

### Problem 119B

Both of the following steady, planar potential flows of an incompressible fluid (density,  $\rho$ ) could represent steady vortex-like motion since both have streamlines which are concentric circles about the origin ( $x = 0, y = 0$ ):

$$(i) \quad \psi = A(x^2 + y^2) \quad (ii) \quad \psi = \frac{A}{2} \ln(x^2 + y^2)$$

Find:

- (a) The magnitude of the velocity at a distance,  $r$ , from the origin in terms of  $r$  and  $A$  for both flows.
- (b) The vorticity,  $\omega$ , for both flows. One of them is irrotational; determine which one.
- (c) The pressure,  $p$ , in the irrotational flow assuming the flow is inviscid and that gravity and other body forces can be neglected. Also assume that the pressure at infinity ( $r \rightarrow \infty$ ) is known; denote it by  $p_\infty$ .