Fluid Mechanics Homework #4

繳交期限：**2019/10/16(三) 09:10**

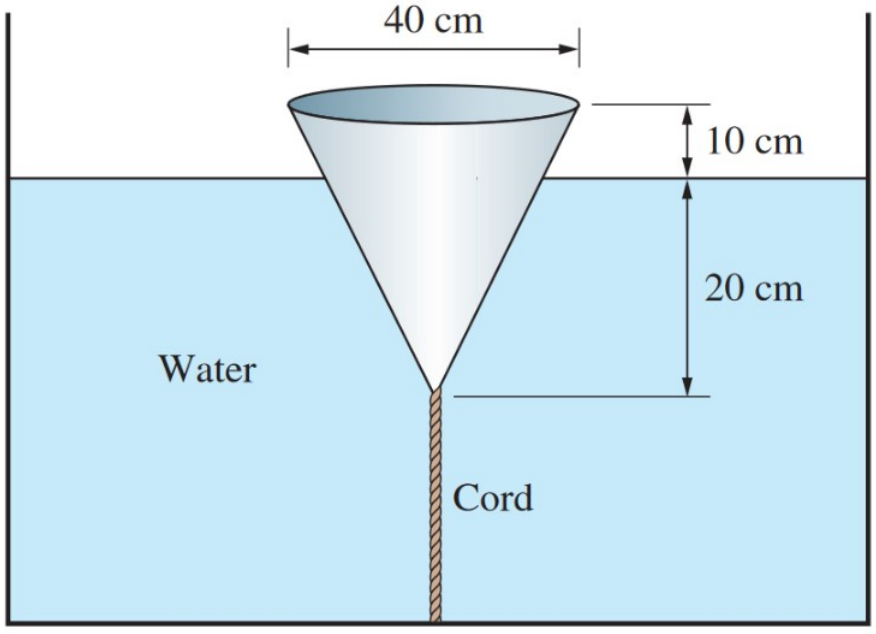
共五題，題號為：**3-96,118,4-6C,16,17**

題號的對照書本是 **Yunus A. Cengel and John M. Cimbala "Fluid Mechanics: Fundamentals and Applications 3/e (SI Units) "**

$3-96$

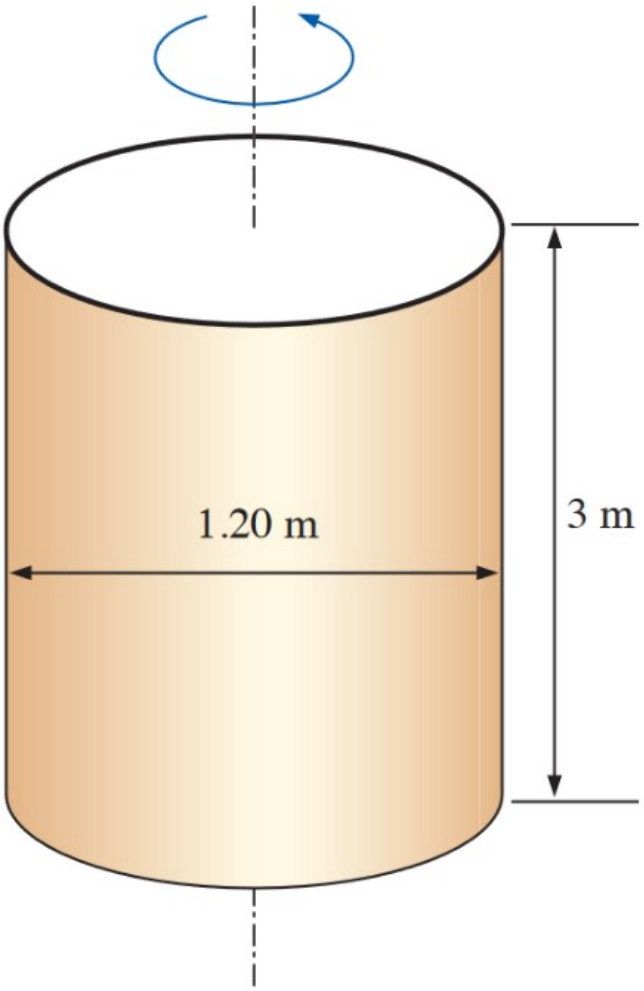
Take the water density to be $1000\ kg/m^3$

An inverted cone is placed in a water tank as shown. If the weight of the cone is 16.5 N, what is the tensile force in the cord connecting the cone to the bottom of the tank?



$3-118$

A 1.2-m-diameter, 3-m-high sealed vertical cylinder is completely filled with gasoline whose density is 740 kg/m^3. The tank is now rotated about its vertical axis at a rate of 70 rpm. Determine (*a*) the difference between the pressures at the centers of the bottom and top surfaces and (*b*) the difference between the pressures at the center and the edge of the bottom surface.



4 – 6*C* (切勿抄襲，請依自己理解作答)

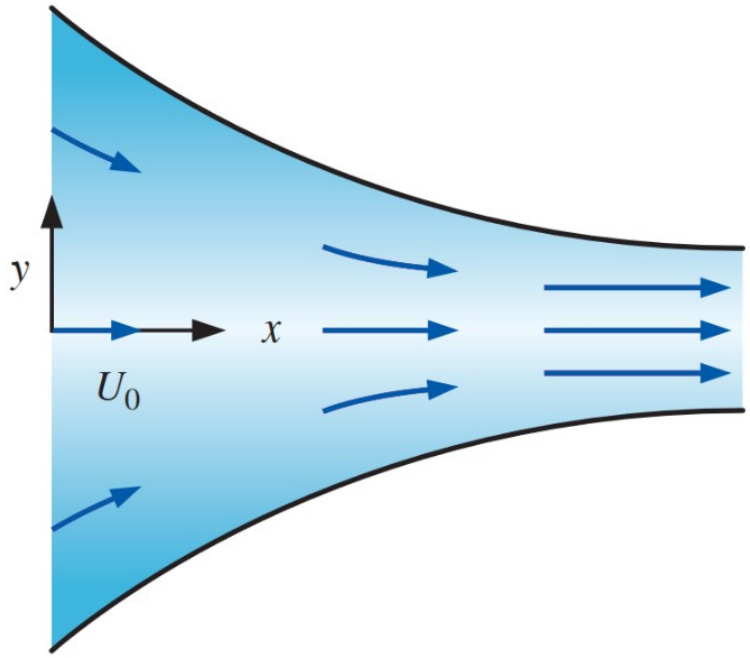
What is the *Eulerian description* of fluid motion? How does it differ from the Lagrangian description?

4 – 16

Consider steady, incompressible, two-dimensional flow through a converging duct (Fig. P4–16). A simple approximate velocity field for this flow is

$$\vec{V} = (u, v) = (U_0 + bx)\vec{i} - by\vec{j}$$

where U_0 is the horizontal speed at $x = 0$. Note that this equation ignores viscous effects along the walls but is a reasonable approximation throughout the majority of the flow field. Calculate the material acceleration for fluid particles passing through this duct. Give your answer in two ways: (1) as acceleration components a_x and a_y and (2) as acceleration vector $\vec{a}$.



4 – 17

Converging duct flow is modeled by the steady, two-dimensional velocity field of Prob. 4–16. The pressure field is given by

$$P = P_0 - \frac{\rho}{2}\left[2U_0bx + b^2(x^2 + y^2)\right]$$

where P_0 is the pressure at $x = 0$. Generate an expression for the rate of change of pressure *following a fluid particle*.