1. (1). Determine the magnitude of the force acting on one side of the vertical triangle ABC of Fig. 1 by integration. (10%)

 (2). Locate the distance of pressure center (x_p, y_p) below the liquid surface in the triangular area ABC of Fig. 1 by integration. (10%)

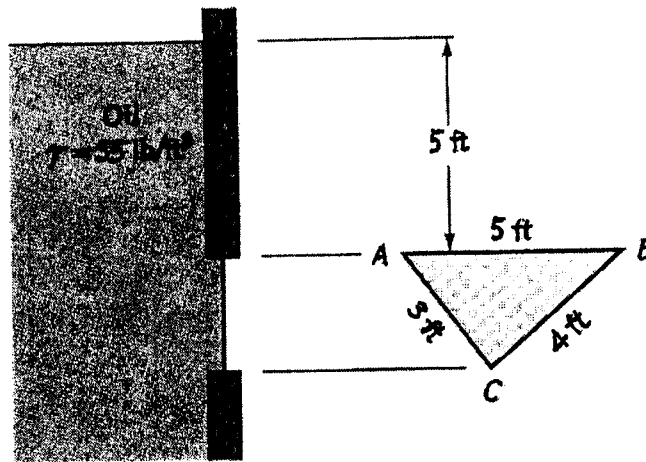Fig. 1

2. Calculate the average velocity and kinetic-energy correction factor for the velocity distribution in a pipe,

$$\frac{v}{v_{max}} = \left(\frac{y}{r_o}\right)^{1/7}$$ with y the wall distance and r_o the pipe radius. (20%)

3. Please draw a figure and derive the equation of both velocity distribution and flow rate for the laminar, incompressible, steady flow in the circular pipe. (20%)

4. At section 1 of a canal the cross section is trapezoidal, $b_1 = 14$ m, $m_1 = 2$, and $y_1 = 9.8$ m, and at section 2, downstream 353 m, the bottom is 0.065 m higher than at section 1, $b_2 = 16.3$ m, and $m_2 = 2.5$, $Q = 730$ m³/s and n = 0.034. Determine the depth of water at section 2. (20%)

5. Please draw a figure and derive the equation of fluid viscosity by using Concentric-cylinder viscometer [Note: please consider the effect of bottom disk]. (20%)