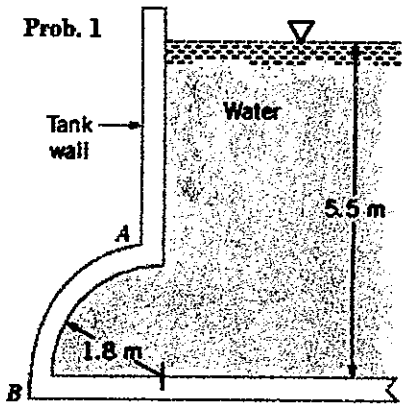
Prob. 1 (25%)

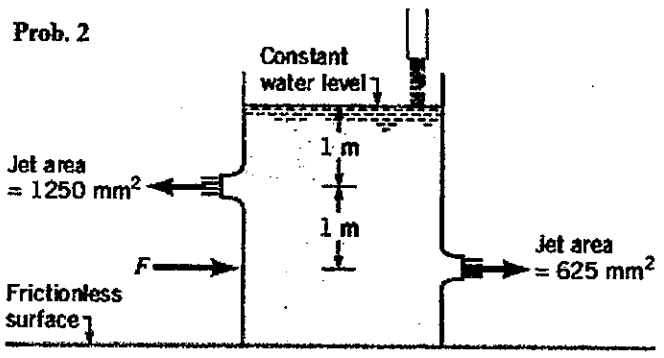
A tank wall has the shape shown in the figure.

Determine the horizontal and vertical components of the force of the water on a 1 m length (unit length in the direction normal to the paper) of the curved section AB.



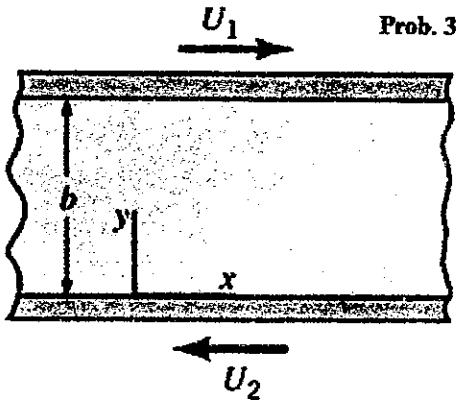
Prob. 2 (25%)

Water is added to the tank shown in the figure through a vertical pipe to maintain a constant water level. The tank is placed on a horizontal plane which has a frictionless surface. Determine the horizontal force, F, required to hold the tank stationary. Neglect all losses.



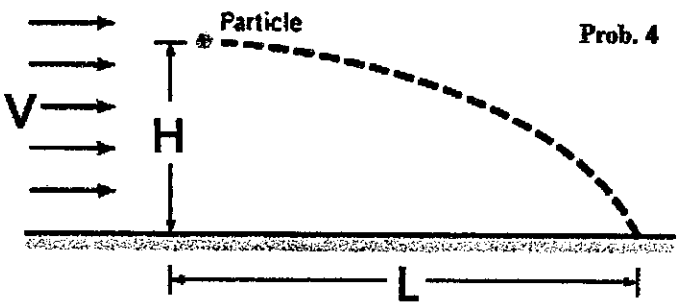
Prob. 3 (25%)

An incompressible, viscous fluid is placed between horizontal, infinite, parallel plates separated by a distance b, as shown in the figure. The two plates move in opposite directions with constant velocities, U_1 and U_2, as shown. The pressure gradient in the x direction is zero, and the only body force is due to gravity in the y direction. Use the Navier-Stokes equations to derive an expression for the velocity distribution between the plates. Assume laminar flow.



Prob. 4 (25%)

When small particles of diameter D are transported by a moving fluid having a velocity V, the particles settle to the ground at some distance L after starting from a height H as shown in the figure. The variation in L with various factors is to be studied with a model having a length scale of $\frac{1}{10}$. That is the model is smaller in size than the prototype. Assume that L is a function of H, D, V, γ, μ, where γ is the particle specific weight and μ is the fluid dynamic viscosity. The same fluid is to be used in both the model and the prototype, but γ (model)=9 × γ (prototype). That is the specific weight of the particle in the model is 9 times the specific weight of the particle in the prototype.



(a) Find the dimensionless groups using the dimensional analysis.

(b) If V = 80 km/h in the prototype, at what velocity should the model tests be run?

(c) During a certain model test it was found that L (model) = 0.24 m. What would be the predicted L in the prototype for this test?

試題隨卷繳回