Homework Set 7
BE-382, Winter '08-'09, Dr. C. S. Tritt

Due 1/19

Note that both *u* and *v* are used to represent velocities in the following problems.

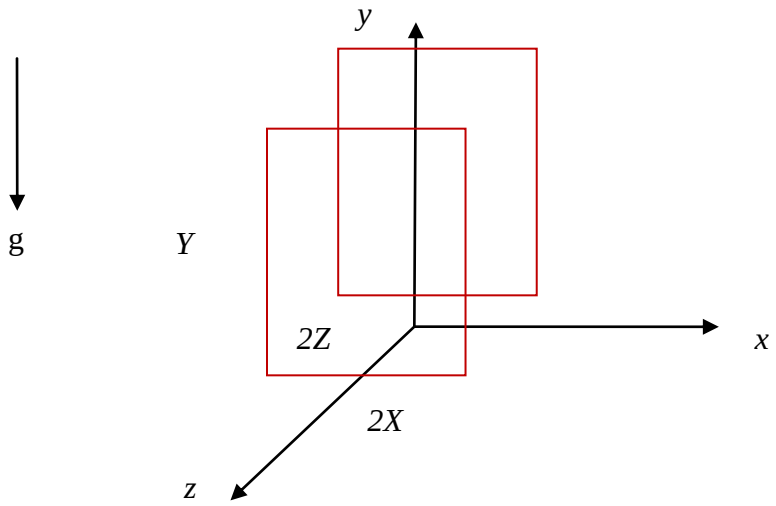
1. Show that the following 2-D flow field satisfies the continuity equation for steady flow of an impressible fluid:

$$u_r = \frac{1}{2} r^{-1/2} \cos\frac{\theta}{2}$$

$$u_\theta = -\frac{1}{2} r^{-1/2} \sin\frac{\theta}{2}$$

2. Write the equations and boundary conditions you would use to find the steady-state velocity distribution throughout a short, circular tube. Call the length of the tube *L*, its radius *R*. Assume a flat inlet velocity distribution ($v = v_0$ at all $r < R$) and incompressibility.

3. Write the equations boundary and initial conditions you'd use to find the transient velocity distribution in a fluid flowing through a finite slit. Neglect pressure differences, but not gravity. Assume the fluid is initially at rest and at time zero the bottom of the slit is opened allowing the fluid to move (prior to this, there would be a hydrostatic pressure gradient that would counter gravity). Assume a uniform inlet velocity distribution. Assume the slit is oriented as shown below.



Note the drawing is poor because Word's drawing tool really sucks. The vertices of the two red rectangles should be connected. The slit is a 2*X* by *Y* by 2*Z* rectangular prism. The faces in the *y*-*x* and *y*-*z* planes are solid. The openings are in the *x*-*z* plane at $y = 0$ and $y = Y$.