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).

\[
\begin{align*}
    u &= \begin{cases} 
    1.5 & , \quad 0.1 < y < 1.0 \\
    1.0 + 5y & , \quad -0.1 < y < 0.1 \\
    0.5 & , \quad -1.0 < y < -0.1
    \end{cases} \\
    v &= 0
\end{align*}
\]

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.