HOJA N°

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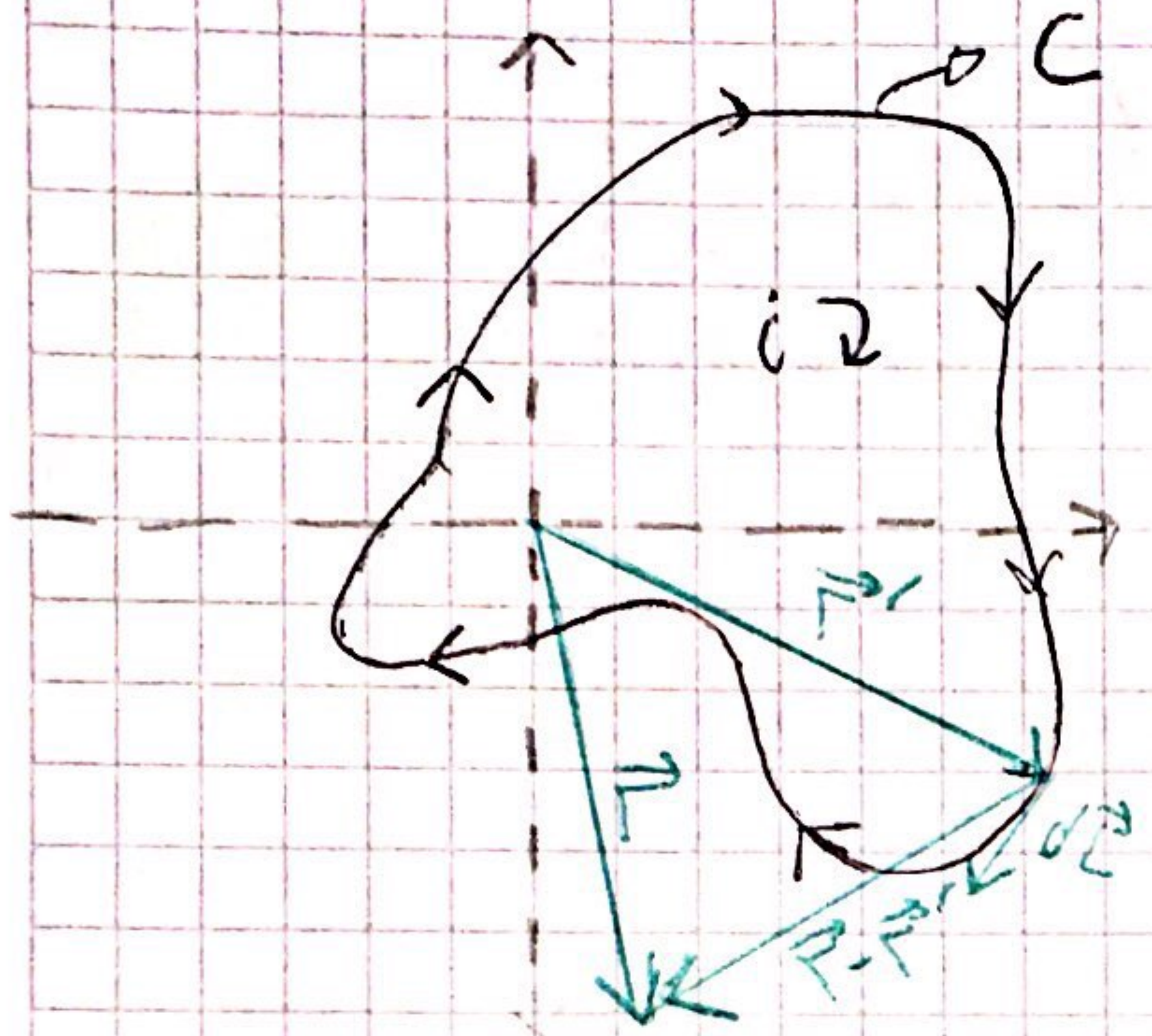
PRÁCTICO 5

Ley de Biot-Savart:



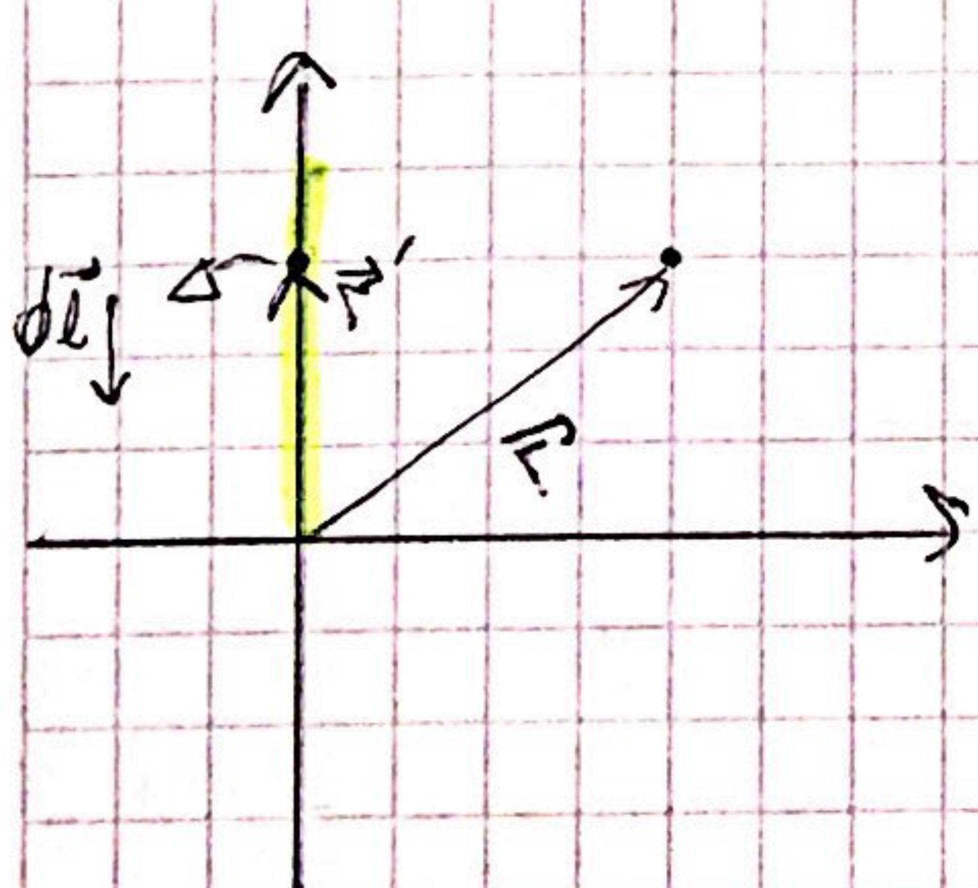
$$\vec{B}(\vec{r}) = \frac{\mu_0 . i}{4\pi} \int_C \frac{d\vec{l} \times (\vec{r}-\vec{r}')}{|\vec{r}-\vec{r}'|^3}$$

$\vec{r}$: sitio donde queremos medir el campo

$\vec{r}'$: posición de la corriente que genera el campo

1

Primero calculo en el eje y



- $\vec{r} = x.\hat{x} + c.\hat{y}$
- $\vec{r}' = y.\hat{y}$
- $d\vec{l} = dy.\hat{y}$

$\vec{r}-\vec{r}' = x\hat{x} + c\hat{y} - y\hat{y} = x\hat{x} + (c-y)\hat{y}$

$|\vec{r}-\vec{r}'| = \sqrt{x^2+(c-y)^2}$

NOTA

$$\vec{B}_1 = \frac{\mu_0 i}{4\pi} \int_{\infty}^{0} \frac{-dy\,\hat{y} \times \left(x\hat{x} + (c-y)\hat{y}\right)}{\left(x^2 + (c-y)^2\right)^{\frac{3}{2}}}$$

$$\begin{matrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & -dy & 0 \\ x & c-y & 0 \end{matrix} \quad \begin{matrix} \hat{i} = 0 \\ \hat{j} = 0 \\ \hat{k} = x \cdot dy \end{matrix}$$

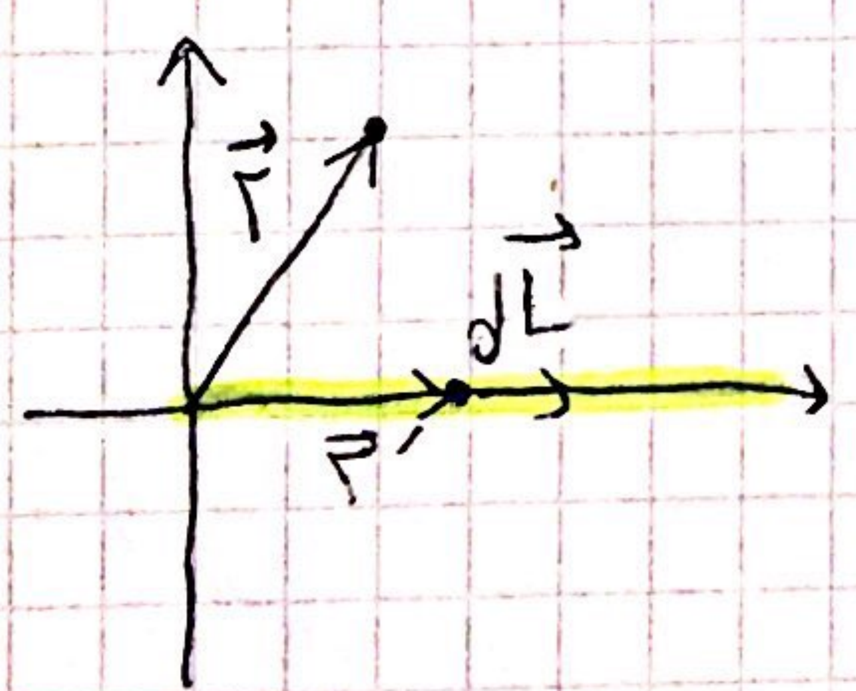
$$= \frac{\mu_0 i}{4\pi} \int_{\infty}^{0} \frac{x\,dy\,(\hat{z})}{\left(x^2 + (c-y)^2\right)^{\frac{3}{2}}}$$

$$= -\frac{\mu_0 i}{4\pi} x(\hat{z}) \int_{\infty}^{0} \frac{dy}{\left(x^2 + (c-y)^2\right)^{\frac{3}{2}}} = \frac{\mu_0 i}{4\pi} \frac{(\hat{z})}{1} \cdot \left(\left. \frac{y-c}{x\sqrt{x^2 + (c-y)^2}} \right|_{\infty}^{0} \right)$$

$$= -\frac{\mu_0 i}{4\pi} (\hat{z}) \left[\frac{-c}{x\sqrt{x^2 + c^2}} - \lim_{y \to \infty} \frac{y-c}{x\sqrt{x^2 + (c-y)^2}} \right]$$

$$= -\frac{\mu_0 i}{4\pi} (\hat{z}) \left[-\frac{1}{x\sqrt{\frac{x^2}{c^2} + 1}} - \frac{1}{x} \right] = \frac{\mu_0 i}{4\pi} \cdot \hat{z} \left(\frac{1}{x\sqrt{\frac{x^2}{c^2} + 1}} + \frac{1}{x} \right)$$

Ahora en el eje X



$$\vec{r} = k \cdot \hat{x} + y \cdot \hat{y}$$

$$\vec{r}' = x \cdot \hat{x}$$

$$\vec{r} - \vec{r}' = (k-x)\,\hat{x} + y\,\hat{y}$$

$$|\vec{r} - \vec{r}'| = \sqrt{(k-x)^2 + y^2}$$

$$d\vec{L} = dx\,\hat{x}$$

$$B_2 = \frac{\mu_0 i}{4\pi} \int_{0}^{\infty} \frac{dx\,\hat{x} \times \left((k-x)\hat{x} + y\hat{y}\right)}{\left((k-x)^2 + y^2\right)^{\frac{3}{2}}}$$

$$\begin{matrix} \hat{i} & \hat{j} & \hat{k} \\ dx & 0 & 0 \\ k-x & y & 0 \end{matrix} \quad \begin{matrix} \hat{i} = 0 \\ \hat{j} = 0 \\ \hat{k} = y\,dx \end{matrix}$$

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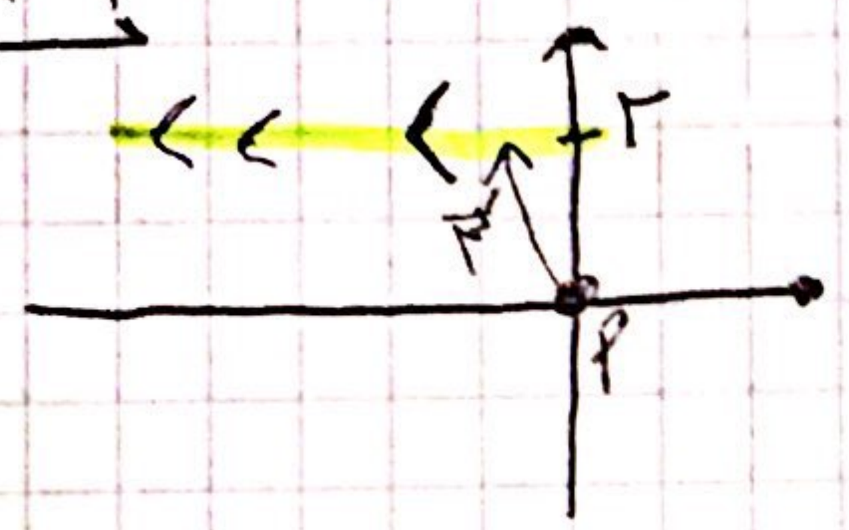
$$= \frac{\mu i}{4\pi} \int_0^{\infty} \frac{y\,dx(-\hat{z})}{((k-x)^2+y^2)^{\frac{3}{2}}} = \frac{\mu i}{4\pi}\hat{z}\left(\frac{1}{y} + \frac{1}{y\sqrt{\frac{k^2}{c^2}+1}}\right)$$

$$B_T = B_1 + B_2$$

2 Separamos por partes:

Parte 1



$$\vec{r} = 0$$

$$\vec{r}' = -x\hat{x} + r\hat{y}$$

$$dL = dx \;\; -\hat{x}$$

$$|\vec{r}-\vec{r}'| = \sqrt{x^2+r^2}$$

$$\vec{B}_1(\vec{r}) = \frac{\mu_0 i}{4\pi} \int_{-\infty}^{0} \frac{(-dx\,\hat{x}) \times (-x\hat{x}+r\hat{y})}{(x^2+r^2)^{\frac{3}{2}}}$$

$$\begin{array}{ccc} \hat{i} & \hat{j} & \hat{k} \\ -dx & 0 & 0 \\ -x & -r & 0 \end{array} \quad \begin{cases} \hat{i} = 0 \\ \hat{j} = 0 \\ \hat{k} = r\,dx \end{cases}$$

$$= \frac{\mu_0 i}{4\pi} \int_{-\infty}^{0} \frac{r\,dx\,\hat{z}}{(x^2+r^2)^{\frac{3}{2}}}$$

$$= \frac{\mu_0 i}{4\pi}(r\hat{z}) \int_{-\infty}^{0} \frac{dx}{(x^2+r^2)^{\frac{3}{2}}}$$

$$= \frac{\mu_0 i}{4\pi}(r\hat{z}) \cdot \left(\frac{x}{r^2(r^2+x^2)^{\frac{1}{2}}} \Bigg|_{-\infty}^{0} \right)$$

$$= \frac{\mu_0 i}{4\pi} r\hat{z}\left(0 - \left(-\frac{1}{r^2}\right)\right) = \frac{\mu_0 i}{4\pi r}\hat{z}$$

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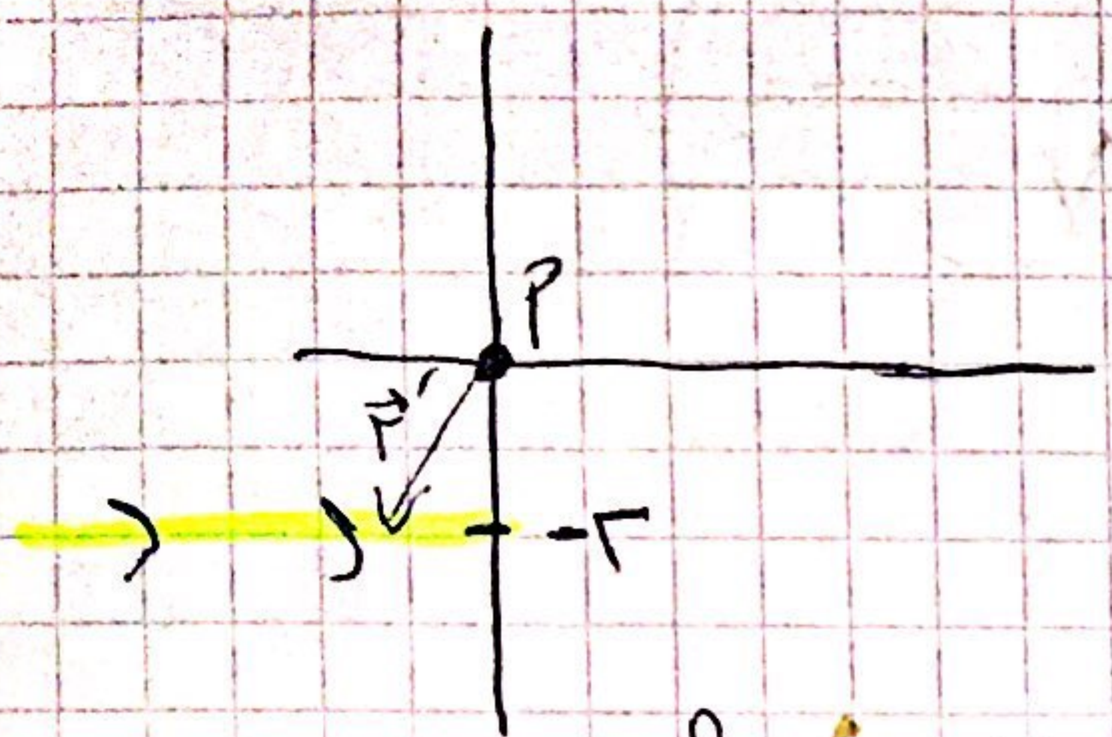
Parte 2



$\vec{r} = 0$

$\vec{r}' = x\,\hat{x} - r\,\hat{y}$

$dL = dx\,\hat{x}$

$|\vec{r} - \vec{r}'| = \sqrt{x^2 + r^2}$

$$B_2(\vec{r}) = \frac{\mu_0 i}{4\pi} \int_{-\infty}^{0} \frac{(dx\ \hat{x}) \times (-x\hat{x} + r\,\hat{y})}{(x^2+r^2)^{\frac{3}{2}}}$$

$$\begin{array}{ccc} \hat{i} & \hat{j} & \hat{k} \\ dx & 0 & 0 \\ x & -r & 0 \end{array} \left.\right\} \begin{array}{l} \hat{i} = 0 \\ \hat{j} = 0 \\ \hat{k} = -dx\,r \end{array}$$

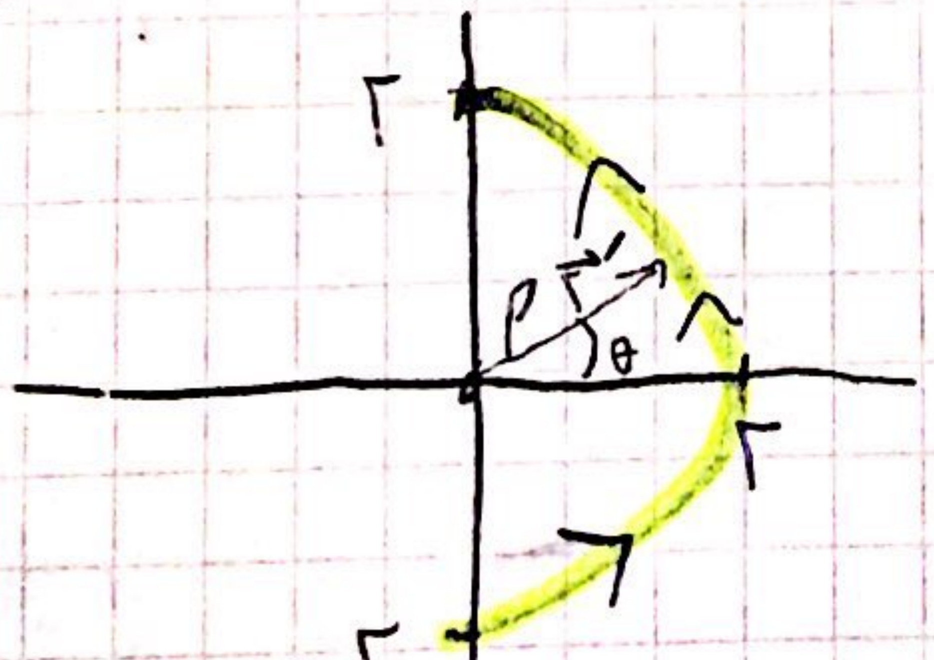
$$= \frac{\mu_0 i}{4\pi} \int_{-\infty}^{0} \frac{dx\, r\,(-\hat{z})}{(x^2+r^2)^{\frac{3}{2}}}$$

$$= \frac{\mu_0 i}{4\pi}\, r\, -\hat{z} \int_{-\infty}^{0} \frac{dx}{(x^2+r^2)^{\frac{3}{2}}}$$

$$= \frac{\mu_0 i}{4\pi}\, r(-\hat{z}) \left[\frac{x}{r^2 (r^2+x^2)^{\frac{1}{2}}} \right|_{-\infty}^{0}$$

$$= \frac{\mu_0 i}{4\pi}\, r\, \hat{z}\, \frac{1}{r^2} = \frac{\mu_0 i}{4\pi r}\, -\hat{z}$$

Parte 3



$\vec{r} = 0$

$\vec{r}' = r\cos(\theta)\,\hat{x} + r\sin(\theta)\,\hat{y}$

$d\vec{L} = r\, d\vec{\theta} = r\,d\theta\,\hat{\theta}$ donde $\hat{\theta} = -\sin\theta\,\hat{x} + \cos\theta\,\hat{y}$

$|\vec{r} - \vec{r}'| = r$

$$B_3(\vec{r}) = \frac{\mu_0 i}{4\pi} \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{(r\,d\theta) \times (-r\cos(\theta)\,\hat{x} - r\sin(\theta)\,\hat{y})}{r^3}$$

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$$= \frac{\mu_0 i}{4\pi}\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{r^2 d\theta}{r^3}\ \hat{z}$$

$$\begin{array}{ccc} \hat{i} & \hat{j} & \hat{k} \\ -r\sin(\theta)d\theta & r\cos(\theta)d\theta & 0 \\ -r\cos(\theta) & -r\sin(\theta) & 0 \end{array}$$

$$= \frac{\mu_0 i}{4\pi r}\ \hat{z}\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} d\theta$$

$\hat{i} = 0$

$\hat{j} = 0$

$\hat{k} = d\theta r^2\sin^2(\theta) + d\theta r^2\cos^2(\theta) = r^2 d\theta$

$$= \frac{\mu_0 i}{4r}\ \hat{z}$$

$$\vec{B}_T = \vec{B}_1 + \vec{B}_2 + \vec{B}_3$$

3

$$\int \frac{\mu_0 . i}{2} \cdot \frac{r^2}{(r^2+z^2)^{\frac{3}{2}}}\, dz = \frac{\mu_0 i r^2}{2}\int \frac{dz}{(r^2+z^2)^{\frac{3}{2}}} = \frac{\mu_0 i r^2}{2}\ \frac{z}{r^2(r^2+z^2)^{\frac{1}{2}}}$$

Y además:

$$\lim_{z\to\infty} \frac{z}{r^2(r^2+z^2)^{\frac{1}{2}}} = \frac{1}{r^2}$$

$$\lim_{z\to-\infty} \frac{z}{r^2(r^2+z^2)^{\frac{1}{2}}} = -\frac{1}{r^2}$$

Entonces:

$$\int_{-\infty}^{\infty} B_z(z)\, dz = \frac{\mu_0 i r^2}{2}\left(\frac{1}{r^2} - \left(\frac{-1}{r^2}\right)\right) = \mu_0 . I$$

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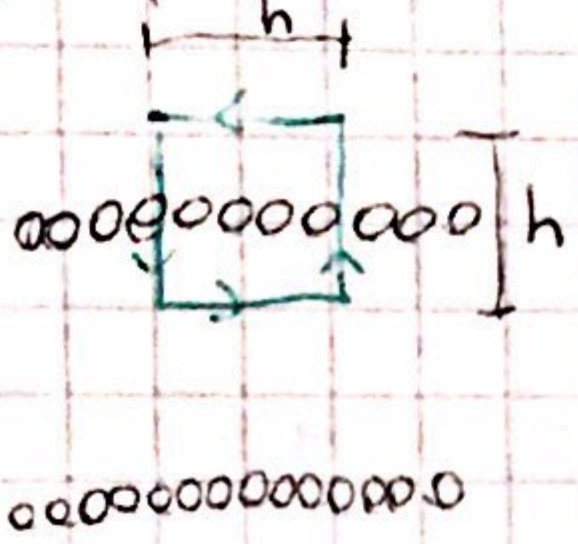
Supongamos que es de longitud infinita, por lo tanto el campo fuera es cero, y dentro uniforme:



$$\oint \vec{B}\, d\vec{l} = \mu_0 . i_{enc}$$

$$B d = \mu_0 \, i N_0 d$$

$$B = \mu_0 . i . N_0$$

Necesitamos calcular R. Para eso calculamos cuanto mide el cable. Sabemos que en total tiene 128 vueltas por lo tanto hay que calcular el perímetro de una circunferencia de radio $r = \frac{8}{2}$ cm y multiplicarla por 128. Es decir

$$\ell = 2\pi . 4cm . 128 = 32,16 m$$

Entonces $R = 0,01 \frac{\Omega}{m} . 32,16 \, m = 0,32 \, \Omega$

$$V = i.R \Rightarrow i = \frac{V}{R} = \frac{50V}{0,32 \, \Omega} = 156,25 A$$

$$N_0 = \frac{4}{cm} = \frac{400}{m}$$

Entonces:

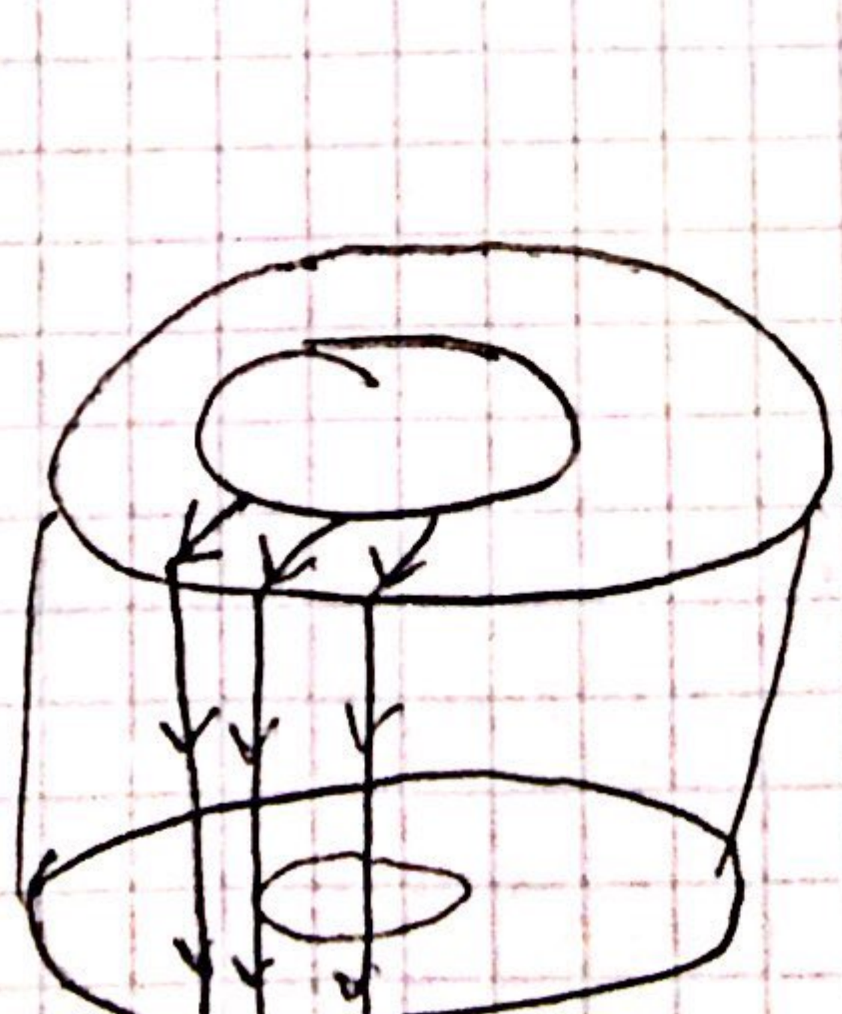
$$B = 4\pi 10^{-7} . 156,25 . 400 . \frac{T.m}{A} . \frac{V}{\Omega} . \frac{1}{m} = 0,078 \; T$$

$$\cancel{B = 160\pi 10^{-2} . T . \frac{\Omega}{V} . \frac{V}{\Omega}}$$

$$\cancel{B = 160\pi 10^{-2} \, T = 5,02 \, T}$$

5

a)



CoSupongamos dicha orientación de i

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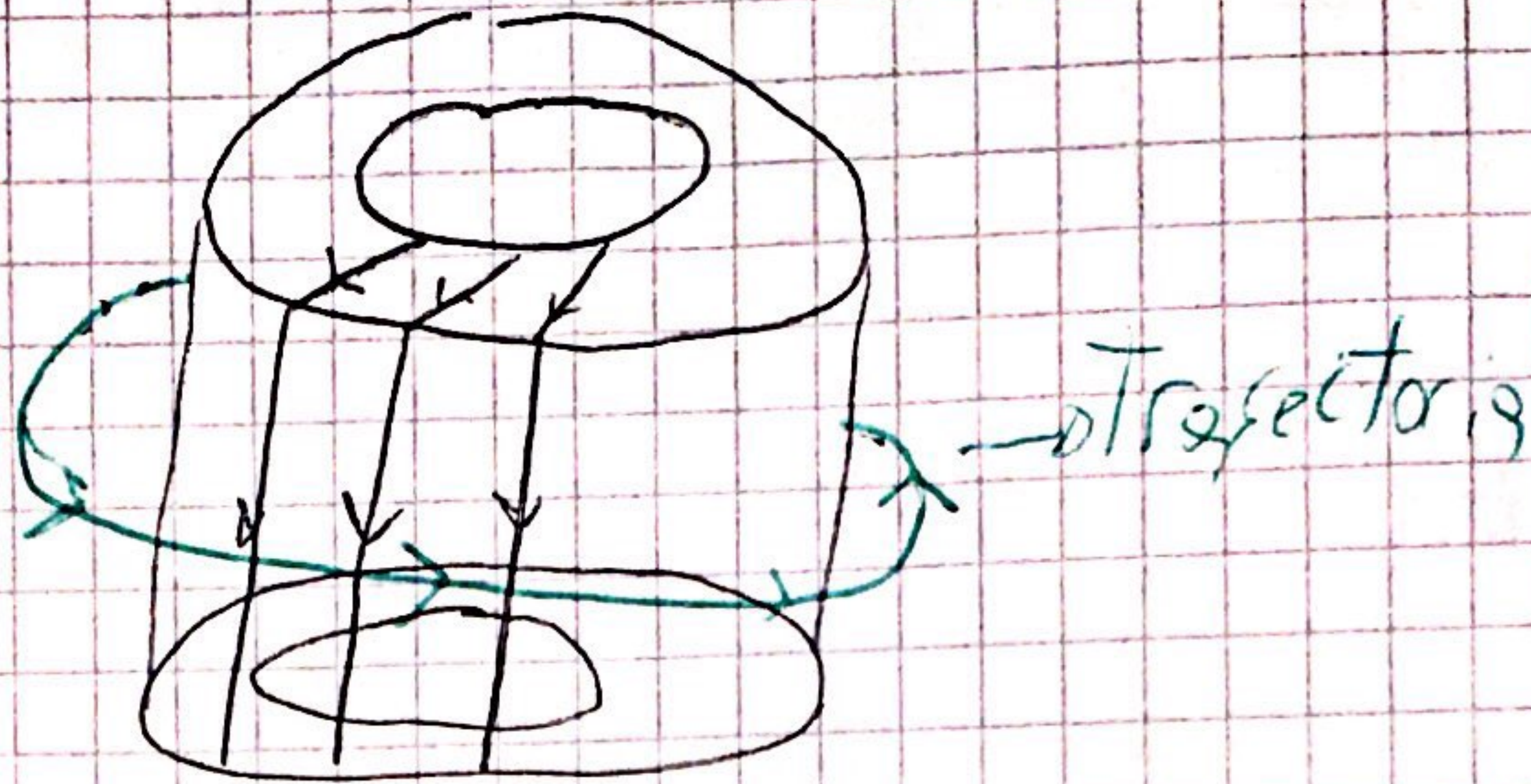
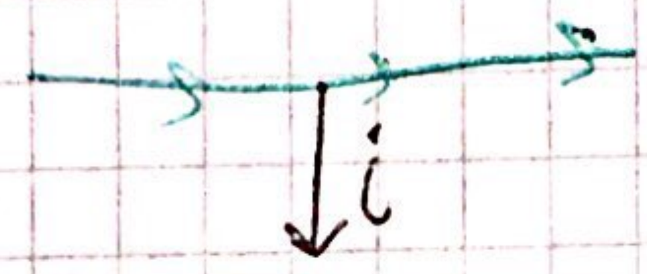
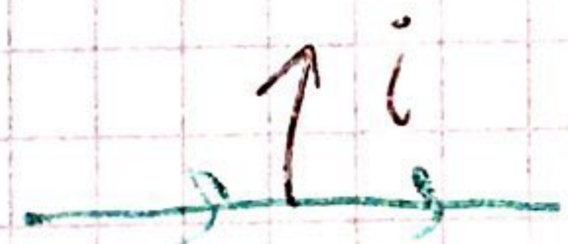
Notemos que:



Para los alambres fuera del toroide:



Para los alambres en el hueco interior del toroide

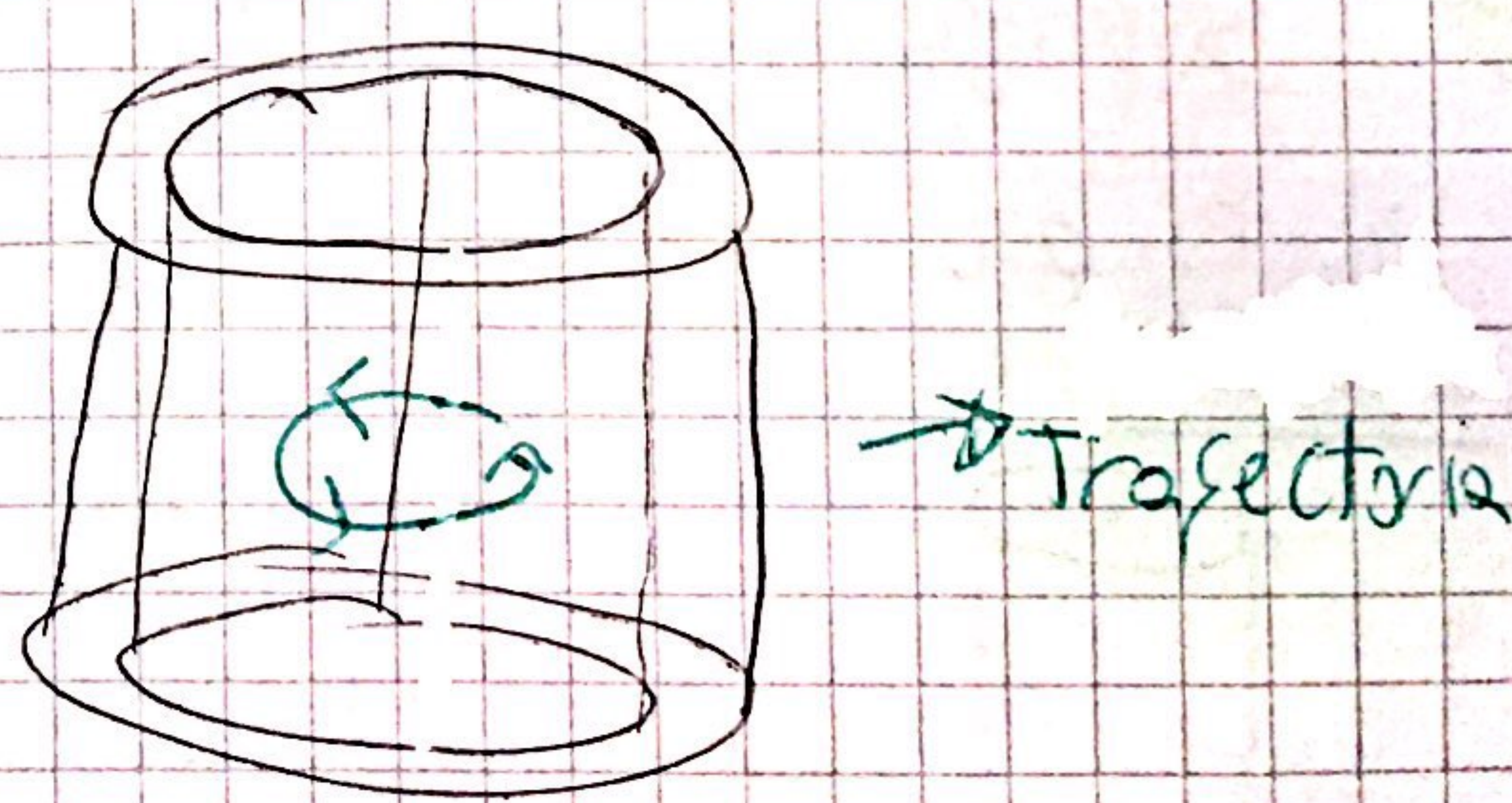


Por lo tanto la $i_{enc} = 0$ fuera del toroide $\Longrightarrow \boxed{B = 0}$

Por otro lado

Para la trayectoria dentro sucede que $i_{enc} = 0$

$\Longrightarrow \boxed{B = 0}$



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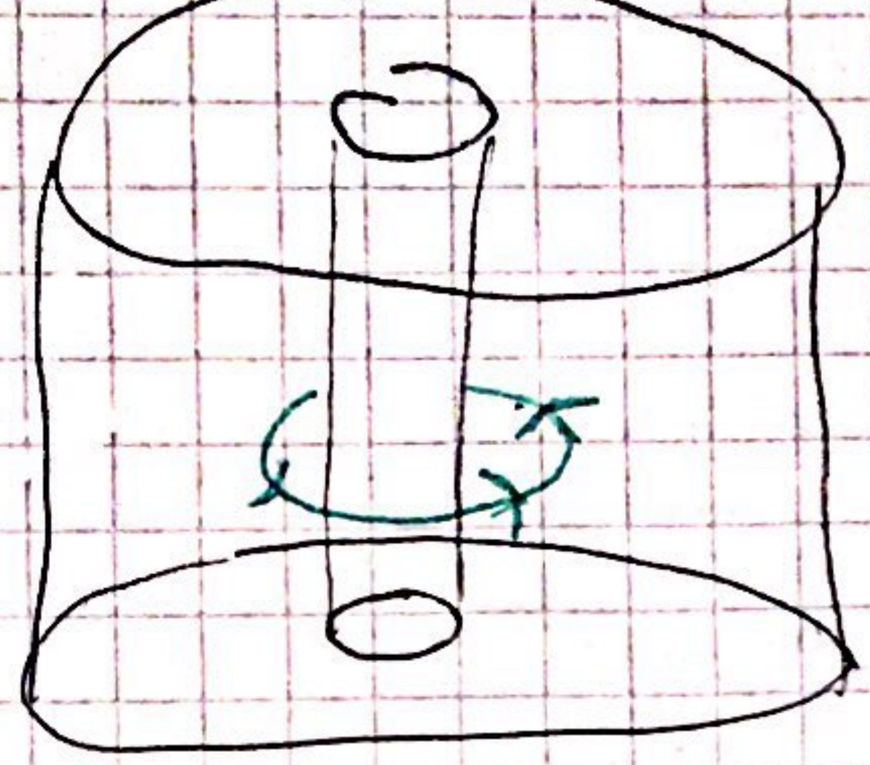
b) Es de notar que:

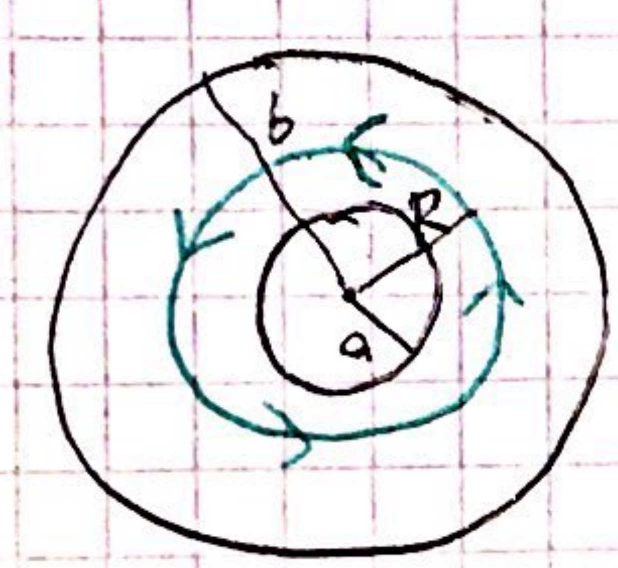


N: Número de espiras.

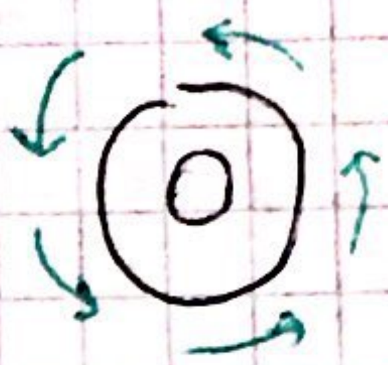
$N = N_0 . l$

$i_{enc} = N i$

Visto desde arriba:



El campo tendrá esta forma:



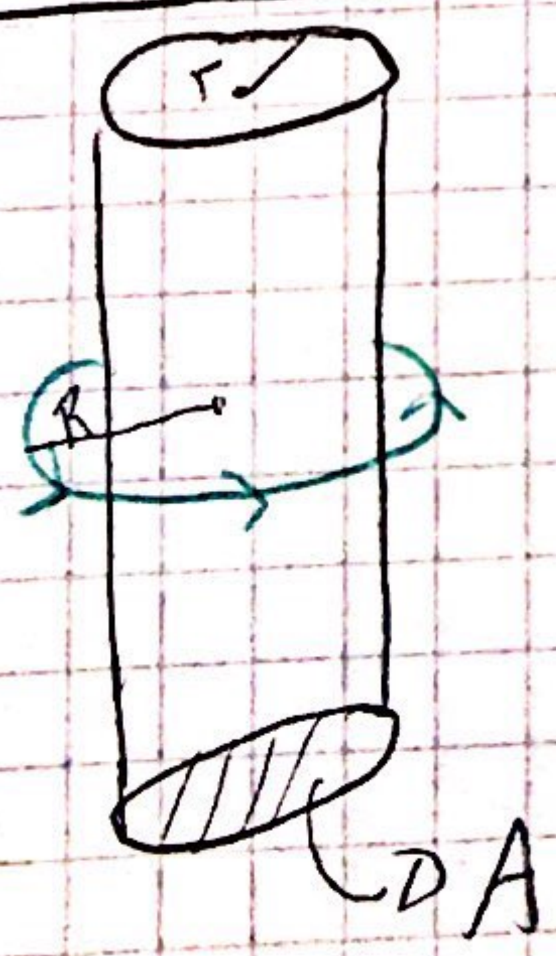
$$\int_0^{2\pi} \vec{B}_\theta(\theta,z)\, d\vec{l} = \int_0^{2\pi} \left(B_\theta(\theta,z)\,\hat{\theta}\right).\left(r\, d\theta\, \hat{\theta}\right) = \int_0^{2\pi} B_\theta(\theta,z)\, r\, d\theta = B_\theta(r,z).r.2\pi$$

$= \mu_0 I_{enc}$

$$\boxed{B = \frac{\mu_0 N . i}{2\pi r}}$$

6) Supongamos que el cilindro es infinitamente largo, es decir que tiene simetría radial.

Fuera del cilindro



$i = j \pi r^2$

$i_{enc} = i$, pues la sup que encierra la trayectoria es A

$\int \vec{B} d\vec{l} = i \mu_0$

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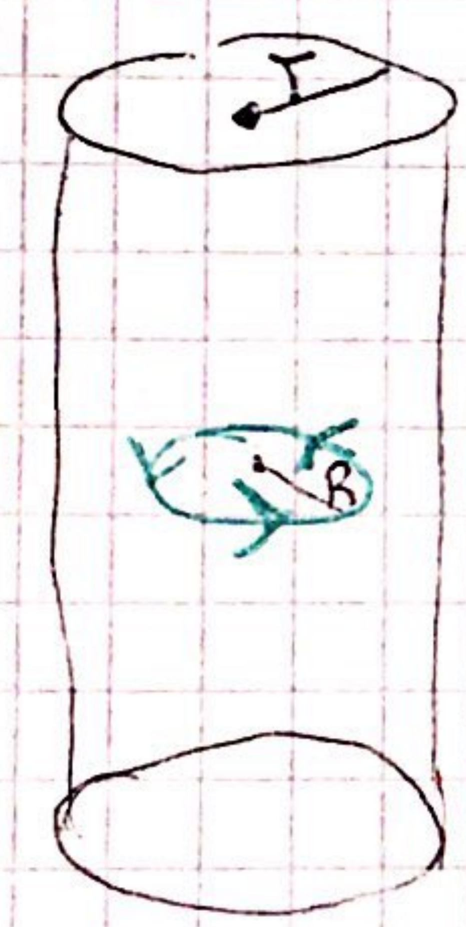
$$B\int dL = \mu_0 . i$$

$$B\, 2\pi R = \mu_0 \cdot j . \pi . r^2$$

$$B = \frac{\mu_0\, j\, \pi\, r^2}{2\pi R}$$

$$\boxed{B = \frac{\mu_0\, j\, r^2}{2R}}$$

Dentro del cilindro:



$$i = j . \pi . r^2$$

$$i_{enc} = j\,\pi . R^2$$

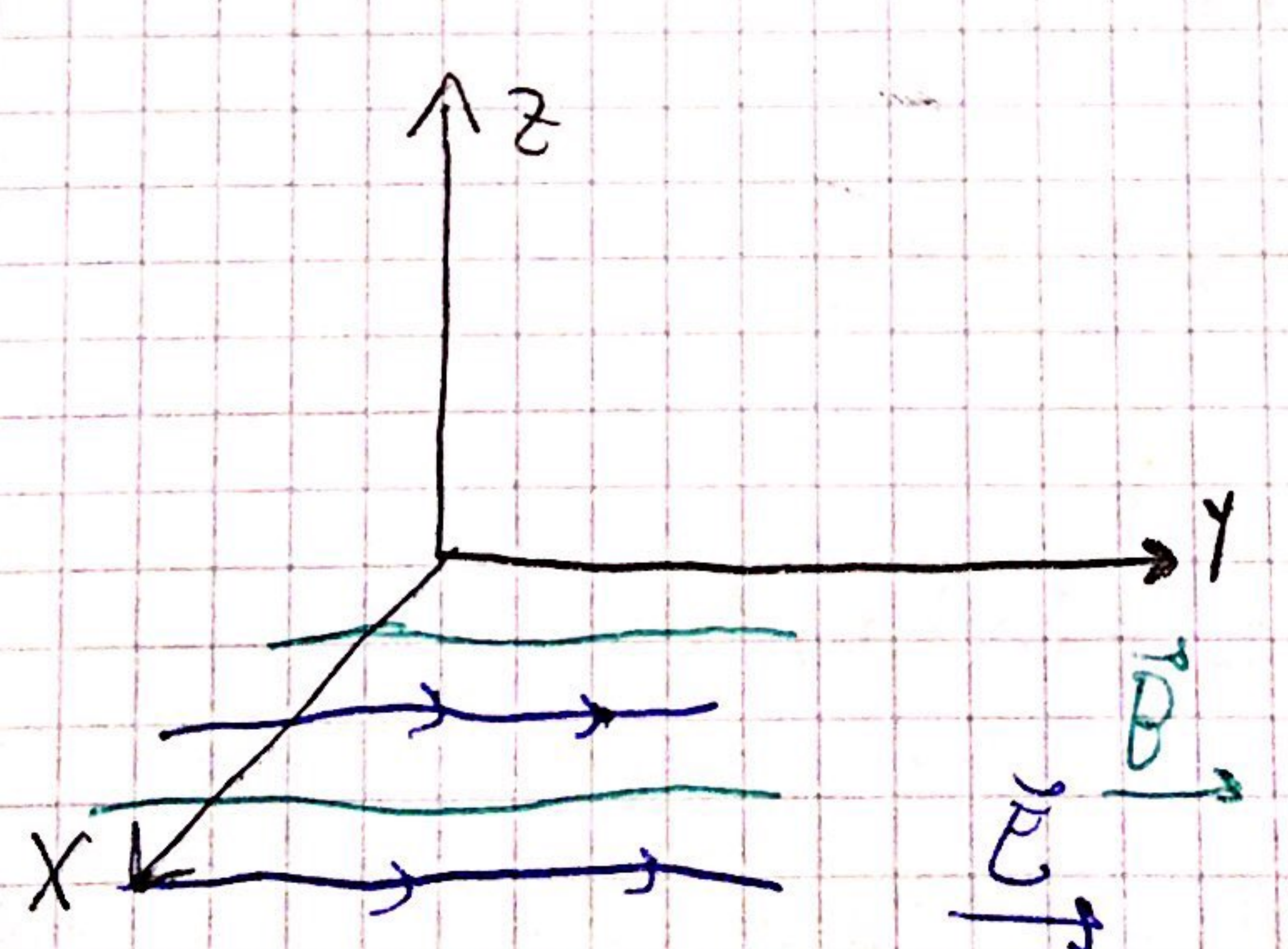
$$\int \vec{B}\, d\vec{l} = \mu_0\, j\, \pi R^2$$

$$B\, 2\pi R = \mu_0\, j\, \pi R^2$$

$$\boxed{B = \frac{\mu_0\, j\, R}{2}}$$

7

a)



NOTA

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$$\vec{F}_{Total} = q(\vec{E} + \vec{V} \times \vec{B})$$

Notemos que:

$$\vec{V} \times \vec{B} = (V_x(t)\hat{x} + V_y(t)\hat{y} + V_z(t)\hat{z}) \times B\hat{y}$$

$$= V_x(t).B.\hat{z} + 0 - V_z(t).B.\hat{x}$$

$$\vec{E} = E.\hat{y}$$

Entonces

$$\vec{F}_T = \vec{F}_x + \vec{F}_y + \vec{F}_z$$

$$\vec{F}_x = -q.V_z(t).B.\hat{x} = m.\vec{a}_x \Longrightarrow \vec{a}_x = \frac{-q V_z(t).B}{m} . \hat{x}$$

$$\vec{F}_y = q.E.\hat{y} = m.\vec{a}_y \Longrightarrow \vec{a}_y = \frac{q.E}{m}\hat{y}$$

$$\vec{F}_z = q.V_x(t) B\hat{z} = m\vec{a}_z \Longrightarrow \vec{a}_z = \frac{q V_x(t) B}{m}\hat{z}$$

b)

$$a_x = -\frac{qB}{m}.V_z(t)$$

$$\frac{d V_x(t)}{dt} = -\omega.V_0.\sin(\omega t)$$

$$\frac{d(V_0 \cos(\omega t))}{dt} = -\omega.V_0.\sin(\omega t)$$

$$-V_0 \omega \sin(\omega t) = -\omega.V_0.\sin(\omega t)$$

✓ Verdadero.

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$$a_y = \frac{q.E}{m}$$

$$\frac{d(V_y(t))}{dt} = \frac{qE}{m}$$

$$\frac{d\left(\frac{q.E.T}{m}\right)}{dT} = \frac{qE}{m}$$

$$\frac{qE}{m} = \frac{qE}{m}$$ verdadero

$$a_z = \frac{q.V_x(t).B}{m}$$

$$\frac{d(V_z(t))}{dt} = \omega . V_x(T)$$

$$\frac{d(V_0 \sin(\omega t))}{dt} = \omega . V_0 . \cos(\omega t)$$

$$V_0 \omega . \cos(\omega T) = \omega . V_0 . \cos(\omega T)$$ verdadero

c)

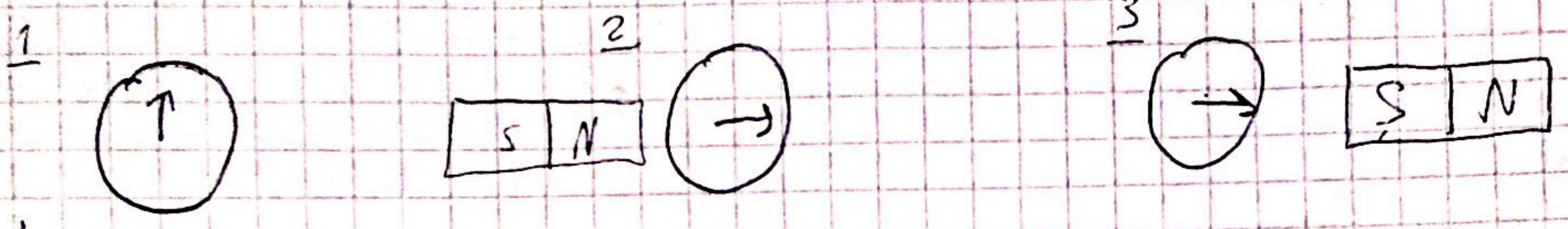
$$X(t) = \frac{1}{2} a_x . T^2 + V_{0x} . T + X_0 = -\frac{qV_z(t) B}{2m} . T^2 + V_0 . T$$

$$Y(t) = \frac{1}{2} . a_y . T^2 + V_{0y} . T + Y_0 = \frac{qE}{2m} . T^2$$

$$Z(t) = \frac{1}{2} a_z . T^2 + V_{0z} . T + Z_0 = \frac{qV_x(t) B}{2m} . T^2$$

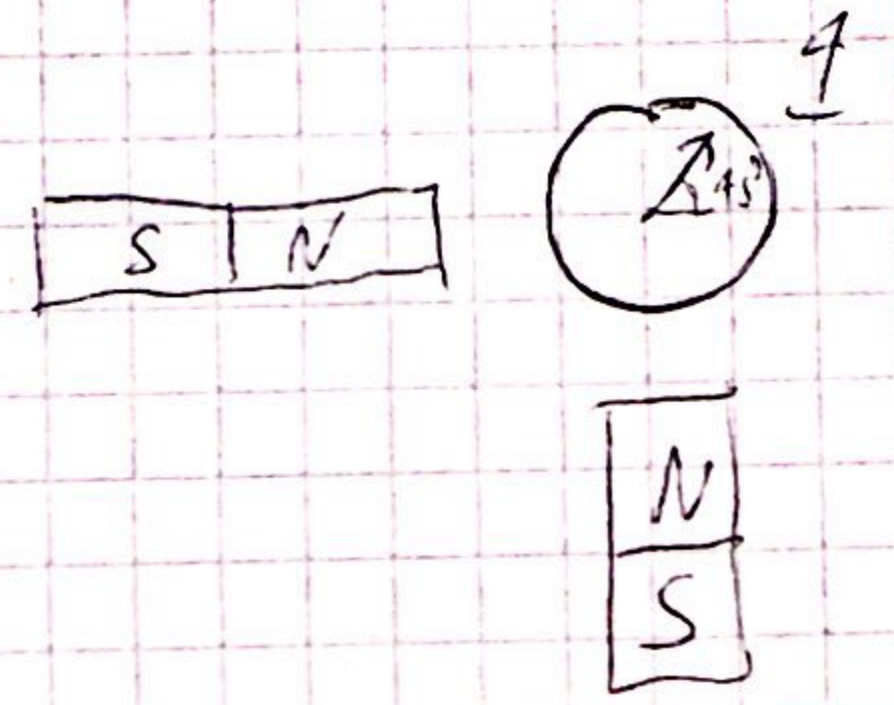
NOTA

8 Notemos las siguientes situaciones donde los imanes producen las mismas intensidades de campo magnético



brújula sin campo

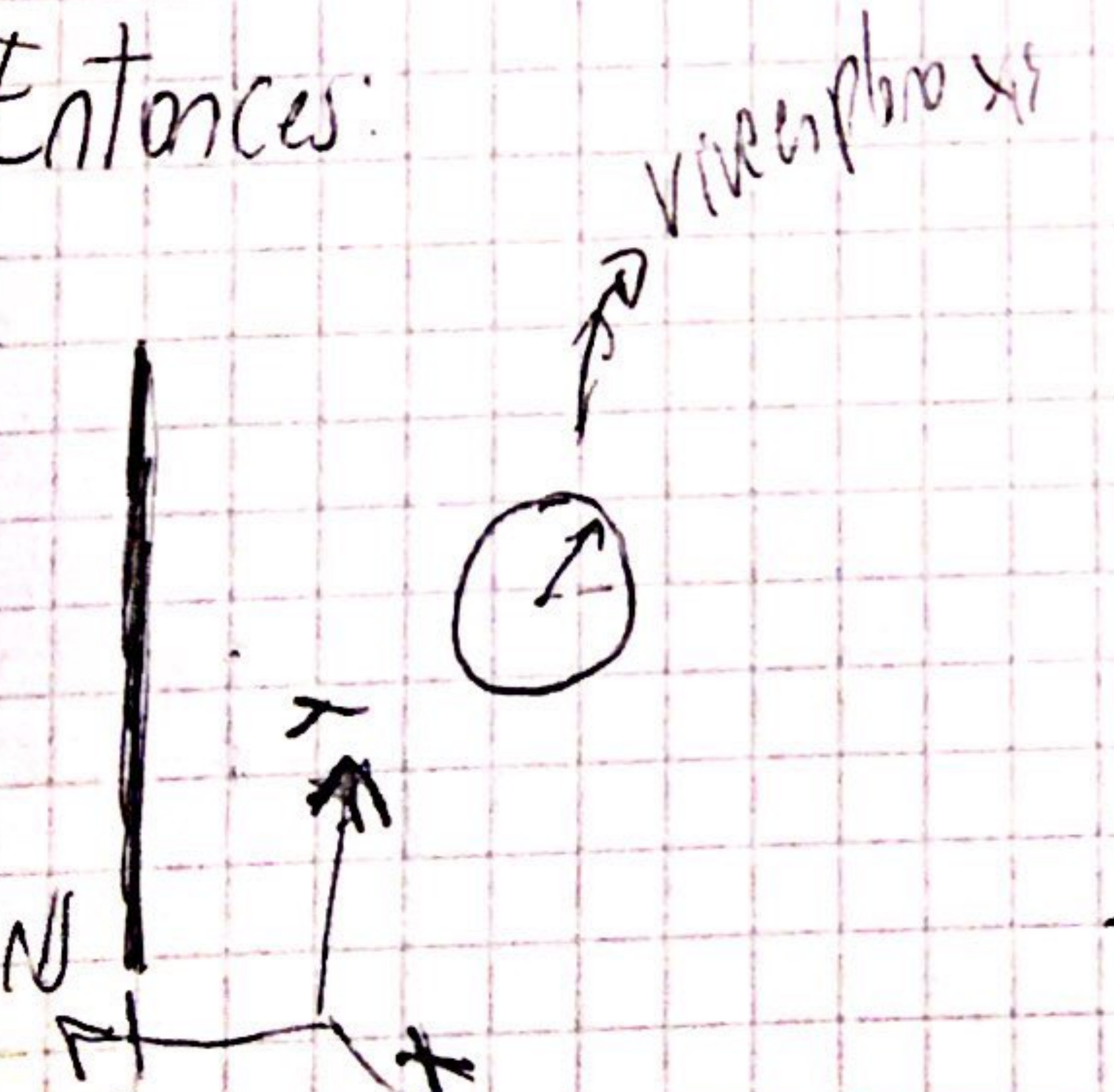
Es de notar entonces:



Con ambos imanes de igual magnitud y direcciones ortogonales.

Es de notar que el alambre en la mesa y la tierra ilustran una situación parecida a 4, pues dadas sus posiciones, para que la aguja se mueva 45°, los campos deben ser iguales en donde está la brújula.

Entonces:



$$\int_A \vec{B}\, d\vec{L} = i \cdot \mu_0$$

$$B_A \int dL = i \, \mu_0$$

$$\frac{2\pi B_A d}{\mu_0} = i$$

$d = 1{,}9$ cm
↓
distancia entre el cable y la brújula.

Dado que $B_A = B_{Tierra}$:

$$i = \frac{2 \cdot 10^{-5}\, T}{4\pi 10^{-7}} \cdot \frac{A}{T m} \cdot 0{,}019 m \cdot 2\pi = 1{,}9 \, A$$

NOTA

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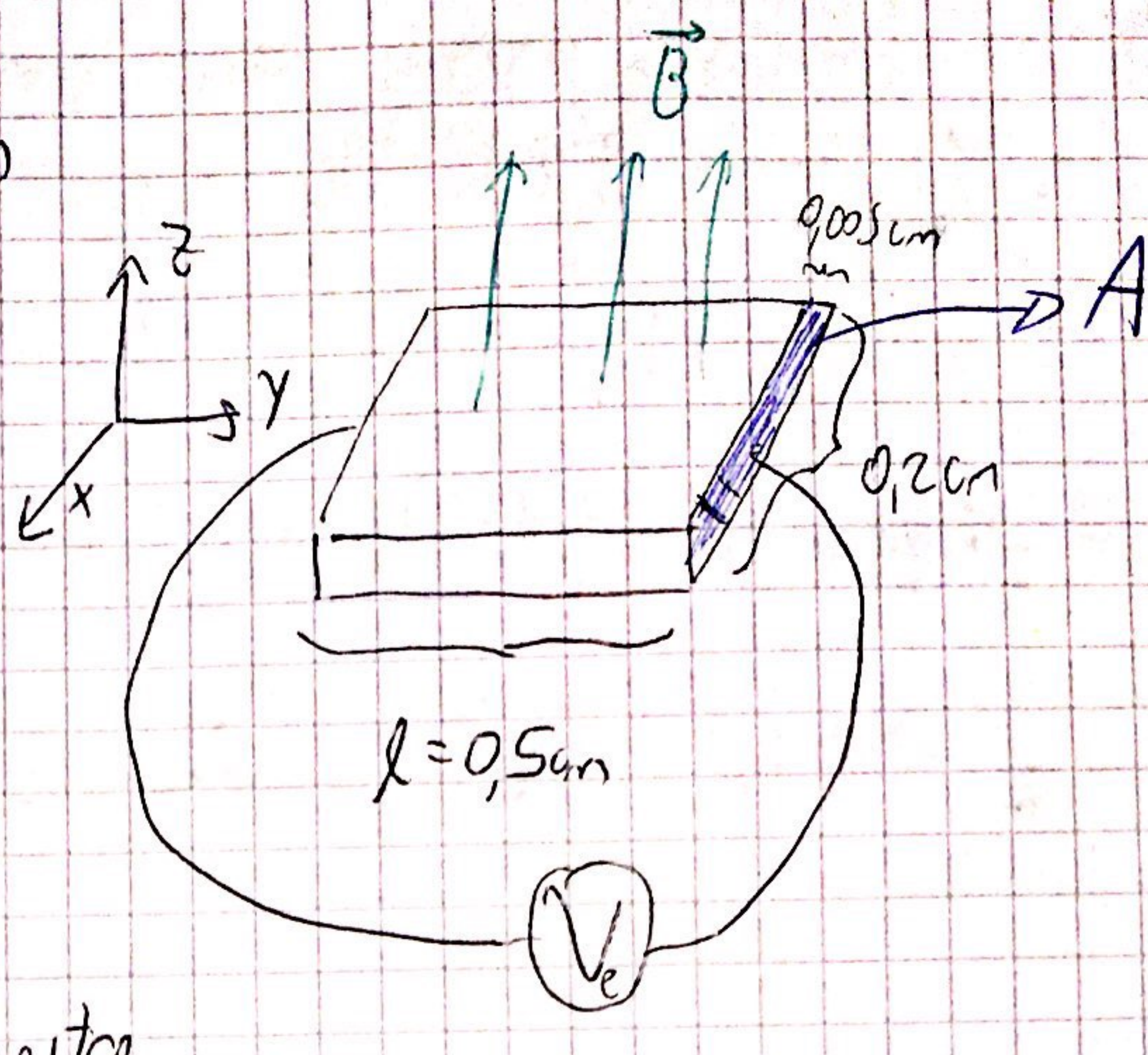
a) $\begin{cases} n = 2.10^{15}\ cm^{-3} \\ \rho = 1{,}6\ \Omega m \\ V_e = 1V \\ B = 0{,}1T \end{cases}$



$V_d = \frac{i}{n.A.e}$ ~ Velocidad de arrastre

$A = 0{,}2cm \cdot 0{,}005\ cm$

Falta conocer i:

$i = \frac{V}{R}$

$\rho = \frac{RA}{l} \Rightarrow R = \frac{\rho . l}{A} \Longrightarrow i = \frac{V.A}{\rho l}$

Entonces:

$V_d = \frac{V.A}{n.A.e\ \rho.l}$ ~ son todos datos

Dado que i va en dirección $\hat{y}$, $\vec{V_d} = \frac{V}{n.e.\rho.l}\ (-\hat{y})$

$V_d = \frac{1}{(2.10^{15})(-1{,}602.10^{-19})(1{,}6)(0{,}5)} \cdot \frac{cm}{s} = \frac{10^4}{(2{,}5632)}$

$= \frac{10^4}{2{,}5632}\frac{cm}{s} = 3900\ \frac{cm}{s}$

NOTA

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b)

$$\vec{F}_m = q \cdot (\vec{V}_f \times \vec{B})$$

$$= q(V_f \cdot \hat{y} \times B\,\hat{z})$$

$$= q V_f B (-\hat{x})$$

$$= (-1{,}602 \cdot 10^{-19})\ (39)(0{,}1)\ C \cdot \frac{m}{s} \cdot T\ (-\hat{x})$$

$$= -6{,}2478 \cdot 10^{-19}\, C \cdot \frac{m}{s} \cdot \frac{N \cdot s}{m \cdot C} \cdot -\hat{x} = 6{,}2478 \cdot 10^{-19}\, N\ \hat{x}$$

c)

NOTA

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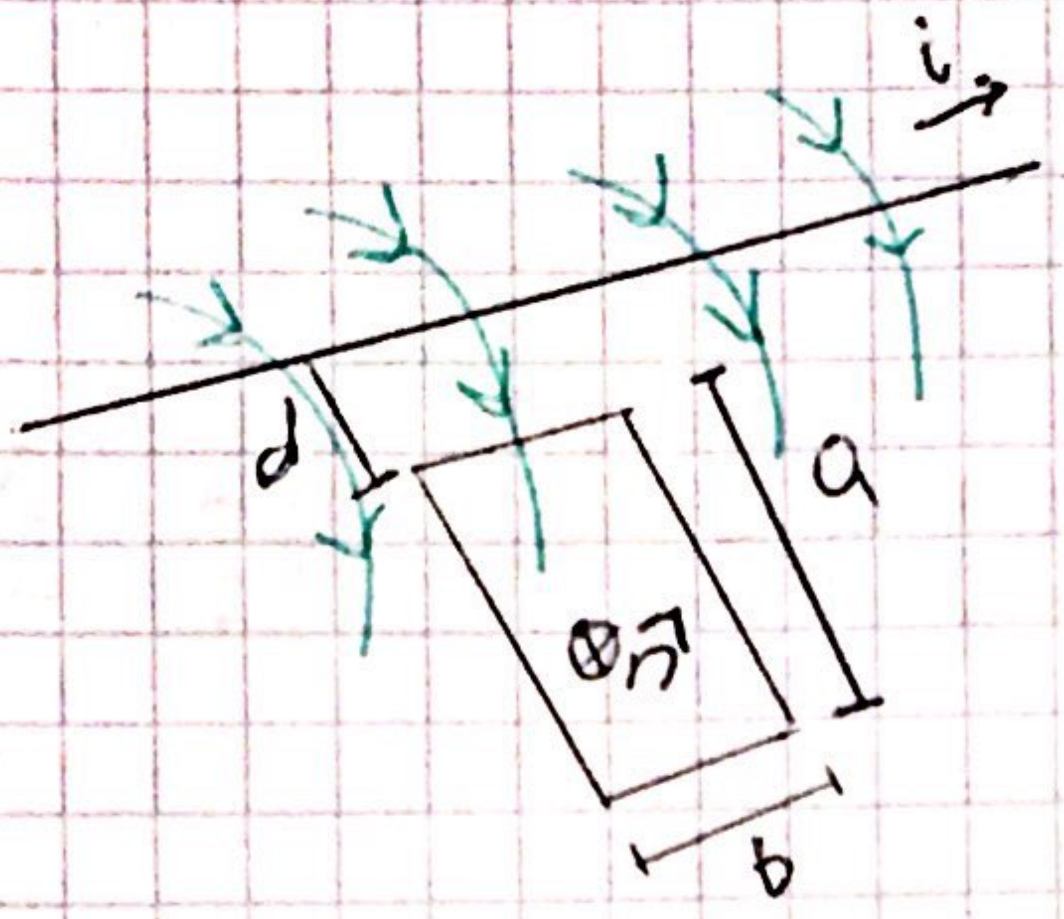
10

Para explicar cómo una fem inducida ε se genera debido a la variación del flujo magnético en el tiempo, se usa la ley de Faraday.

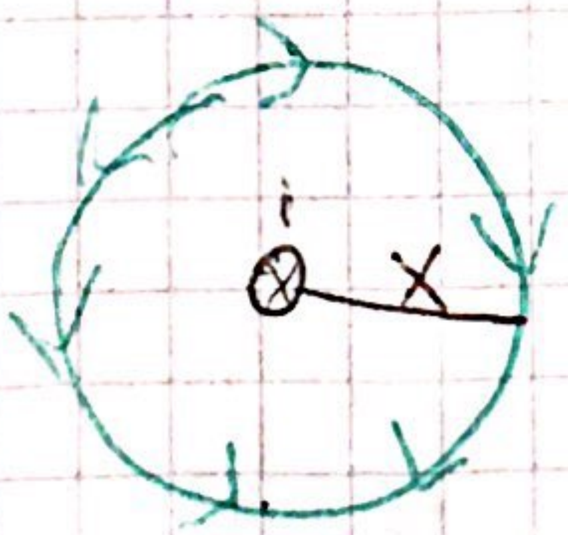


Es claro que el campo magnético va a ser radial, dado por i

$$\varepsilon = \frac{-d\Phi_B}{dt}$$

$$\Phi_B = \int_S \vec{B}\, ds$$

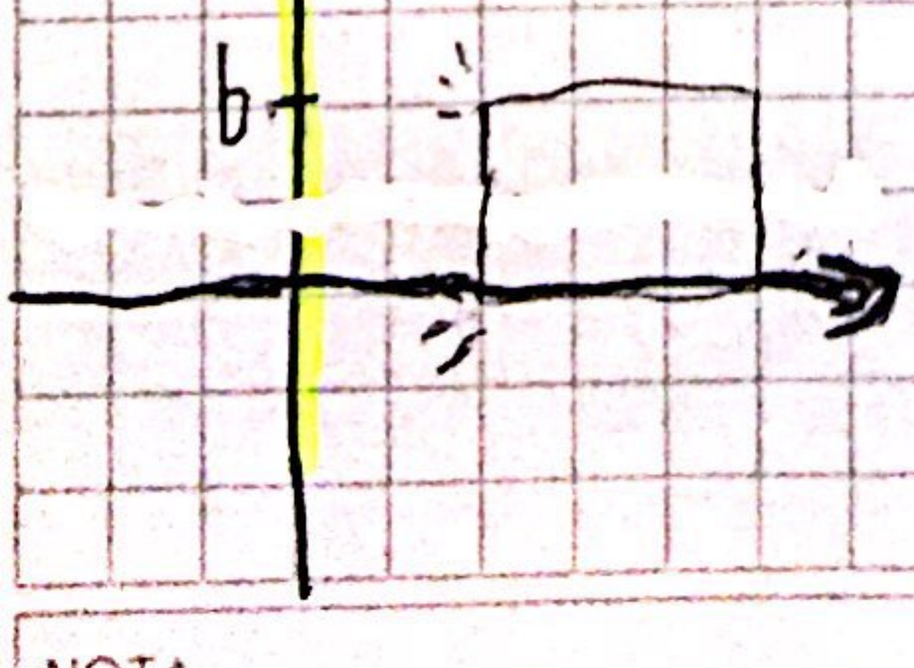
Cálculo del campo:



$$\oint B\, dl = \mu_0\, i_{enc}$$

$$B\, 2\pi x = \mu_0\, i$$

$$\boxed{B = \frac{\mu_0\, i}{2\pi x}}$$



$$\Phi_B = \int_d^{d+a}\int_0^b B\, ds$$

$\cdot\ d\vec{s} = dx.dy\ -\hat{z}$

$\cdot\ d(t) = V.t + d_0$

↳ función posición

$$= \frac{\mu_0 i}{2\pi}\int_d^{d+a}\frac{1}{x}\,dx\int_0^b dy\,(-\hat{z})$$

$$= \ln(x)\Big|_d^{d+a}\cdot\frac{\mu_0 i b}{2\pi}\,-\hat{z} = \ln\left(\frac{d+a}{d}\right)\frac{\mu_0 i b}{2\pi}\cdot -\hat{z}$$

Notar que $\dot{d}(t) = V$. Entonces:

$$\mathcal{E} = -\frac{d\Phi_B}{dt} = -\left(\frac{a}{d+a}\cdot\frac{1}{a}\cdot V\cdot\frac{\mu_0 i b}{2\pi}(-\hat{z})\right) = \frac{V_0}{d+a}\cdot\frac{\mu_0 i b}{2\pi}\,\hat{z}$$

~~Lo se va moviendo en sentido~~ $+\hat{X}$

$$\cancel{\Phi_B = \int_0^{d(t)} B\,dx\int_0^b dy\,(-\hat{z})}$$

$$\cancel{= B\cdot d(t)\cdot b\,(-\hat{z})}$$

$$\cancel{\mathcal{E} = -\frac{d\Phi_B}{dt} = B\cdot V\cdot b\,\hat{z}}$$

$$\cancel{i = \frac{\mathcal{E}}{R} = \frac{B\cdot V\cdot b}{R}}$$

~~la velocidad es constante.~~

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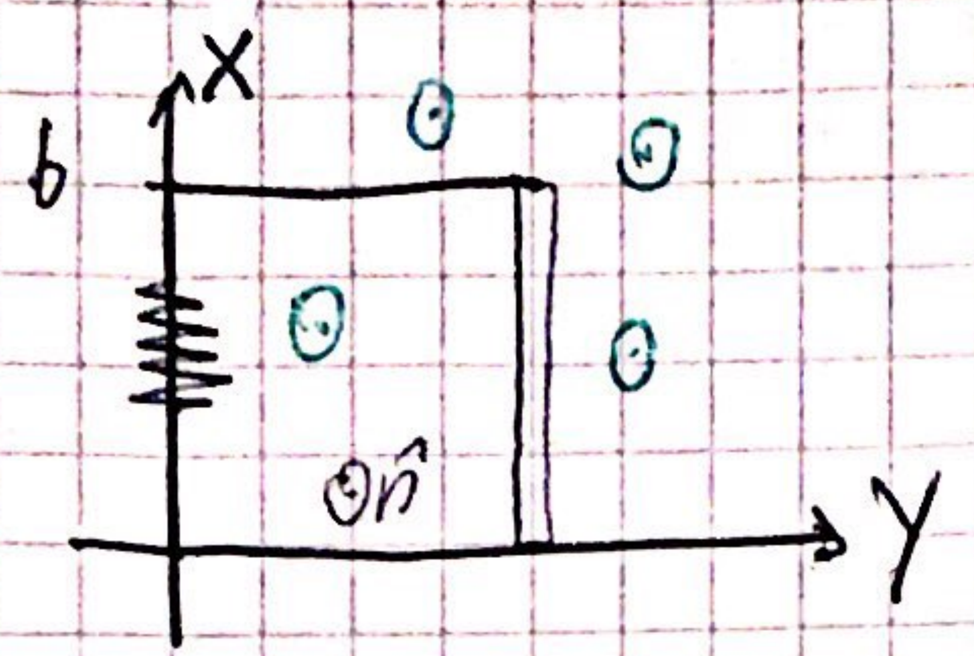

a) $V = i.R$

$$\Phi_B = \int_0^b \int_0^{y(t)} B . dy\, dx = B \int_0^b \int_0^{y(t)} dy\, dx = B . b . y(t)$$

uniforme y paralelo a la normal de la sup

donde $y(t) = \frac{1}{2} a_y t^2 + V_0 T$

$\Rightarrow V(t) = a_y T + V_0$

Luego:

$$\mathcal{E} = V = -\frac{d\Phi_B}{dT} = -Bb\, y'(T) = -Bb\, V(T)$$

$$\Rightarrow \quad i = -\frac{Bb V(T)}{R}$$

b)

$$\vec{F} = i \vec{l} \times \vec{B} = i\, l . B (-\hat{y}) = \frac{Bb V(t)}{R} . b . B (-\hat{y}) = \frac{B^2 b^2 V(T)}{R}$$

c) $F = m . a_y$

$$\Rightarrow a_y = \frac{F}{m} = \frac{B^2 b^2 V(T)}{m . R} = \frac{B^2 b^2 . (a_y . T + V_0)}{m . R}$$

$$\Rightarrow \quad a_y = a_y . \frac{B^2 b^2 T}{mR} + \frac{B^2 b^2 V_0}{m.R}$$

$$a_y \left(1 - \frac{B^2 b^2 . T}{m.R}\right) = \frac{B^2 b^2 V_0}{mR}$$

$$a_y = \frac{B^2 b^2 V_0}{mR - B^2 b^2 T}$$

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$$\Rightarrow V_y(T) = \int a_y \, dT = \int \frac{B^2 b^2 V_0}{mR - B^2 b^2 T} \, dT = -V_0 \cdot \ln(mR - B^2 b^2 T)$$

Luego: $V_y(T) \stackrel{?}{=} 0$

$$-V_0 \ln(mR - B^2 b^2 T) = 0$$

$$\ln(mR - B^2 b^2 T) = 0$$

$$mR - B^2 b^2 T = 1$$

$$mR - 1 = B^2 b^2 T$$

$$\frac{mR - 1}{B^2 b^2} = T'$$

Entonces:

$$y(T) = \frac{1}{2} a_y(T) \cdot T^2 + V_0 \cdot T$$

$$y(T') = \frac{1}{2} \cdot a_y(T') \cdot (T')^2 + V_0 \cdot T' = \frac{1}{2} \cdot$$

$$= \frac{1}{2} B^2 b^2 V_0 \cdot \frac{(mR-1)^2}{(B^2 b^2)^2} + V_0 \cdot \frac{mR-1}{B^2 b^2}$$

$$= \frac{(mR-1)^2}{2B^2 b^2} + \frac{V_0 (mR-1)}{B^2 b^2} = \frac{(mR-1)^2 + 2V_0(mR-1)}{2B^2 b^2}$$

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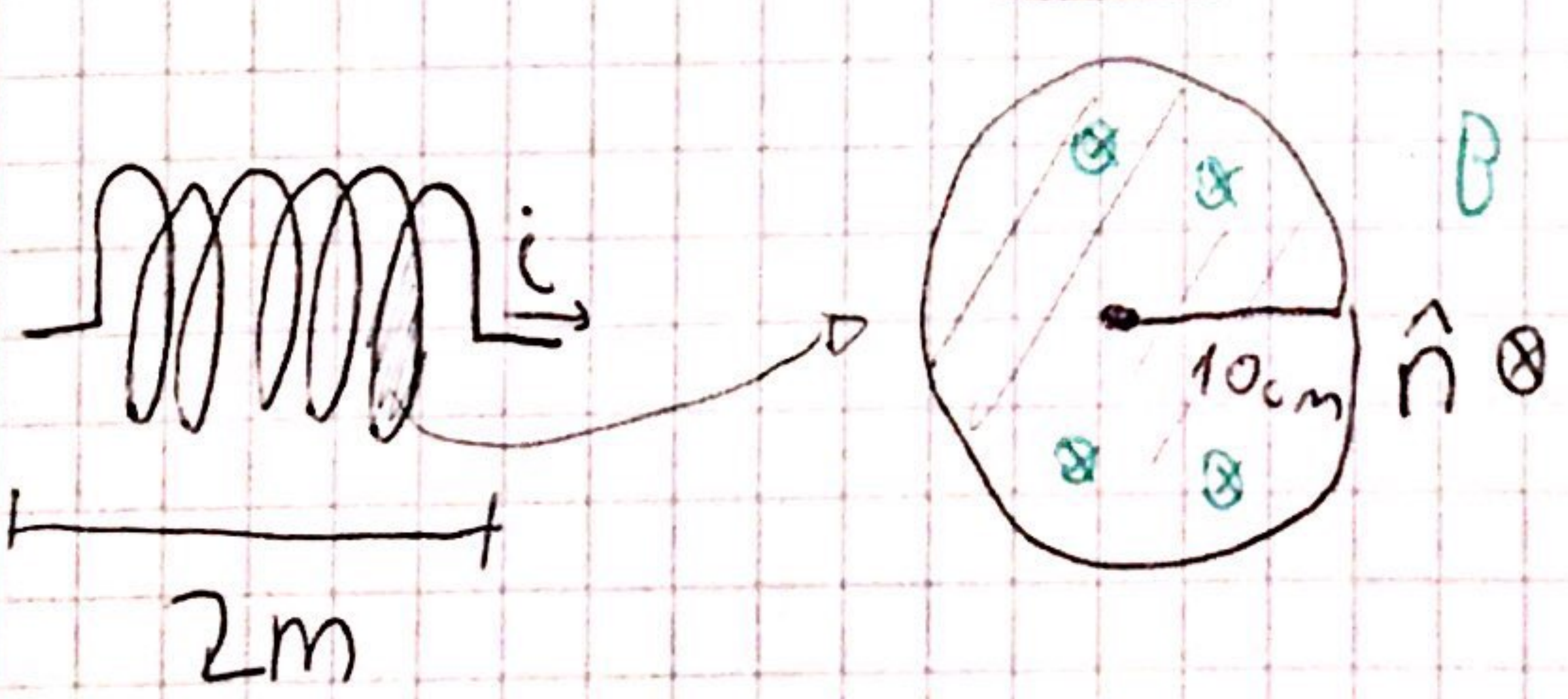
$N \cdot \Phi_B = L \cdot i$

$$\boxed{L = \frac{N \cdot \Phi_B}{i}}$$



$A = \pi \cdot (10cm)^2$

$N = 1200$

Sabemos que en un solenoide: $B = \mu_0 \cdot i \cdot N_0$, $\Phi_B = B \cdot A = \mu_0 i N_0 A$

Luego:

$$L = \frac{N_0 \mu_0 \, i \, N_0 A}{i} = \frac{\mu_0 N_0^2 \, i \, A}{i} = N_0^2 \cdot A \cdot \mu_0 = \frac{N^2 A \mu_0}{\ell^2} = \frac{(1200)^2 \cdot \pi \cdot 100cm^2 \cdot 4\pi 10^{-7}}{4m^2 \cdot A \cdot T^{-1} \cdot m^{-1}}$$

$N_0 = \frac{N}{\ell}$

$= 142 \frac{Tm}{A} cm^2$

$= 0.142 \frac{Tm^2}{A}$

NOTA

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