Homework 4

Due Nov 14, 2006.

1 [Milne-Thomson 6.4] Sketch the streamlines represented by $\phi + \mathrm{i}\psi = Az^2$ (A is real), and show that the speed is everywhere proportional to the distance from the origin.

2 [Kundu 6.13] A hurricane is blowing over a long "Quonset hut", that is, a long half-circular cylindrical cross-section building, 6 m in diameter. If the velocity far upstream is $U_\infty = 40$ m/s and $p_\infty = 1.003 \times 10^5$ N/m, $\rho_\infty = 1.23$ kg/m^3, find the force per unit depth on the building, assuming the pressure inside is p_∞.

3 Derive the following expression for the moment about the origin of the forces acting on a body in steady two-dimensional potential flow:

$$\text{Real part of } \left[-\tfrac{1}{2}\rho \int_C z \left(\frac{\mathrm{d}w}{\mathrm{d}z} \right)^2 \mathrm{d}z \right].$$

4 Compute the force on the wall $y = 0$ due to the dipole with strength $\mathbf{D}$ at $(0, a)$.