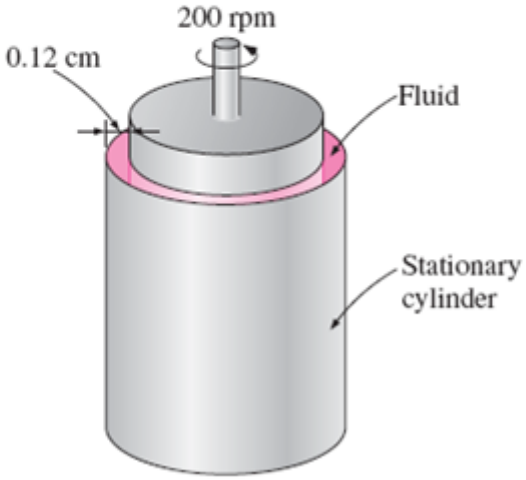
# Review problems for Midterm exam1 for 057:020, Fall 2007

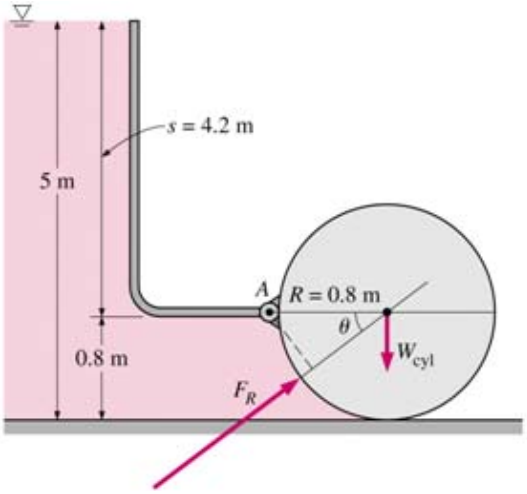
## Chapter 1: Shear stress

The viscosity of a fluid is to be measured by a viscometer constructed of two 75-cm-long concentric cylinders. The outer diameter of the inner cylinder is 15 cm, and the gap between the two cylinders is 0.12 cm. The inner cylinder is rotated at 200 rpm, and the torque is measured to be 0.8 N · m. Determine the viscosity of the fluid.



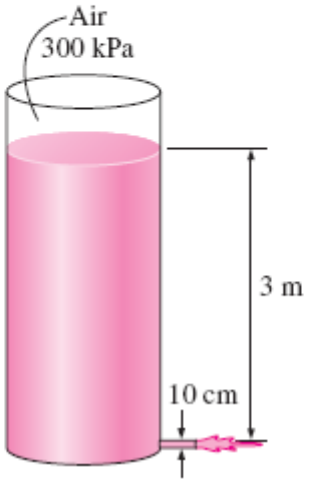

## Chapter 2: Hydrostatic forces

A long solid cylinder of radius 0.8 m hinged at point *A* is used as an automatic gate, as shown in Fig. 3–36. When the water level reaches 5 m, the gate opens by turning about the hinge at point *A*. Determine (*a*) the hydrostatic force acting on the cylinder and its line of action when the gate opens and (*b*) the weight of the cylinder per m length of the cylinder.



## Chapter 3: Bernoulli equation

A pressurized tank of water has a 10-cm-diameter orifice at the bottom, where water discharges to the atmosphere. The water level is 3 m above the outlet. The tank air pressure above the water level is 300 kPa (absolute) while the atmospheric pressure is 100 kPa. Neglecting frictional effects, determine the initial discharge rate of water from the tank.




## Chapter 4: Fluid kinematics

Consider steady flow of water through an axisymmetric garden hose nozzle. Along the centerline of the nozzle, the water speed increases from $u_{entrance}$ to $u_{exit}$ as sketched. Measurements reveal that the centerline water speed increases parabolically through the nozzle. Write an equation for centerline speed $u(x)$, based on the parameters given here, from $x = 0$ to $x = L$.

For the velocity field , calculate the fluid acceleration along the nozzle centerline as a function of $x$ and the given parameters.