Problem Set 1

Physics 41

Due Date: Friday, September 4, 2009

1. Chapter 1: Problems 73, 74, 76, 78 and Chapter 2: Problems 63, 96, 122.

2. A vector field describes a set of vectors at every spatial point described by coordinates (x, y, z). Consider two 2-dimensional vector fields given by $\mathbf{A}(x, y, z) = (y\mathbf{i} - x\mathbf{j})/\sqrt{x^2 + y^2}$ and $\mathbf{B}(x, y, z) = (x\mathbf{i} + y\mathbf{j})/\sqrt{x^2 + y^2}$.

   (a) Find $|\mathbf{A}|$ and $|\mathbf{B}|$.

   (b) Find $\mathbf{A} \cdot \mathbf{B}$ and $\mathbf{A} \times \mathbf{B}$.

   (c) Roughly sketch on a paper both the vector fields. Do you understand the answer for the dot product and cross product found above pictorially.

3. Find the derivatives of the following functions of x.

   (a) $f(x) = \ln(a + bx)$

   (b) $f(x) = \frac{1}{\sqrt{x^2+a^2}}$

   (c) $f(x) = \arcsin(x)$

4. Integrate the following functions of x.

   (a) $f(x) = \frac{1}{a+bx}$

   (b) $f(x) = \ln x$

   (c) $f(x) = \frac{1}{a^2+x^2}$