3-31-14 lab 5 SUPP.

LAB 5 Data from meterstick

4B 3-31-14

$\Delta(\mu_0 n_{TH})$

$$= \frac{\partial(\mu_0 n_{TH})}{\partial N} \cdot \Delta N + \frac{\partial(\mu_0 n_{TH})}{\partial \ell} \cdot \Delta \ell$$

$\Delta N = 0$

$$\Delta = \left| \mu_0 \cdot \frac{\partial(N/\ell)}{\partial \ell} \cdot \Delta \ell \right|$$

$$\Delta = \left| -\mu_0 \frac{N}{\ell^2} \cdot \Delta \ell \right| = \mu_0 \frac{N}{\ell^2} \cdot \Delta \ell$$

$$\Delta = \mu_0 \frac{N}{L^2} \cdot \Delta L$$

3-31-14 4B $\underline{sp14}$

Quick comparison

$\mu_0 = \underbrace{4\pi}_{12.57} \times 10^{-7}$ (units)

$\Delta \stackrel{\sim}{=} 4\pi \times 10^{-7} \cdot \frac{74}{(1)} \cdot \underbrace{0.0005 m}_{\Delta l}$

$\Delta l = 0.05 cm$

$\Delta = 12.57 \times 10^{-7} \cdot \frac{74}{1} \cdot 5 \times 10^{-4}$ $= 11$

$\Delta = 4649.6 \times 10^{-11}$

$\Delta = 4.6 \times 10^{-8}$

What was your RMSE?

How does it compare with Δ?

typically $\Delta \ll$ RMSE.

PC data: using magnetic sensor –

$\mu_0 n_{exp} \pm$ RMSE

Recipe: (A) Round RMSE to one place.

(B) Round $\mu_0 n_{exp}$ to the same place.

Example:

$\mu_0 n_{exp} = 0.000111\underline{3}215 \frac{T}{A}$

RMSE $= 0.00000\underline{9}21$

$= 0.000009$

$\mu_0 n_{exp} = 0.000111\underline{3}215 \pm 0.000009$

$= 0.00011\underline{1} \pm 0.00000\underline{9}$

Lab 5 PC DATA (4)

$$\mu_0 n_{exp\,MAX} = \begin{array}{r} 0.000111 \\ +\,0.000009 \\ \hline 0.000120 \end{array}$$

$$\mu_0 n_{exp\,min} = \begin{array}{r} 0.000111 \\ -\,0.000009 \\ \hline 0.000102 \end{array}$$

CHECK:

$$\mu_0 n_{exp\,min} < \mu_0 n_{TH} < \mu_0 n_{exp\,MAX}$$

$$0.000102 < \mu_0 \frac{N}{l} < 0.000120$$

IF RMSE $\approx \Delta$ use:

$$\left| \mu_0 n_{exp} - \mu_0 n_{TH} \right| < (RMSE + \Delta)$$

(i) $\Delta = \mu_0 \frac{N}{L^2} \cdot \Delta L$

(ii) RMSE from LoggerPro.

3-31-14

5

SLINKY LAB NOTES:

MORE SAMPLE DATA:

$$\begin{array}{rl} 0.000105 & \leftarrow \mu_0 n_{exp} \\ +\ 0.000007 & \leftarrow \text{RMSE} \\ \hline 0.000112 & \leftarrow \text{MAX} \end{array}$$

$$\begin{array}{rl} 0.000105 & \leftarrow \mu_0 n_{exp} \\ -\ 0.000007 & \leftarrow \text{RMSE} \\ \hline 0.000098 & \leftarrow \text{MIN} \end{array}$$

CHECK: $0.000098 < \mu_0 \frac{N}{L} < 0.000112$

0.05 cm = 0.0005 m

$83 = N$, $l = L = 0.9931$ (m)

$12.57 \times 10^{-7} \cdot \frac{83}{0.9931}$ ← 2 sig. fig.

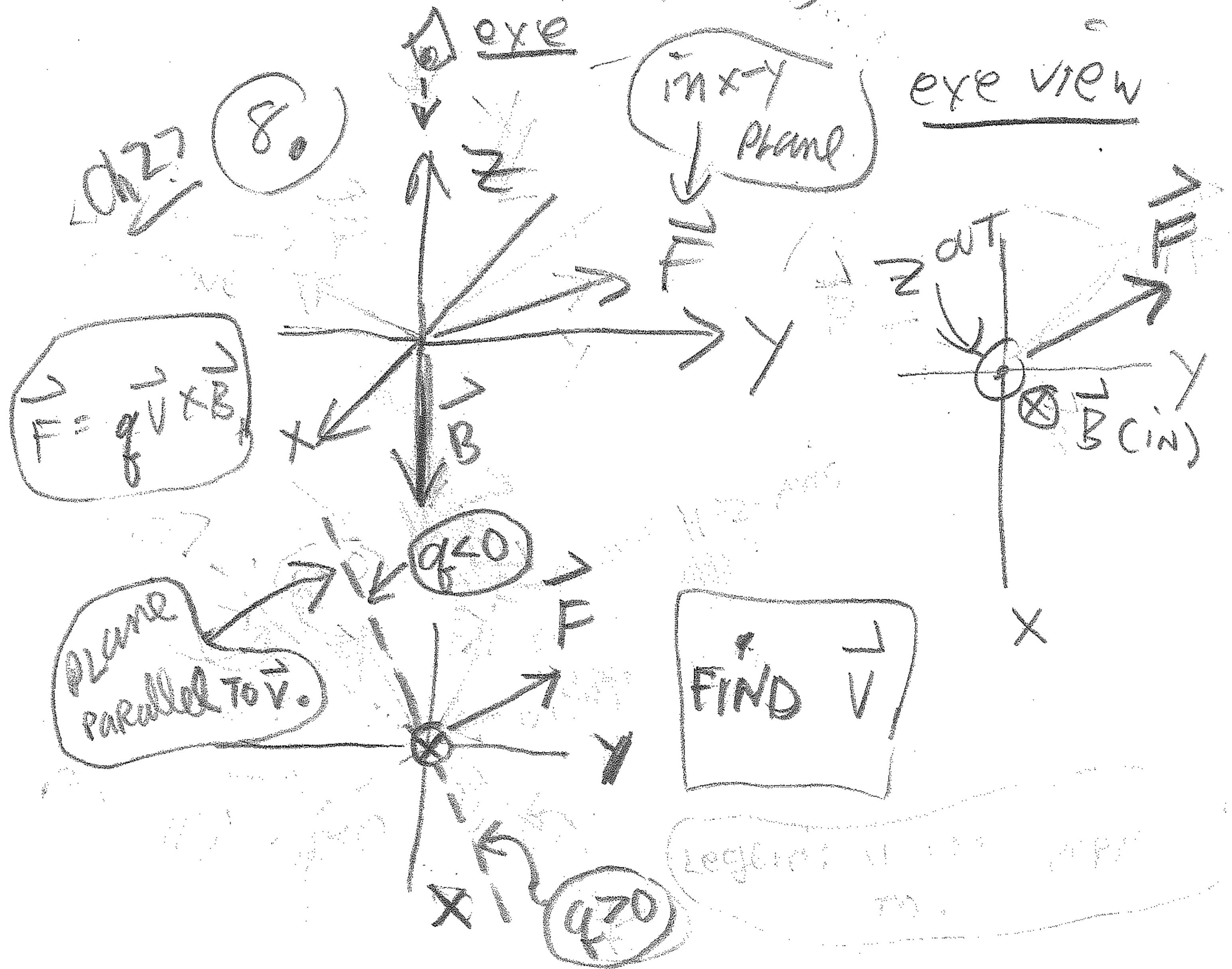
Analyze → $0.000098 < 0.000105 < 0.000112$

CH27:

8, 22, 24, 30, 42, 43

69, 70, 74, 75, 46,

48, 50, 54, 79.



CHARGE is negative ↓

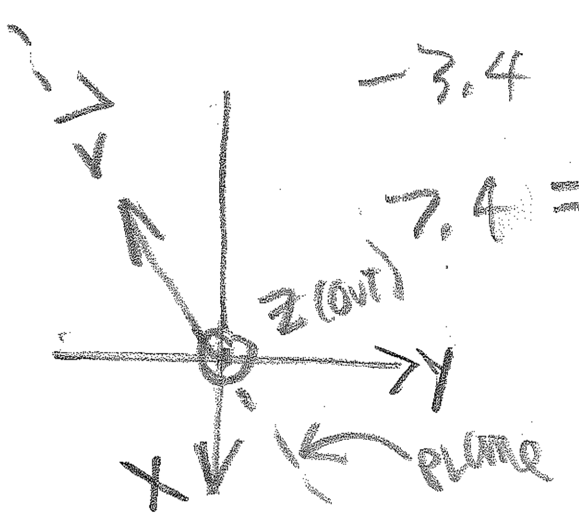
$$-q \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ v_x & v_y & v_z \\ 0 & 0 & -1.25 \end{vmatrix} = \vec{F} = -3.4\hat{i} + 7.4\hat{j}$$

$$\boxed{\vec{F} = -q\vec{v} \times \vec{B}}$$, where $-q < 0$.

$$-q \cdot \left[\hat{i}(v_y \cdot (-1.25) - 0) - \hat{j} \cdot (v_x \cdot (-1.25) - 0) \right]$$

$$-3.4 = q v_y \cdot 1.25 \longrightarrow v_y = \frac{-3.4}{q \cdot (1.25)}$$

$$7.4 = -q \cdot v_x \cdot 1.25 \longrightarrow v_x = \frac{-7.4}{q \cdot (1.25)}$$



v_z component can be anything!