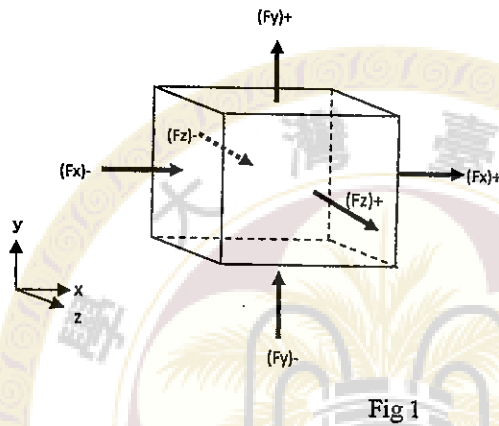
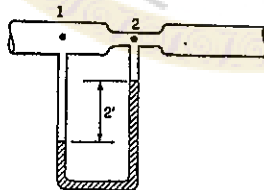


1. Answer the following questions:
 - (a) Describe the Lagrangian and Eulerian methods and highlight their differences when they are used to present the motion of fluid. (15 points)
 - (b) What are Newtonian fluid and Non-Newtonian fluid? (10 points)
2. Consider a control volume of a cubic shape in a flow field as shown below (Fig 1). Its side lengths are dx , dy and dz , respectively. The mass flux vector at the central point of the cube is denoted as $\rho \vec{V}$.



- (a) Determine the net rate of mass outflow from this cubic volume. (10 points)
 - (b) Derive the equation of mass conservation for an incompressible in the system. (15 points)
3. A Venturi meter with a throat diameter for 6 in. is placed in a 12-in.-diameter pipeline. It meters the flow of oil having a specific gravity $S_o = 0.08$. A differential manometer containing a fluid of specific gravity $S_M = 3.20$ is connected between the pipe and the throat section and shows a deflection of 24 in. Above the manometer liquid the tubes are filled with oil (Fig 2). Neglecting energy losses, what is the indicated flow through the meter? (25 points)



4. The trapezoidal channel shown in Fig 3. with $S = 0.0009$ and $n = 0.025$, carries a discharge $Q = 300$ cfs. Compute the flow depth y and the average velocity V . (25 points)

