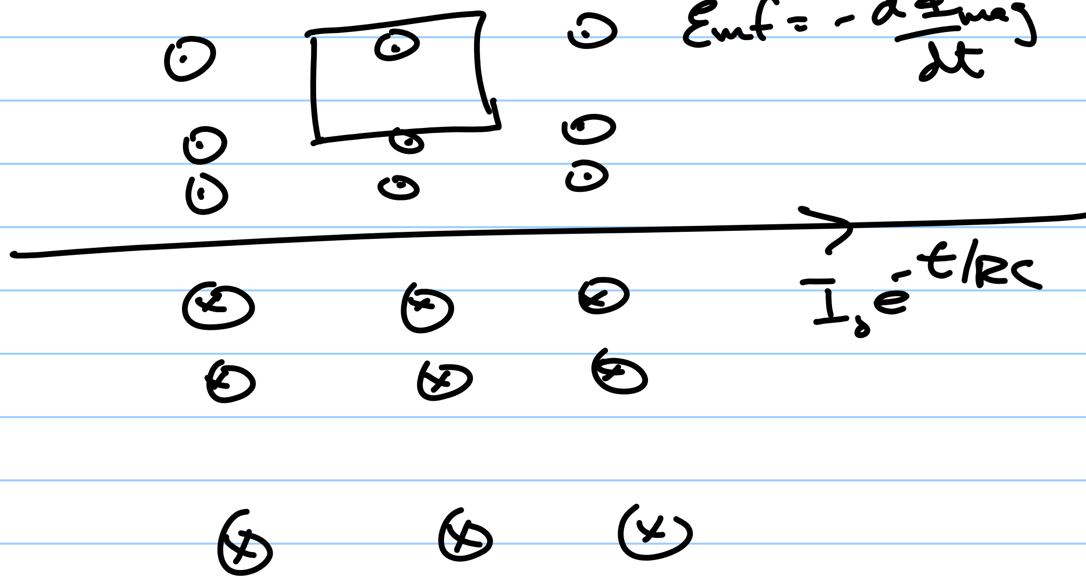
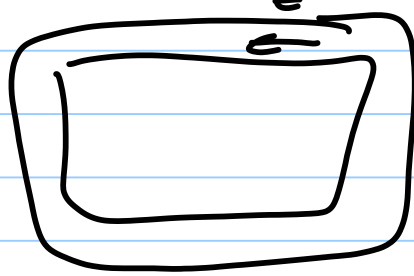
Note Title 3/31/2008

$$\mathcal{E}mf = -\frac{d\Phi_{mag}}{dt}$$

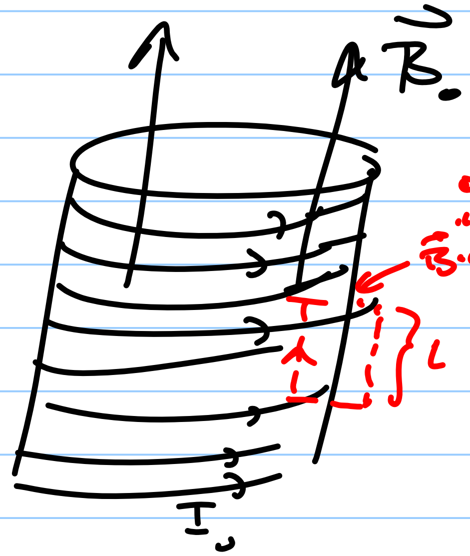


$\vec{E}$ comes from $\dfrac{d\Phi_m}{dt}$



$$\oint \vec{E}\cdot d\vec{l} = \mathcal{E}mf$$

Solenoid



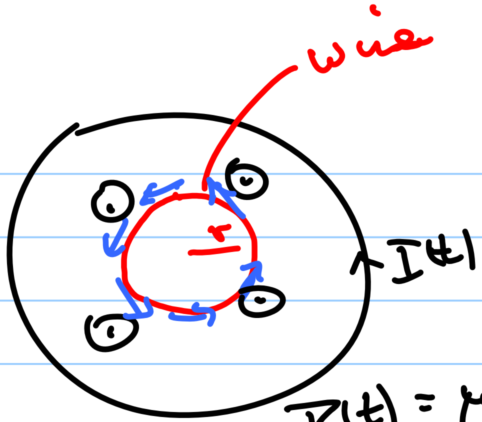
$B \neq 0$

amps law

$$\oint \vec{B}\cdot d\vec{l} = \mu_0 I_{enc}$$

$$B \cancel{L} = \mu_0 n \cancel{L} I_0$$

n = # wire / length



$$\underline{\underline{\mathcal{E}mf}} = -\frac{d\Phi_m}{dt} = -\frac{d}{dt}\left[\pi r^2 \mu_0 n I(t)\right]$$

$$\mathcal{E}mf = \pi r^2 \mu_0 n \frac{dI}{dt}$$

$$B(t) = \mu_0 n I(t)$$

Electrostatics $\vec{\nabla}\times\vec{E} = 0$

$$\int \underbrace{\vec{\nabla}\times\vec{E}}_{\phi}\cdot d\vec{a} = \underbrace{\oint \vec{E}\cdot d\vec{l}}_{\phi}$$

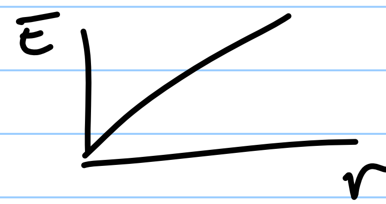
$$\oint \vec{E}\cdot d\vec{l} \neq 0$$

$\vec{F} = q\vec{E}$ still

$$\underbrace{\oint \vec{E}\cdot d\vec{l}} = \pi r^2 \mu_0 n \frac{dI}{dt}$$

$$\oint |\vec{E}||d\vec{l}|\cos\phi = E\oint |d\vec{l}| = E\, 2\pi r =$$

$$E = \frac{\pi r^{\cancel{2}} \mu_0 n \frac{dI}{dt}}{2\pi \cancel{r}}$$



$$\underbrace{\oint \vec{E}\cdot d\vec{l}} = -\frac{d}{dt}\Phi_m = -\frac{d}{dt}\int \vec{B}\cdot d\vec{a}$$

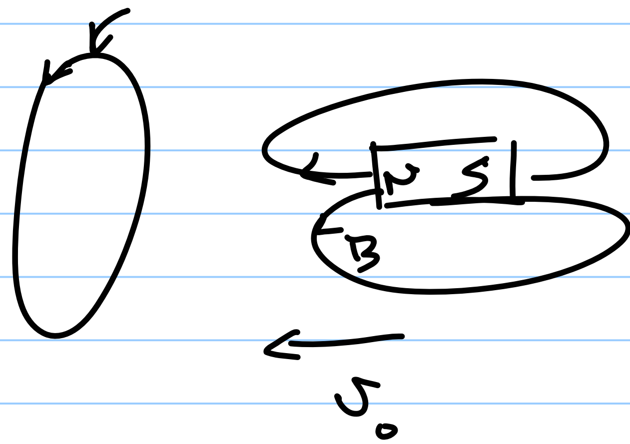
$$\int \underline{\vec{\nabla}\times\vec{E}}\cdot d\vec{a} = -\int \underline{\frac{\partial \vec{B}}{\partial t}}\cdot d\vec{a}$$

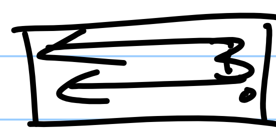
$$\vec{\nabla}\times\vec{E} = -\frac{\partial \vec{B}}{\partial t}$$ Faradays law diff. form

$$\frac{d}{dt}\vec{B} = \frac{\partial \vec{B}}{\partial t} + \frac{\partial \vec{B}}{\partial x}\frac{dx}{dt} + \frac{\partial \vec{B}}{\partial y}\frac{dy}{dt} + \cdots$$

choose so fix x, y, z

wire resistance R find I



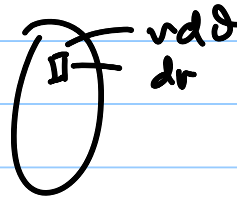


Prin. Emf from Faraday's Law

Kirchoff $\sum V = 0$ $\mathcal{E}mf - IR = 0$

Method. $\mathcal{E}_m = -\frac{d\Phi}{dt}$ find $\Phi = \int \vec{B} \cdot d\vec{a}$

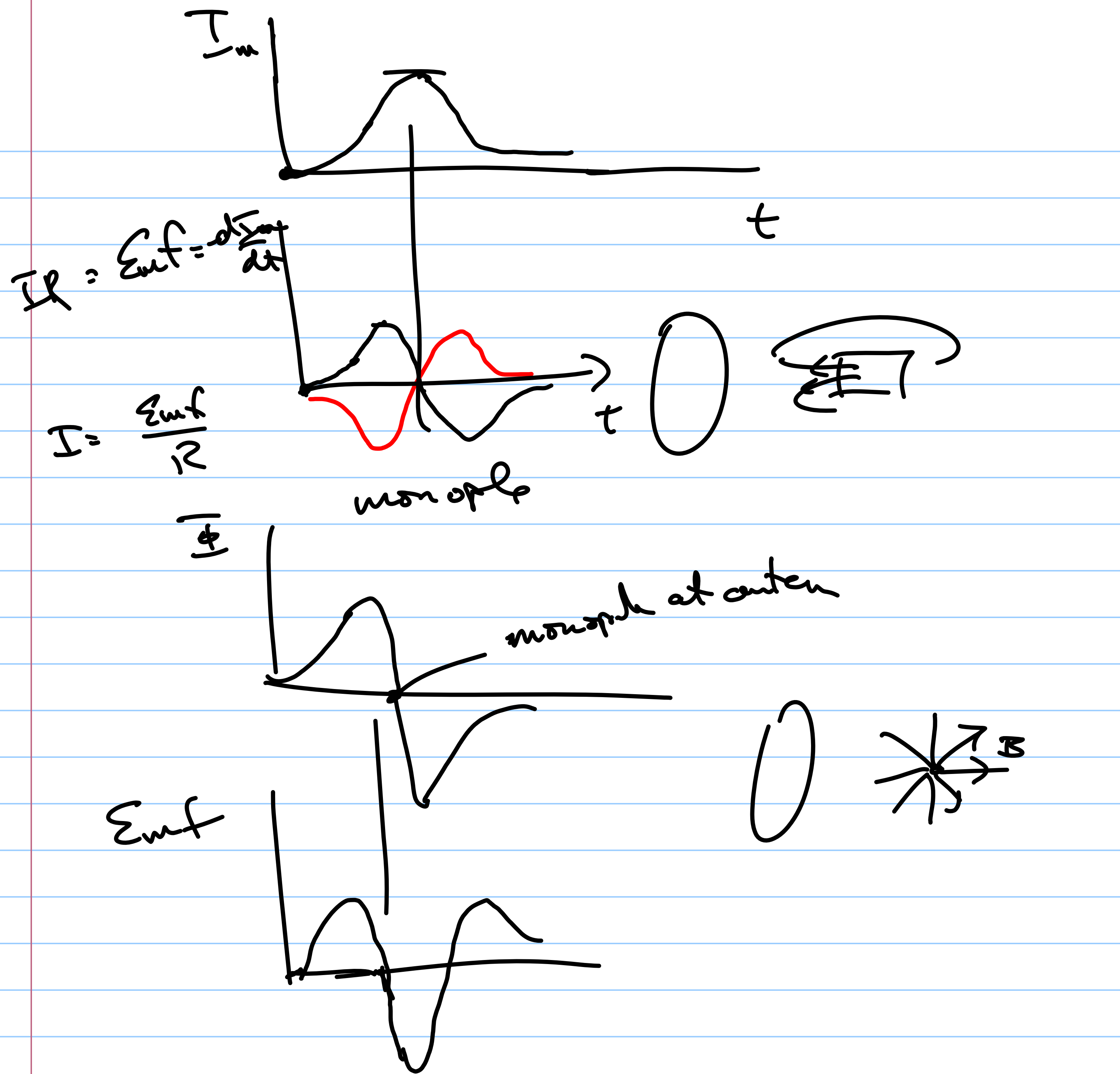
find $\vec{B}$ bar mag.



$$\frac{d}{dt} \int_0^{2\pi}\int_0^{R} \vec{B} \cdot d\vec{a}$$

Check: check units

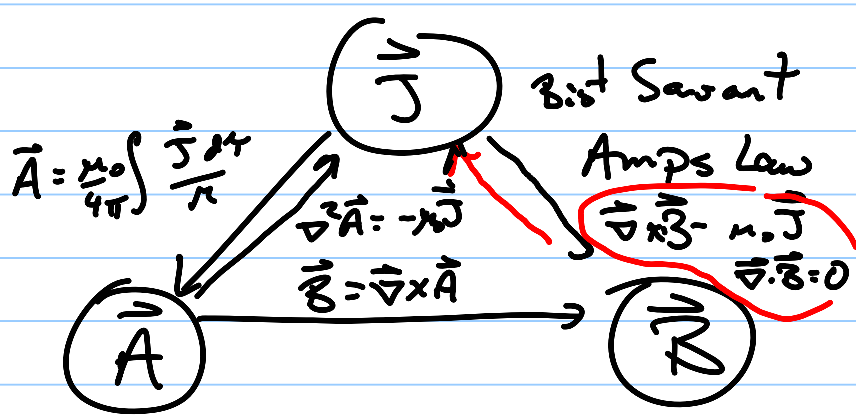
graphical method: find Φ_m



Review for exam III

Triangle diagram

- know how to find one given other



- $\vec{F} = q\vec{v}\times\vec{B} \rightarrow \int dq\, \vec{v}\times\vec{B}$ $\qquad dq = \lambda\, dx$, $K\, da$, $\rho\, d\tau$

$$\int \rho\, d\tau\, \vec{v}\times\vec{B}$$

$\vec{J} = \rho\vec{v}$

- Conservation of charge $\quad \vec{\nabla}\cdot\vec{J} = -\frac{\partial\rho}{\partial t}$

$$\downarrow$$

$$\oint \vec{J}\cdot d\vec{a} = -\frac{dQ_{enclosed}}{dt}$$

- OHM's Law $\quad \vec{J} = \sigma\vec{E}$

- Faraday's Law $\quad \mathcal{E}mf = -\frac{d\Phi_{mag}}{dt}$

where $\Phi_{mag} = \int \vec{B}\cdot d\vec{a}$ or in differential form

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

Review both lectures (tablet problems) & homework