(3) In class problem

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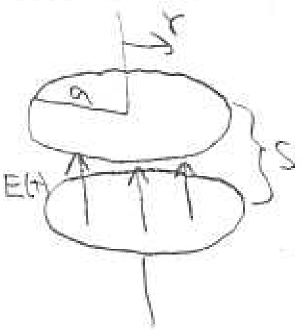
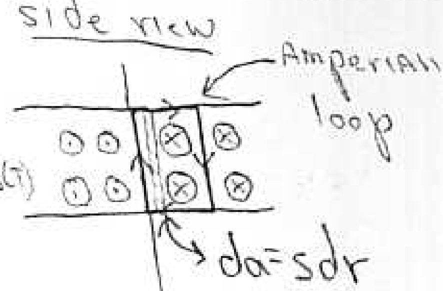
Calculate the first 2 Terms in the perturbation expansion for the magnetic field and the first 3 Terms for the electric field for a parallel plate capacitor (harmonic dependence of the electric field).





* when Taking E·dl only S length side counts

Call: $E_1 = E_0 e^{i\omega t}$

correction field $= E_2$

$\vec{E}(r=0) = E_0 e^{i\omega t}$

$E_2(r=0) = 0$

START

$$\vec{\nabla} \times \vec{B} = \mu_0 \epsilon_0 \frac{\partial E}{\partial t}$$

from stokes theorem..

$$\int \vec{B} \cdot d\vec{l} = \mu_0 \epsilon_0 \frac{\partial E}{\partial t} \int d\vec{a}$$

$$\vec{B}\, 2\pi r = \mu_0 \epsilon_0 i\omega E_0 e^{i\omega t} \pi r^2$$

$$\vec{B}_1 = \frac{\mu_0 \epsilon_0}{2} i\omega r E_0 e^{i\omega t} \hat{\phi}$$

for $B \cdot dl$ go out To radius r

Now find E_2

$$\vec{\nabla} \times \vec{E}_2 = -\frac{\partial B}{\partial t}$$

from stokes again

$$\int \vec{E} \cdot d\vec{l} = -\frac{\partial}{\partial t}\left[\frac{\mu_0 \epsilon_0}{2} i\omega r E_0 e^{i\omega t}\right] \int d\vec{a}$$

$$-E_2 2s = -\frac{\mu_0 \epsilon_0}{2} i^2 \omega^2 r \cdot rs \quad ; \; i^2 = -1$$

$$E_2 = \frac{-\omega^2 r^2}{4} \mu_0 \epsilon_0 E_0 e^{i\omega t}$$