Fundamentals of Electromagnetic Fields and Waves: I

Fall 2006, EE 30348, Electrical Engineering, University of Notre Dame

Assignment 2

Due date: **Tuesday, September 12th (in class)**.

1) **Contour (line) integrals:**
Iskander: Problem 1.26, Problem 1.27, Problem 1.28, Problem 1.29, Problem 1.30.

2) **Surface Integrals:**
Iskander: Problem 1.31, Problem 1.32, & Problem 1.33.

3) **Volume Integrals:**
A sphere of radius r_0 centered around the origin has charge distributed non uniformly inside. Find the total charge in the sphere (in Coulombs, or C) if the volume-density of charge (in $\mathrm{C/m^3}$) at any point (r, θ, ϕ) is given by
a) $\rho_v(r, \theta, \phi) = \rho_0 r \cos(\theta)$,
b) $\rho_v(r, \theta, \phi) = \rho_0 \sin(qr)$ [where q is a constant], &
c) $\rho_v(r, \theta, \phi) = Q_0 \delta(\mathbf{r})$ [where $\delta(...)$ is a Delta-function].

4) **Gauss's law:**
Iskander: Problem 1.34, & Problem 1.35.

5) **Coulomb vs. Gauss, CvG part I:**

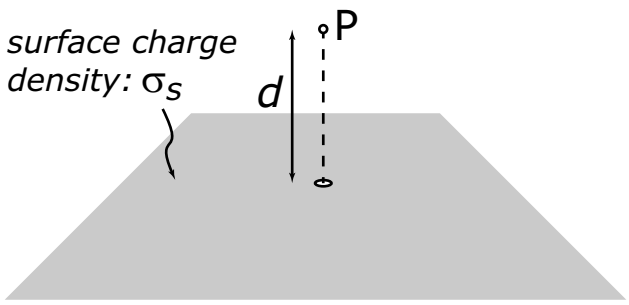

Figure 1: Setup for Problem 5.

Consider an infinite sheet, as shown in Figure 1. Let's sprinkle some charge on it such that it distributes uniformly with a sheet density σ_s (in C/m^2). Imagine you are sitting at point P, distance d from the sheet.
a) Find the electric field **E** at point P using Coulomb's law. Does it depend on d?
b) Find the same now using Gauss's law.
c) If you have done it right, take a moment to appreciate the ease and power Gauss's law gives you.

Please attach this sheet on top of your solutions.