APPH 6101 Plasma Physics I  
Homework 8: Due 17 November, 2005.

Questions 1-5

Due problems 6.9, 6.10, 6.11, 6.12, and 6.13 in Gurnett and Bhattacharjee, p. 247-248.

Question 6

Consider an inviscid (i.e. without viscosity) conducting plasma that is in a state of steady (but not necessarily uniform) rotation about the z-axis. Let the plasma conductivity be uniform in space, \( \sigma \). Let the magnetic field be given as \( \mathbf{B} = (B_z, B_r, 0) \), having no azimuthal component.

Part a

(Ignoring Hall terms in Ohm’s Law), show that

\[
\nabla \times \mathbf{J} = \sigma \nabla \times (\mathbf{V} \times \mathbf{B})
\]

Part b

Explain why the plasma current is wholly azimuthal. Since \( \nabla \cdot \mathbf{B} = 0 \), show that the fluid has constant uniform angular velocity along any field line.