**Chemical Engineering 374**

**Reading Questions 19—Chapter 9.5-9.6**

**Name** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What kind of fluid is assumed for the Navier-Stokes (N-S) equation?
2. What assumption about the fluid density was also made in order to obtain the N-S equation?
3. How are each of the following boundary conditions expressed mathematically?
   1. No-slip boundary condition
   2. Interface boundary condition
   3. Free-surface boundary condition
4. From Example 9-18 for fully-developed laminar flow in a pipe,
   1. What boundary condition was applied to the centerline of the pipe (r=0)?
   2. How is the average velocity related to the maximum (centerline) velocity?
   3. What is the shear stress in the fluid as a function of the radial position?
5. In Example 9-19, when Equation 5 was integrated to give Equation 8, why was the integration “constant” not a constant at all, but a function?