain change?

3. Adjust the analysis method to instead step in 0.5-1.8% height increments for Problems #1 & #2. Confirm that similar estimates on emptying container are achieved.