NAME

Please explain your answers in detail. What you write is all I have to grade the problem. Little credit will be given if your explanations involves generic phrases (such as "use Hamiltons principle") without a detailed explanation.

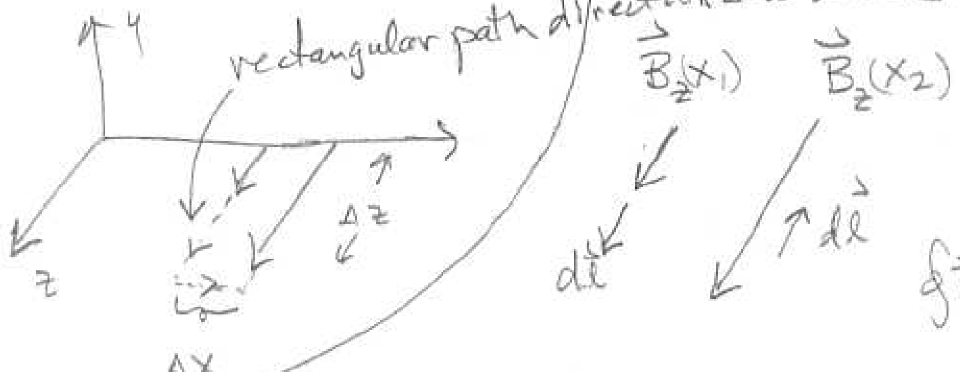
1. (a) What aspects of Faraday's law are demonstrated in the applet where the bar magnet moves through a conducting wire loop? (b) What is wrong with the solution posted on the wiki to this problem (homework 12 problem 4)?

(a) $\mathcal{E}mf = -\frac{d\Phi}{dt}$ $\Phi = \int \vec{B}\cdot d\vec{a}$ applet shows changing Φ due to changing B thru the loop. It also show Lenz's law where the current in the loop opposes the changing flux.

(b) The solution does not include the effect of the displacement current $\vec{J}_{DISP} = \epsilon_0 \frac{\partial \vec{E}}{\partial t}$ which will generate a $\vec{B}$ & therefore affect the flux in part (a)

2. On the part of the wiki devoted to this exam, there is a snapshot sketch of a plane harmonic electromagnetic wave. Apply the integral form of Ampere's law for this configuration of electric and magnetic fields. That is, choose an appropriate rectangular Amperian path whose width, given by ϵ, is very small. Then assume that the field for the line integral can be approximated by $B(x_2) \approx B(x_1) + (\partial B/\partial x)\Delta x$ where $B(x_2)$ and $B(x_1)$ are the fields at x_1 and $x_2 = x_1 + \epsilon$. Derive an partial differential equation in terms of how B_z changes with x and how E_y changes with t. Note that the Amperian path remains fixed in the coordinate system drawn while the wave moves through it along the x axis.

direction ccw since $\vec{E}$ points in $\hat{y}$.



$\vec{\nabla}\times\vec{B} = \mu_0\vec{J} + \mu_0\vec{J}_D$

Stokes Th

$\oint \vec{B}\cdot d\vec{l} = \mu_0\epsilon_0 \frac{\partial \Phi_E}{\partial t}$

$\vec{B}\cdot d\vec{l} = -\vec{B}_z(x_2)\,\Delta z + \vec{B}_z(x_1)\,\Delta z = \left[-\vec{B}_z(x_1) - \frac{\partial B}{\partial x}\Delta x + \vec{B}_z(x_1)\right]\Delta z = -\frac{\partial B_z}{\partial x}\Delta x \Delta z$

$\mu_0\epsilon_0 \frac{\partial \Phi_E}{\partial t} = \mu_0\epsilon_0 \frac{\partial}{\partial t}\int \vec{E}\cdot d\vec{a} = \mu_0\epsilon_0 \frac{\partial E_y}{\partial t}\Delta x \Delta z =$

cancel $\Delta x \Delta z \Rightarrow$ $\boxed{-\frac{\partial B_z}{\partial x} = \mu_0\epsilon_0 \frac{\partial E_y}{\partial t}}$