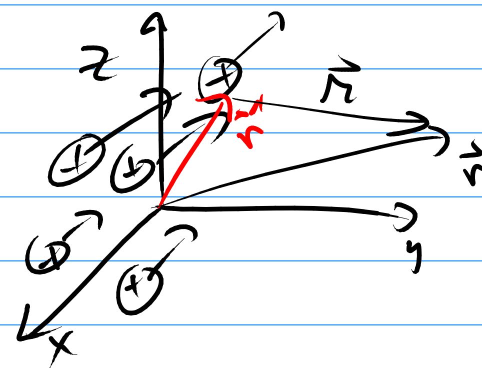
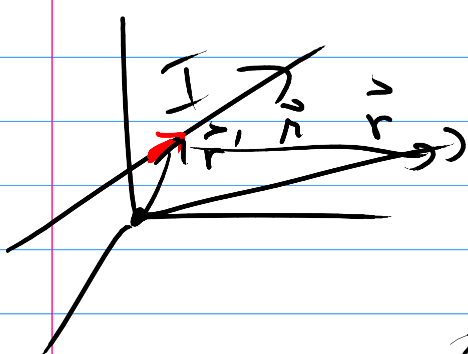
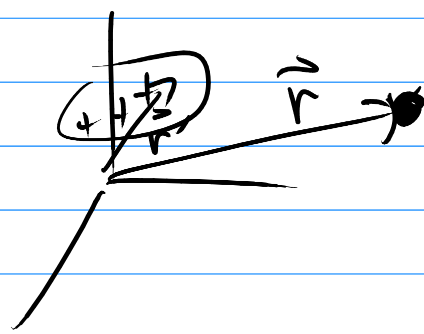
$$\vec{B} = \frac{\mu_0}{4\pi}\int \frac{I\, d\vec{l} \times \hat{\mathscr{r}}}{\mathscr{r}^2}$$ Biot Savart

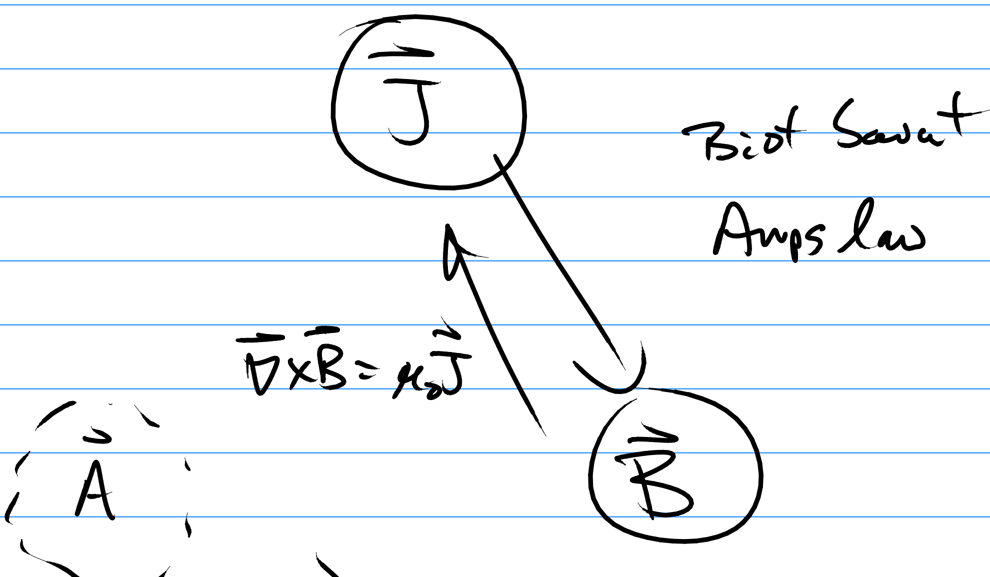
$$\vec{B} = \frac{\mu_0}{4\pi}\int \frac{\vec{K} \times \hat{\mathscr{r}}\, da}{\mathscr{r}^2}$$



$$\vec{B} = \frac{\mu_0}{4\pi}\int \frac{\vec{J} \times \hat{\mathscr{r}}}{\mathscr{r}^2}\, d\tau' = \frac{\mu_0}{4\pi}\int \frac{\vec{J}(\vec{r}\,') \times (\vec{r} - \vec{r}\,')\, d\tau'}{|\vec{r} - \vec{r}\,'|^3}$$







$$\vec{F} = q\vec{v} \times \vec{B} + q\vec{E}$$

$\vec{K} \times \vec{B}\, da$

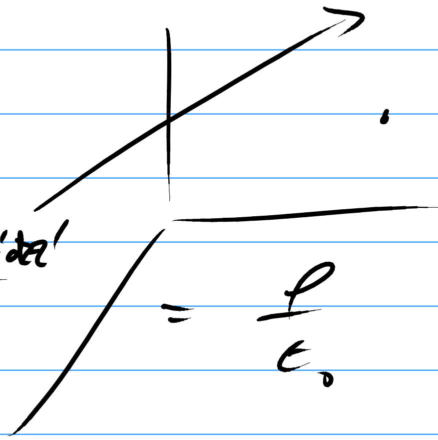
$\vec{J} \times \vec{B}\, d\tau$

$$\vec{B}(\vec{r}) = \frac{\mu_0}{4\pi}\int \frac{\vec{J}(\vec{r}\,') \times (\vec{r}-\vec{r}\,')}{(\vec{r}-\vec{r}\,')^3}\, dx'\,dy'\,dz'$$

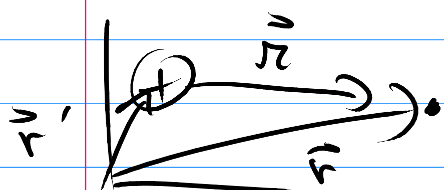
$\vec{B}(x,y,z)$

$$\vec{\nabla}\cdot\vec{B} = \frac{\partial}{\partial x}B_x + \frac{\partial}{\partial y}B_y + \frac{\partial}{\partial z}B_z = 0$$

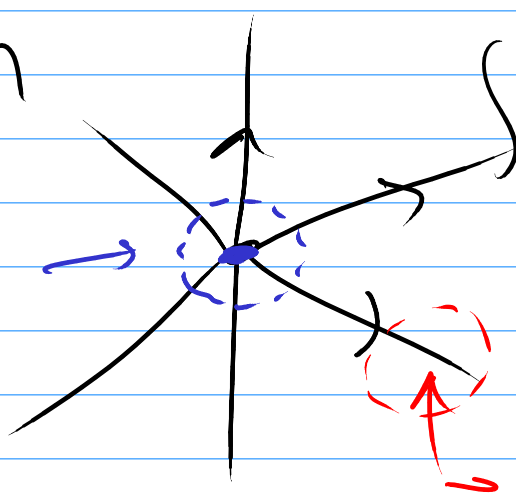
$$\vec{\nabla}\times\vec{B}(\vec{r}) = \mu_0 \vec{J}(\vec{r})$$



$$\vec{\nabla}\cdot\vec{E} = \vec{\nabla}\cdot\underbrace{\int \frac{1}{4\pi\epsilon_0}\frac{\rho(\vec{r}\,')\,dx'\,dy'\,dz'}{|\vec{r}-\vec{r}\,'|^2}}_{E(\vec{r})} = \frac{\rho}{\epsilon_0}$$



InkSurvey



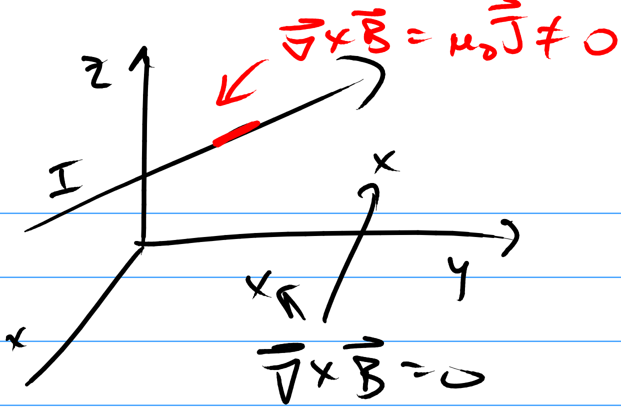
$$\int \vec{\nabla}\cdot\vec{B}\, d\tau = \oint \vec{B}\cdot d\vec{a}$$

$\vec{B}$

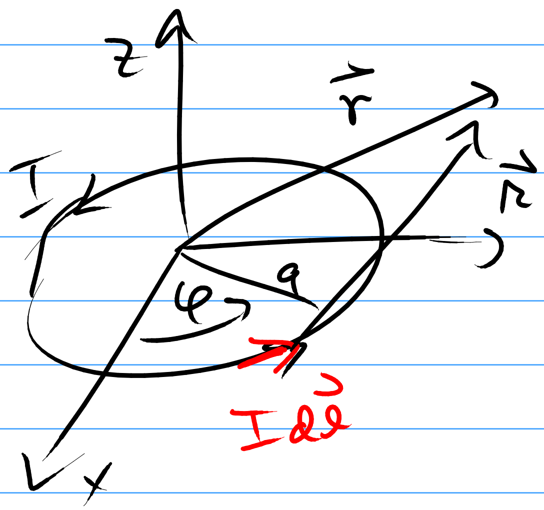
$\oint \vec{B}\cdot d\vec{a} \neq 0$

$\oint \vec{B}\cdot d\vec{a} = 0$

$\vec{\nabla}\cdot\vec{B} = 0$



$$\vec\nabla\times\vec B=\mu_0\vec J$$

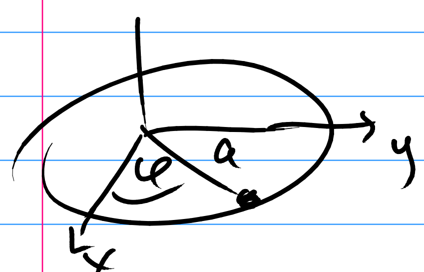


find $\vec B=\frac{\mu_0}{4\pi}\int\frac{I\,d\vec\ell\times\hat{\mathscr{r}}}{\mathscr{r}^2}$

$$\hat\varphi=-\sin\varphi\,\hat x+\cos\varphi\,\hat y$$

$$d\vec\ell=a\,d\varphi\,\hat\varphi=a\,d\varphi\left(-\sin\varphi\,\hat x+\cos\varphi\,\hat y\right)$$

$$\vec{\mathscr{r}}=\vec r-\vec r\,'\qquad \vec r=x\hat x+y\hat y+z\hat z$$

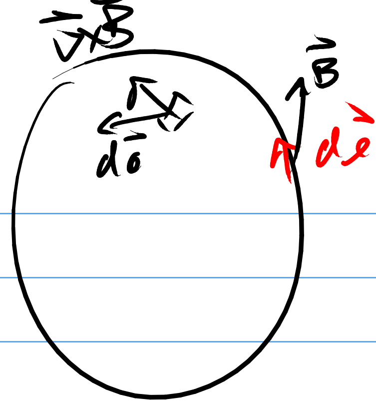


$$\vec r\,'=a\cos\varphi\,\hat x+a\sin\varphi\,\hat y$$

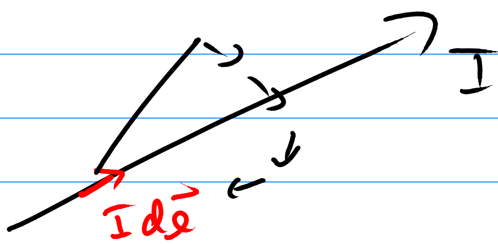
$\vec\nabla\times\vec B=\mu_0\vec J$ integral form uses Stokes

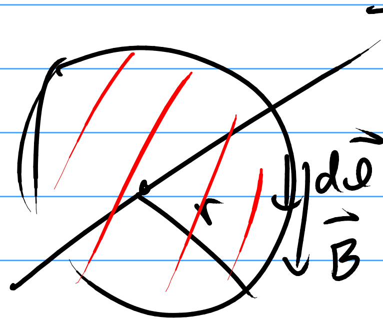
$$\int\underbrace{\vec\nabla\times\vec B}_{=\mu_0\vec J}\cdot d\vec a=\oint\vec B\cdot d\vec\ell$$

Biot Savart



$$\int \mu_0 \vec{J} \cdot d\vec{a} = \oint \vec{B} \cdot d\vec{l} \qquad \text{Amp's law}$$





$$B\,2\pi r = \mu_0 I_0$$

$$B = \frac{\mu_0 I_0}{2\pi r}$$