

Problem Set #5
Due at 4pm Friday, October 14, 2005

1. Fields in a non-uniform material

- a) Griffiths Problems 4.33 (p. 198)
- b) We can generalize part (a) by considering a material in which the permittivity varies continuously with z , $\epsilon = \epsilon(z)$. Assume E_x and E_z depend only on z while $E_y = 0$, and $\rho_f = 0$ everywhere. On the plane $z = 0$, the material has $\epsilon(0) = \epsilon_0$ and the field is arranged so that $E_x(0) = E_z(0) = E_0$. Determine \vec{E} , \vec{D} , and ρ_b everywhere in terms of $\epsilon(z)$.

2. Griffiths Problem 5.3 (p. 208)

3. Griffiths Problem 5.10 (p. 220)

In each case, consider the limit $a \rightarrow 0$ and show that $\vec{F} = \vec{\nabla}(\vec{m} \cdot \vec{B})$ where \vec{m} is proportional to the area of the loop (and therefore proportional to a^2). Find the magnitude and direction of \vec{m} .

4. Griffiths Problem 5.29 (p. 240)

Evaluate both \vec{A} and \vec{B} both inside and outside the sphere.

5. Griffiths Problem 5.38 (p. 247)