Exercises for Space Plasma Physics:
VII. Stationary MHD

1. Discuss mathematical similarities and differences of MHS and stationary, incompressible hydro-dynamics.

2. Is this similarity useful to study stationary MHD? Under which conditions?

3. What are quasi-static equilibria? Is this a useful concept at all?

4. Euler potentials are defined as $\vec{B} = \nabla\alpha \times \nabla\beta$. Discuss briefly advantages and disadvantages of using Euler potentials.

5. For simplicity, one often investigates configuration in 2D, which are invariant in one spatial coordinate (say in y) and uses a flux function $A(x, z)$ with $\vec{B} = \nabla A \times \vec{e}_y$. Can you provide the vector potential and the Euler potentials for a given flux-function?

6. Now let's consider the full 3D case. Assume you have α and β given. Can you derive a coresponding vector potential $\vec{A}$?