

## Homework 2: AE550, Viscous Fluid Flow

Sept. 18 2008

Due: September 25, 2008 (beginning of class)

### Problem 1.

Consider a wide liquid film of constant thickness  $h$  flowing steadily due to gravity down an inclined plane at angle  $\theta$  as shown in the figure. Outside the layer the pressure is atmospheric and we neglect the shear stress on the free surface. Determine the velocity distribution as

$$u = \frac{\rho g \sin \theta}{2\mu} y(2h - y) \quad (1)$$

Also determine the volume flow rate per unit width as

$$Q = \rho g h^2 \sin \theta / 3\mu \quad (2)$$

Compare with the solution to the flow between parallel plates. Comment on this comparison.

### Problem 2

Derive the continuity equation in spherical polar coordinates.

