Physics 405 Spring 2009

Problem Set #2: DUE Fri. Feb. 6 2007

Read: Griffiths Chap. 2.1

(1) Notion of Flux: (Griffiths 1.29), postponed from Problem 1, of P.S. #1 (10points).

(2) Griffiths, Problem 1.54 page 55   (10 points)

(3) Griffiths, Problem 1.58 page 56   (10 points)
(Use the expression for Div. in spherical coordinates given in the inside cover of
Griffiths)

(4) The following are general vector differential identities (10 points):

$$\nabla \times (\nabla \Phi) = 0 , \quad \nabla \cdot (\nabla \times \mathbf{A}) = 0 \cdot$$

where Φ is an arbitrary scalar field and $\mathbf{A}$ is an arbitrary vector field. Prove that these are
consequences of the geometrical fact:

The boundary of a boundary has no dimension (i.e. is a point).

Hint: Apply Stokes' Theorem, the Divergence theorem, and/or the Fundamental theorem
on integrals of gradients twice to these double derivatives.