

Problem 115B

The following is the streamfunction for a particular steady, planar, incompressible and inviscid flow:

$$\psi = A(x^2y - y^3/3)$$

where A is a known constant.

- (a) Find expressions for the velocity components u and v in this flow.
- (b) Find an expression for the vorticity.
- (c) We can define a velocity potential, ϕ , for this flow. Why? Find an expression for the velocity potential assuming the value of the velocity potential at the origin is zero.
- (d) Make a rough sketch of the streamlines of this flow.
- (e) Find an expression for the pressure in this flow assuming that the pressure, p , at the origin is known. Denote the fluid density by ρ and neglect all body forces. What shape are the lines of constant pressure (isobars) ?