

Physics 405 Spring 2007

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

Read: Griffiths Chap. 2.1

(1) Mathematica program, postponed from Problem 1, of P.S. #1 (6 points).

(2) **Griffiths**, Problem 1.54 page 55 (12 points)

(3) **Griffiths**, Problem 1.58 page 56 (12 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):

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

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.