Static Fields Homework 4

Due 4/13/18 @ 4:00 pm

PRACTICE:

1. (a) Write down $d\vec{A}$ for each of the surfaces of a rectangular prism, a finite cylinder, and a sphere.

   (b) Write down $d\tau$ in rectangular, cylindrical, and spherical coordinates.

REQUIRED:

1. (a) Charge is distributed throughout the volume of a dielectric cube with charge density $\rho = \beta z^2$, where z is the height from the bottom of the cube, and where each side of the cube has length L. What is the total charge inside the cube? Do this problem in two ways as both a single integral and as a triple integral.

   (b) Charge is distributed on the surface of a dielectric cube with charge density $\sigma = \alpha z$, where z is the height from the bottom of the cube, and where each side of the cube has length L. What is the total charge on the cube? Don't forget about the top and bottom of the cube.

2. Use integration to find the total mass of ice cream in a packed cone (both cone and hemisphere of ice cream on top).

3. Using integration, find the surface area of a cone.

4. (a) Starting with the integral expression for the electrostatic potential due to a ring of charge, find the value of the potential everywhere along the axis of symmetry.

   (b) Find the electrostatic potential everywhere along the axis of symmetry due to a finite disk of charge with uniform (surface) charge density σ. Start with your answer to part (a)

   (c) Find two nonzero terms in a series expansion of your answer to part (b) for the value of the potential very far away from the disk.