

AME60635 ASSIGNMENT qhw10
EXAMINATION PREPARATORY PROBLEMS

Problem 10-1 An incompressible flow field is represented by the stream function $\psi = 3Ax^2y - Ay^3$, where A is a constant. [a] Is this flow field rotational or irrotational (prove it)? [b] Determine the velocity potential, ϕ . [c] Sketch a couple of streamlines in the first (x, y) quadrant to show their *qualitative* behavior. [d] what are the SI units of A ?

Problem 10-2 Consider the two-dimensional, incompressible, irrotational flow that is formed from the superposition of a doublet, uniform flow and a clockwise free vortex. Determine the flow's [a] stream function, Ψ , [b] velocity potential, Φ , and [c] r and θ velocity components. Noting that this flow field describes the flow about a cylinder, determine [d] the expression for the cylinder's radius in terms of constants that are present in the flow's stream function. Next, find the θ locations of the stagnation point(s) on the cylinder and, finally, [e] the expression for the pressure distribution on the cylinder's surface.