Homework 2
Due at the beginning of class Jan. 22

1. Derive the expression for $\nabla \cdot \hat{\Re}/|\vec{\Re}|^2$ for $\vec{\Re} \neq 0$, and $\vec{\Re} = \vec{r} - \vec{r'}$ with $\vec{r}$ locating an arbitrary field point for the source at $\vec{r'}$. Use cartesian coordinates.

2. Derive an expression for the electric field at an arbitrary point from a uniformly charged arc of a circle of radius R (centered at the origin) which is in the x-y plane of the cylindrical coordinate system. The segment of the circle goes from $\phi = 0$ to $\phi = \pi/2$.

3. A uniformly charged spherical shell of radius R and charge density σ has a small hole in it. What is the approximate electric field in the hole?

4. Shadowitz section 1-5 problem 10.

5. Verify the divergence theorem for the electric field from a spherical object or radius R which has charge density $\rho = \alpha r$ using a spherical surface with $r > R$.

6. Calculate the charge within a prism in which the charge density is given by $\rho = xyz^2$ while the prism is formed by a triangle in the xy plane extending up the z-axis to z=3. One side of the triangle is along the x axis from 0 to 1. Another side is along the y axis from 0 to 1. The third side connects these two lines.

7. Two spherical cavities are hollowed out of a large spherical chunk of metal. A point charge is placed at the center of each cavity, one having charge q_a and the other q_b. Find the surface charges both within and on the ouside of this metal object.

8. Derive the expression for the reflected particle density for a stream of photons in one dimension reflecting from a moving mirror (see class notes). The incident photon density is λ_{in} and the mirror moves at constant speed V. **(b) How does the calculation change if the mirror accelerates? (c) How does the calculation change if the model is for a stream of balls incident on the mirror (assume they can pass through each other)?**