Problem 137A

The incompressible planar potential flow of a uniform stream of velocity, U, past a cylinder of radius, R, has the following complex potential in the absence of circulation:

$$f = \phi + i\psi = U(z + R^2/z)$$

where ϕ, ψ are respectively the velocity potential and the stream function and z is the vector $x + iy$.

Show that the flow around a flat plate set normal to the uniform stream can be generated by the conformal mapping

$$\zeta = z - R^2/z$$

and find the width of the plate in terms of R.

Using the above solution find the location on the surface of the flat plate at which the fluid velocity is equal to U.