Quiz 1

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E&M II
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Name:
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Prob. 1(2)

An electric field is given as $\bar{x}(x+3y-az)+\bar{y}(bx+5z)+\bar{z}(2x-cy-z)$.

(a)(1) What is the charge density ρ(x,y,z) associated with the above E-field in the vacuum.

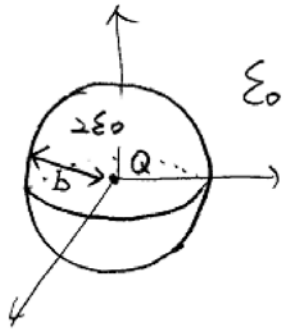
(b)(1) The curl of the above E-field is zero. Determine constant a,b,c.

Prob. 2 (2)

Using the Gauss's Law given as $\nabla \cdot \bar{D} = \rho,$ derive the Coulomb's law in the vacuum given as $\bar{F} = \bar{a_R} \frac{Q_1 Q_2}{4\pi\varepsilon_0 R^2}$, assuming Q_1 is located in the origin.

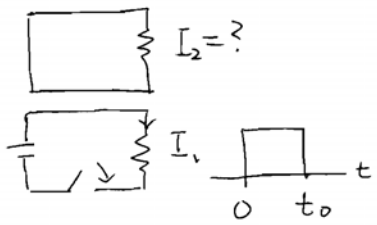
Prob. 3 (2)

Charge Q is located at the center of a dielectric sphere having radius b and $\varepsilon = 2\varepsilon_0$. There is a vacuum outside the dielectric sphere. Determine the polarization vector, $\overline{P}(R,\theta,\phi)$.



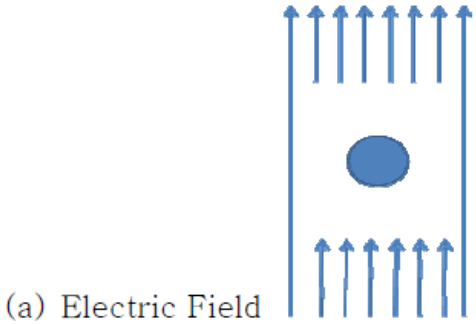
Prob. 4(2)

Consider two current loops shown below. The switch of the bottom loop closes at t=0 and opens at $t=t_0$ producing current conduction only between t=0 and $t=t_0$. Determine when (t=?) and in which direction (clockwise or counter-clockwise?) the current in the first loop flows.

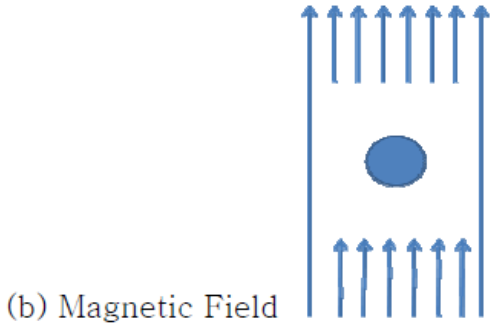


Prob. 5(2)

A perfectly conducting cylinder is immersed in a uniform electric (a) and magnetic (b) field as shown below. Sketch the resulting E-field (a) and H-field (b) lines. Assume the radius of the cylinder is small so that the uniform filed line is not disturbed far away from the cylinder. In your sketches, clearly show how the filed lines look around the cylinder as well as polarities of charges/surface currents induced on the cylinder.



(a) Electric Field



(b) Magnetic Field