Flow is sent into a constant-area channel with two different top and bottom velocities, as shown in the figure. We will assume that the layer between them has a simple linear profile, so that the overall velocity profile across the channel is as follows (also plotted below right).

$$u = \begin{cases} 1.5 & , \quad 0.1 < y < 1.0 \\ 1.0 + 5y & , \quad -0.1 < y < 0.1 \\ 0.5 & , \quad -1.0 < y < -0.1 \end{cases}$$

$$v = 0$$

a) Determine and sketch a streamfunction $\psi(y)$ for this flow. Your result will be in three joined pieces like $u(y)$ above. (Hint: Set the integration constants to get continuity)

b) Determine and sketch the vorticity profile $\xi(y)$ for this flow.

c) Do your velocity and vorticity fields satisfy the Helmholtz Equation? Explain.