

Assignment #2 for Electricity and Magnetism: Physics 334

1. A static charge distribution produces a radial electric field

$$\mathbf{E}(r) = A \frac{e^{-kr}}{r^2}, \quad (1)$$

where A and k are constant.

- What is the charge distribution $\rho(r)$?
 - Sketch $\rho(r)$ as a function of r .
 - What is the total charge Q in all space?
2. Suppose that instead of the Coulomb force law, the force between two point charges q_1 and q_2 was

$$\mathbf{F}_{12} = \frac{q_1 q_2}{4\pi\epsilon_0} \frac{(1 - \sqrt{\alpha r_{12}})}{r_{12}} \hat{r}, \quad (2)$$

where α is a constant.

- What is the appropriate electric field \mathbf{E} surrounding a point charge?
- Choose a path around the point charge and calculate the line integral

$$\oint \mathbf{E} \cdot d\ell.$$

Compare with the Coulomb result.

- Find

$$\oint \mathbf{E} \cdot d\mathbf{a}$$

for a spherical surface of radius R with the charge at the center. Compare with the Coulomb result.

- Repeat (c) at radius $R + \Delta$ and find $\nabla \cdot \mathbf{E}$ at distance R from the point charge.

3. Robert Good: Chapter 2 #'s 2-1 through 2-21.