Sam Murphy

HW6

2) $V_0 = \langle V_{0x}, 0, 0\rangle \qquad P = (x, 0, 0)$

$$B = \frac{B_0}{r^3}(2\cos\theta\,\hat{r} + \sin\theta\,\hat{\theta}) \qquad r = \sqrt{x^2+y^2+z^2}$$

$$\hat{r} = \frac{x}{r}\hat{\imath} + \frac{y}{r}\hat{\jmath} + \frac{z}{r}\hat{k} \qquad \theta = \tan^{-1}\left(\frac{\sqrt{x^2+y^2}}{z}\right)$$

$$\hat{\theta} = \frac{z}{r_\perp}\left(\frac{x}{r}\hat{\imath} + \frac{y}{r}\hat{\jmath}\right) - \frac{r_\perp}{r}\hat{k} \qquad r_\perp = \sqrt{x^2+y^2}$$

$$B = \frac{B_0}{r^3}\left(2\cos\theta\left(\frac{x}{r}\hat{\imath} + \frac{y}{r}\hat{\jmath} + \frac{z}{r}\hat{k}\right) + \sin\theta\left(\frac{z}{r_\perp}\left(\frac{x}{r}\hat{\imath} + \frac{y}{r}\hat{\jmath}\right) - \frac{r_\perp}{r}\hat{k}\right)\right)$$

$$B = \frac{B_0}{r^4}\left(2\cos\theta(x\hat{\imath} + y\hat{\jmath} + z\hat{k}) + \sin\theta\left(\frac{zx}{r_\perp}\hat{\imath} + \frac{zy}{r_\perp}\hat{\jmath} - r_\perp\hat{k}\right)\right)$$

$P_0 = (x, \frac{\pi}{2}, 0)$

$$B = \frac{B_0}{r^4}\left(\frac{zx}{r_\perp}\hat{\imath} + \frac{zy}{r_\perp}\hat{\jmath} - r_\perp\hat{k}\right) \qquad @\,(x, 0, 0)$$

$$B = \frac{B_0}{x^4}(0\hat{\imath} + 0\hat{\jmath} - x\hat{k}) \qquad B = -\frac{B_0}{x^3}\hat{k}$$

$$B = \frac{B_0}{r^3}\hat{\theta} \qquad B = \langle 0, 0, \frac{-B_0}{x^3}\rangle$$

$\Delta t = 1$

$$\frac{x_1 - x_0}{\Delta t} = V_{0x} \qquad x_1 = V_{0x}\Delta t + x_0$$

$$\frac{y_1 - y_0}{\Delta t} = V_{0y} = 0 \qquad y_1 = y_0$$

$$\frac{V_{x_1} - V_{x_0}}{\Delta t} = \frac{q}{m}(V_1 \times B_1)$$

$$\begin{matrix} V_{0x} & 0 & 0 \\ 0 & 0 & -\frac{B}{x^3} \end{matrix}$$

$$V_{x_1} - V_{x_0} = \frac{q\Delta t}{m}\left(-\frac{BV_{0x}}{x^3}\hat{j}\right)$$

$$V_{1x} = \frac{q\Delta t}{m}\frac{-BV_{0y}}{x^3}\hat{j} + V_{0x}\hat{i} = \left\langle V_{0x}, \frac{-Bq\Delta t V_{0x}}{mx^3}, 0 \right\rangle$$

$2\Delta t$

$$\frac{x_2 - x_1}{\Delta t} = V_{1x} \qquad x_2 = V_{1x}\Delta t + x_1$$

$$x_2 = V_{0x}\Delta t + V_{0x}\Delta t + x_0$$

$$x_2 = 2V_{0x}\Delta t + x_0$$

$$\frac{y_2 - y_1}{\Delta t} = V_{1y} \qquad y_2 = V_{1y}\Delta t + y_1$$

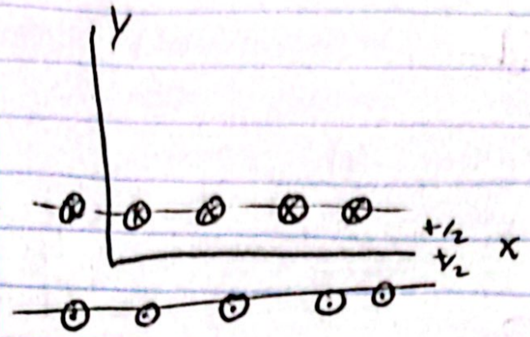
$$y_2 = -\frac{Bq\Delta t V_{0x}}{mx^3}\Delta t$$

$$\frac{V_2 - V_1}{\Delta t} = \cancel{B_0}\frac{q}{m}(\cancel{B} \times B)$$

$$\begin{matrix} V_{0x}, & \frac{-Bq\Delta t V_{0x}}{mx^3}, & 0 \\ 0 & 0 & -B/x^3 \end{matrix}$$

$$V_2 = \frac{q}{m}\Delta t\left(\frac{B^2 q\Delta t V_{0x}}{mx^6}\hat{i} - \frac{V_{0x}B}{x^3}\hat{j}\right)$$

6.3



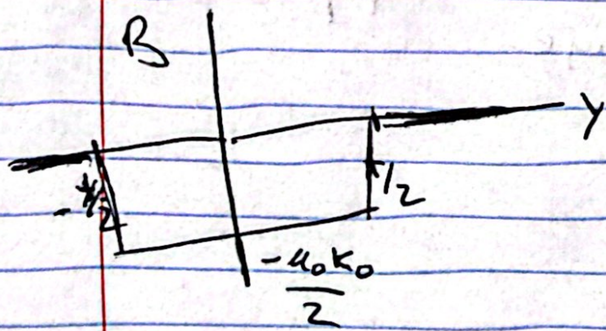
$K = K_0 \hat{z}$

$K = -K_0 \hat{z}$

b/c long no z variation

b/c symmetry no x variation

$B = B_y(y)\hat{y}$

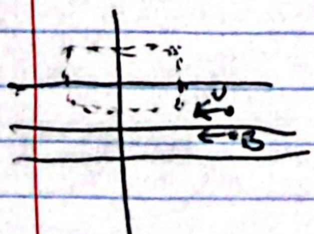


Amperes Law

$\oint B \cdot dl = \mu_0 I_{enc}$

$I_{enc} = 0$

B = 0 outside of the sheets of charge



I ~~think it also cancels~~

Think of loop as very small rectangle

$h \ll w$

let L be length of enclosed charge

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

$I_{enc} = K_0 L$

$dl = 2L$

$B(2L) = \mu_0 K_0 L$

$\therefore B = \frac{\mu_0 K_0}{2}$

$y < -t/2 \quad B = 0$

$-t/2 < y < t/2 \quad B = \frac{\mu_0 K_0}{2}$

$t/2 < y \quad B = 0$

This is the situation if bottom plane is out of the page & top plane is into the page