23/1/2023 EX 2 . LEAC1

$\ell = 36$ mm

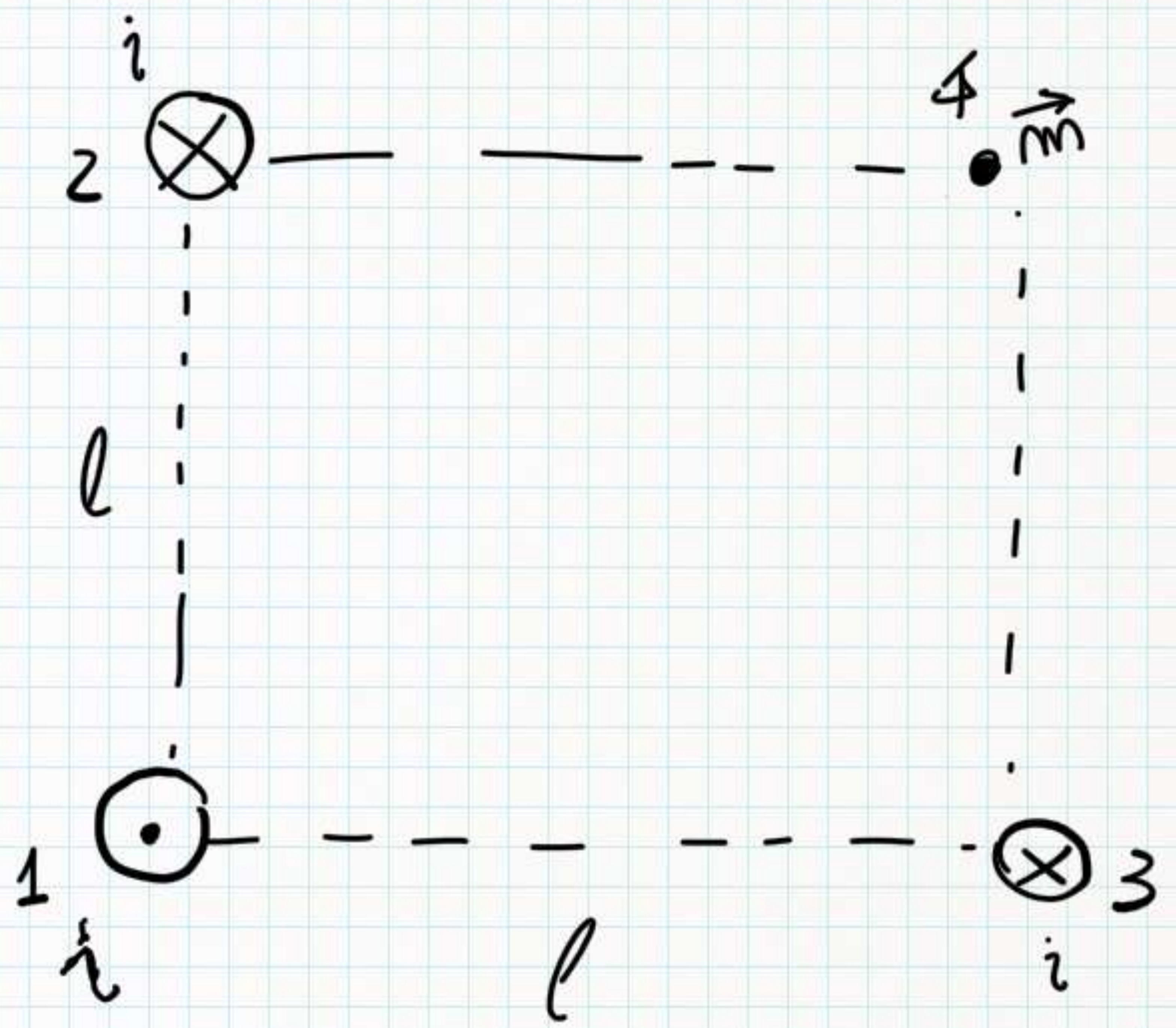
$m = 6.7\ \mu A \cdot m^2 \qquad \hat{m} \upuparrows \vec{B}(4)$

$U_m = -2.8 \cdot 10^{-12}$ J

(1) $B(4) = |\vec{B}(4)|$?

(2) $i = ?$

(3) $i_1 \to I$? | $\vec{B}(4) = \underline{0}$.



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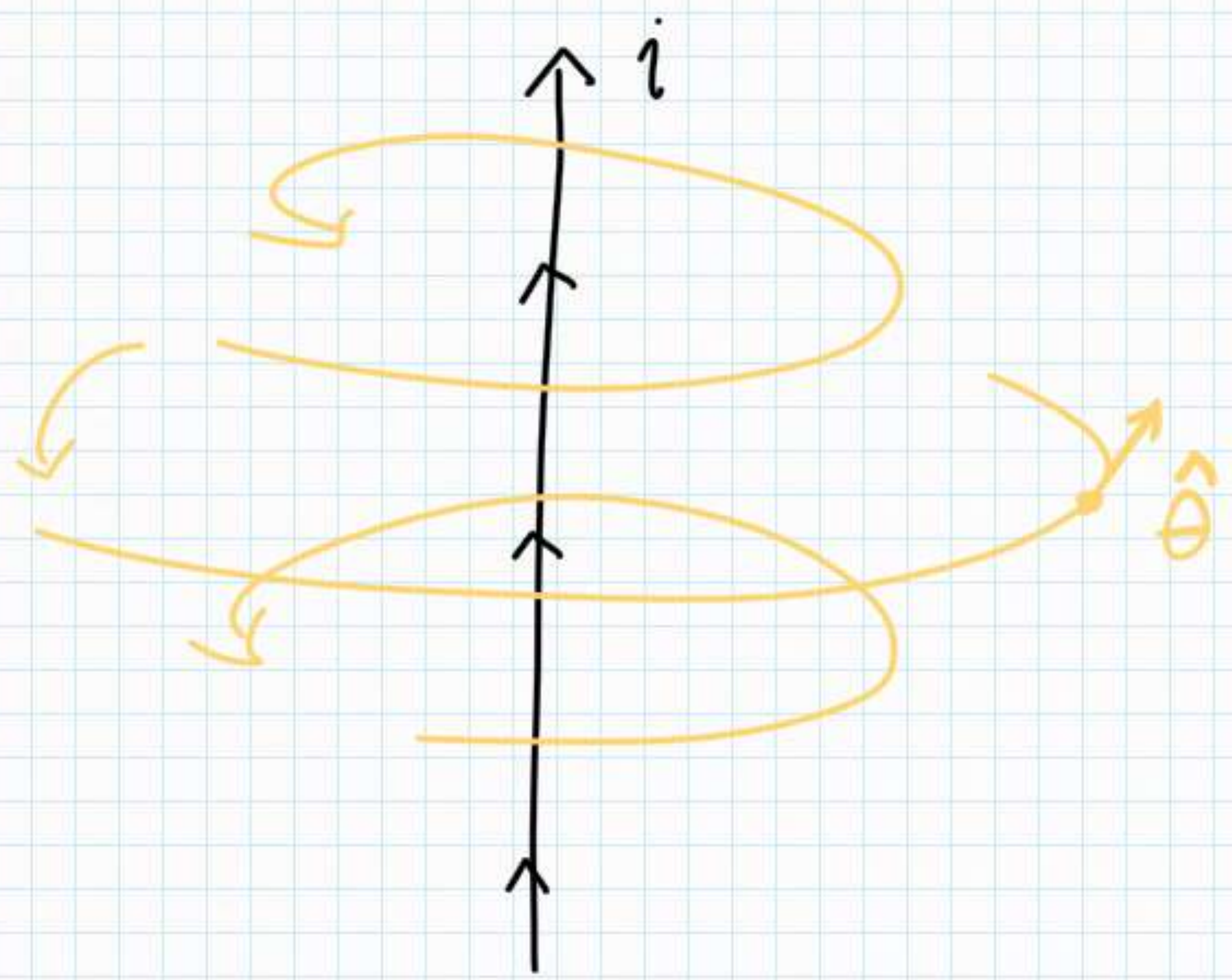
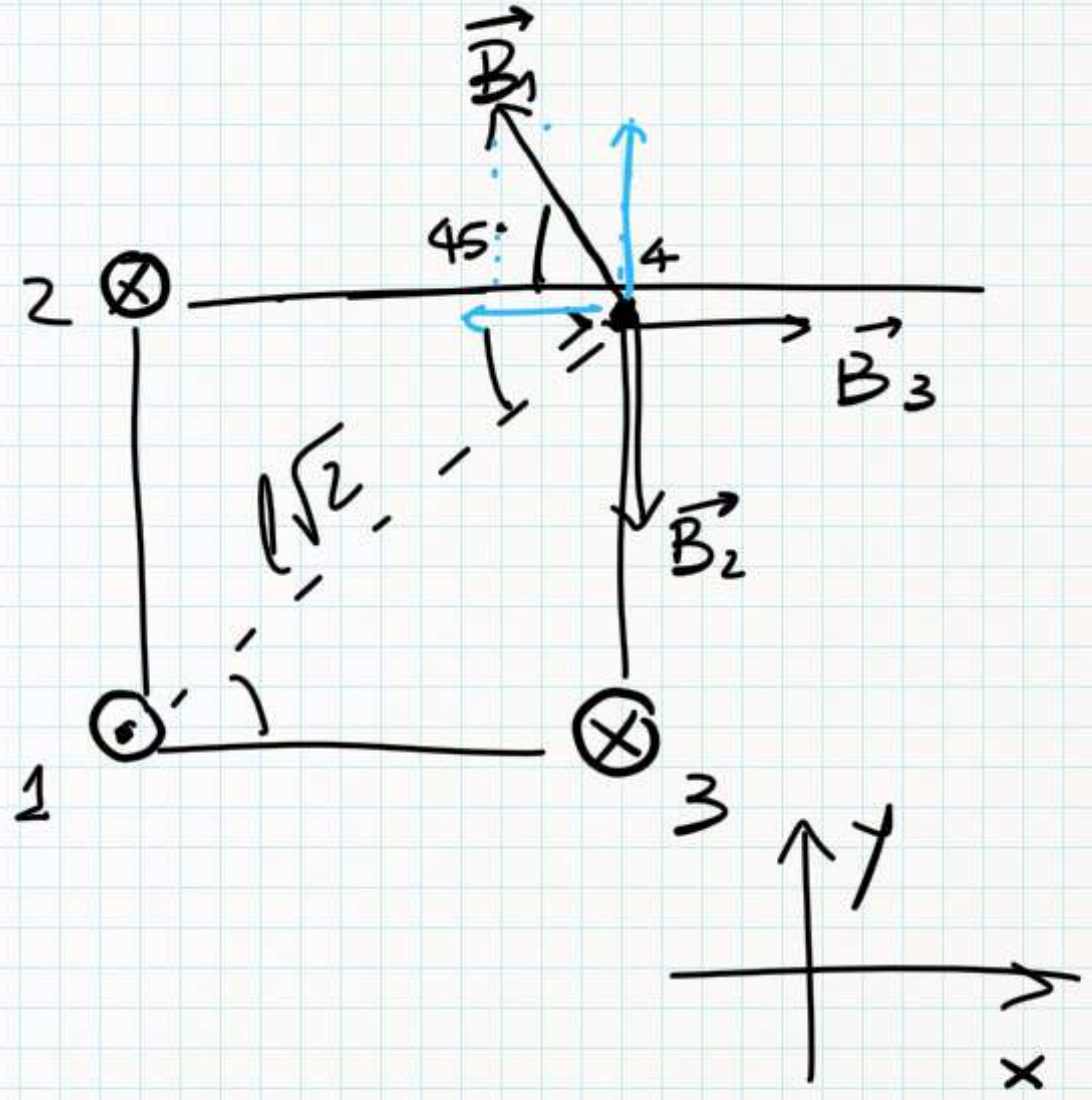
(1) $U_m = -\vec{m} \cdot \vec{B}(4) = -m\, B(4) \cancel{\cos(\alpha)}^{1} = -m \cdot B(4) \longrightarrow B(4) = \dfrac{-U_m}{m} = 4{,}18 \cdot 10^{-7}\,T$

(2)

$$\vec{B}_{filo}(r) = \frac{\mu_0 i}{2\pi r}\,\hat{\theta}$$



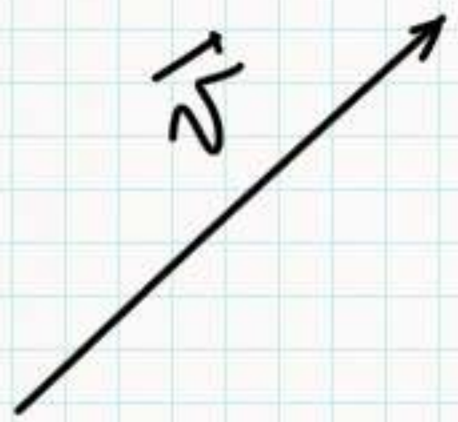


$$\vec{B}(4) = \hat{x}\left\{\frac{\mu_0 i}{2\pi l} - \frac{\mu_0 i}{2\pi\, l\sqrt{2}}\overbrace{\cos\left(\frac{\pi}{4}\right)}^{\frac{\sqrt{2}}{2}}\right\} +$$

$$+\hat{y}\left\{-\frac{\mu_0 i}{2\pi l} + \frac{\mu_0 i}{2\pi\, l\sqrt{2}}\underbrace{\sin\left(\frac{\pi}{4}\right)}_{\frac{\sqrt{2}}{2}}\right\} = \hat{x}\,\frac{\mu_0 i}{2\pi l}\left(\overbrace{+1 - \frac{\cancel{\sqrt{2}}}{2\cancel{\sqrt{2}}}}^{1/2}\right) + \hat{y}\left(-\frac{1}{2}\right)\frac{\mu_0 i}{2\pi l} =$$

$$= \frac{\mu_0 i}{4\pi l}\left(\hat{x} - \hat{y}\right)$$

MODULO DI $\vec{B}(4)$:



$$|\vec{v}| = \sqrt{v_x^2 + v_y^2} \longrightarrow B(4) = \frac{\mu_0 i}{4\pi l}\sqrt{2}$$

$$\boxed{i = \frac{4\pi l\, B(4)}{\mu_0 \sqrt{2}} = 1.06 A}$$

(3) $$\vec{B}(4) = (\hat{x} - \hat{y})\left(\frac{\mu_0 i}{2\pi l} - \frac{\mu_0 I}{4\pi l}\right) = \underline{0}$$

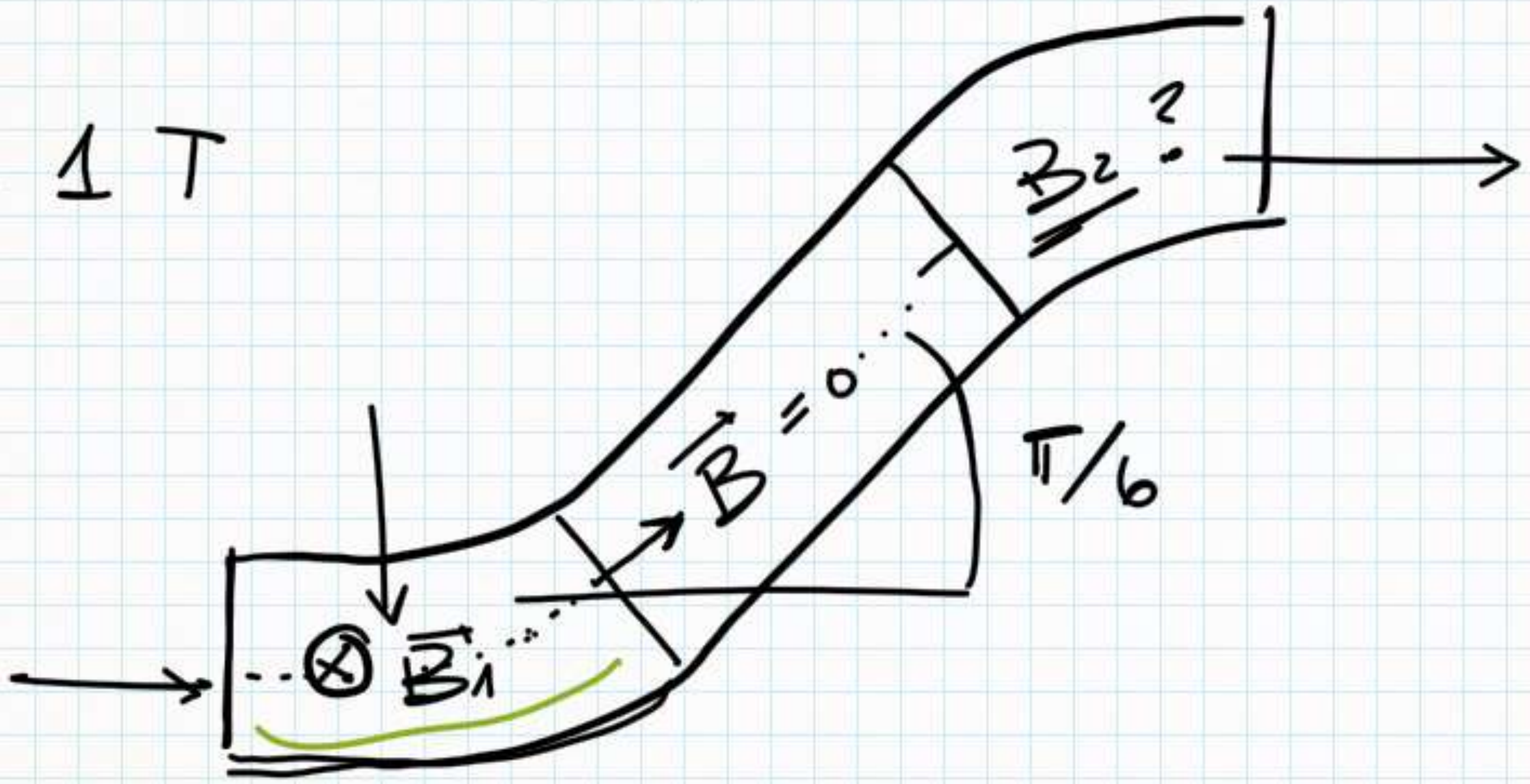
$$\frac{\cancel{\mu_0} i}{2 \cancel{\pi} \cancel{l}} = \frac{\cancel{\mu_0} I}{4 \cancel{\pi} \cancel{l}} \qquad \boxed{I = 2i = 2,12 A}$$

15/2/2023 (ROVIGATTI) EX. 2

$\frac{m_2}{m_1} = 2$ $\qquad B_1 = 1\ T$

$q = |e|$

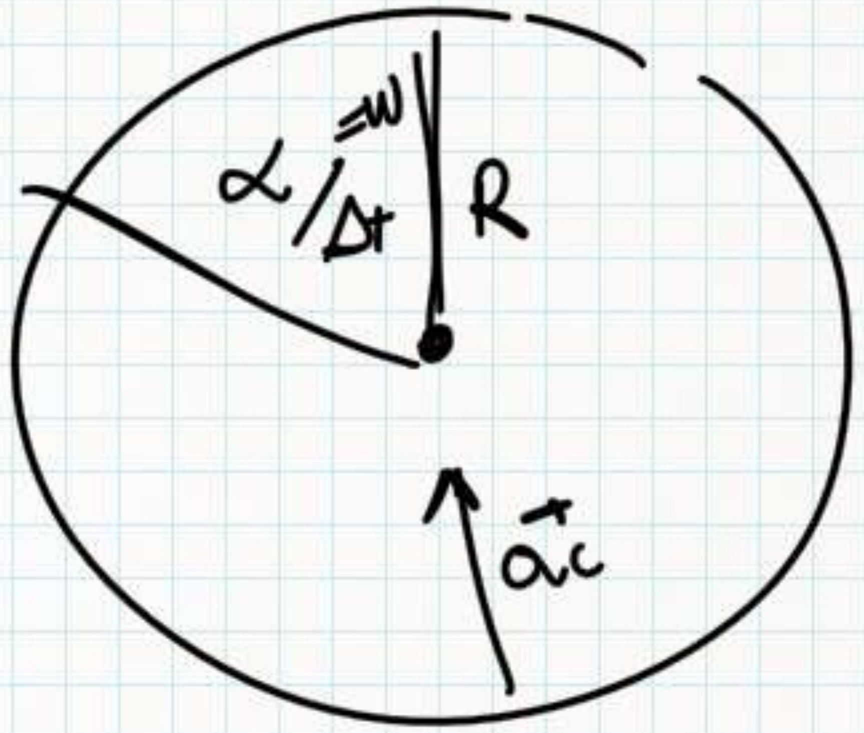
$\vec{v}$



(q, m_1)

(q, m_2)

$\vec{F}_L = q\,\vec{v} \times \vec{B}$



$v = \omega R$

$a_c = \omega^2 R$

$$\begin{cases} F_c = m_1 a_c \\ \quad \parallel \\ F_L = q v B_1 \end{cases}$$

$m_1 \omega^{\cancel{2}} \cancel{R} = q(\cancel{\omega}\cancel{R}) B_1$

$1 \to \frac{\pi}{6}$

$m_1 = \frac{qB_1}{\omega} = \frac{qB_1\,\Delta t}{\pi/6} = 1.68 \cdot 10^{-27}$ kg

(1) $\Delta t = 5{,}5$ ns $\to m_1$

$\omega = \frac{\alpha}{\Delta t}$

(2) $\vec{B}_1'$? TALE CHE m_2 ESCANO CON $\alpha = \frac{\pi}{6}$

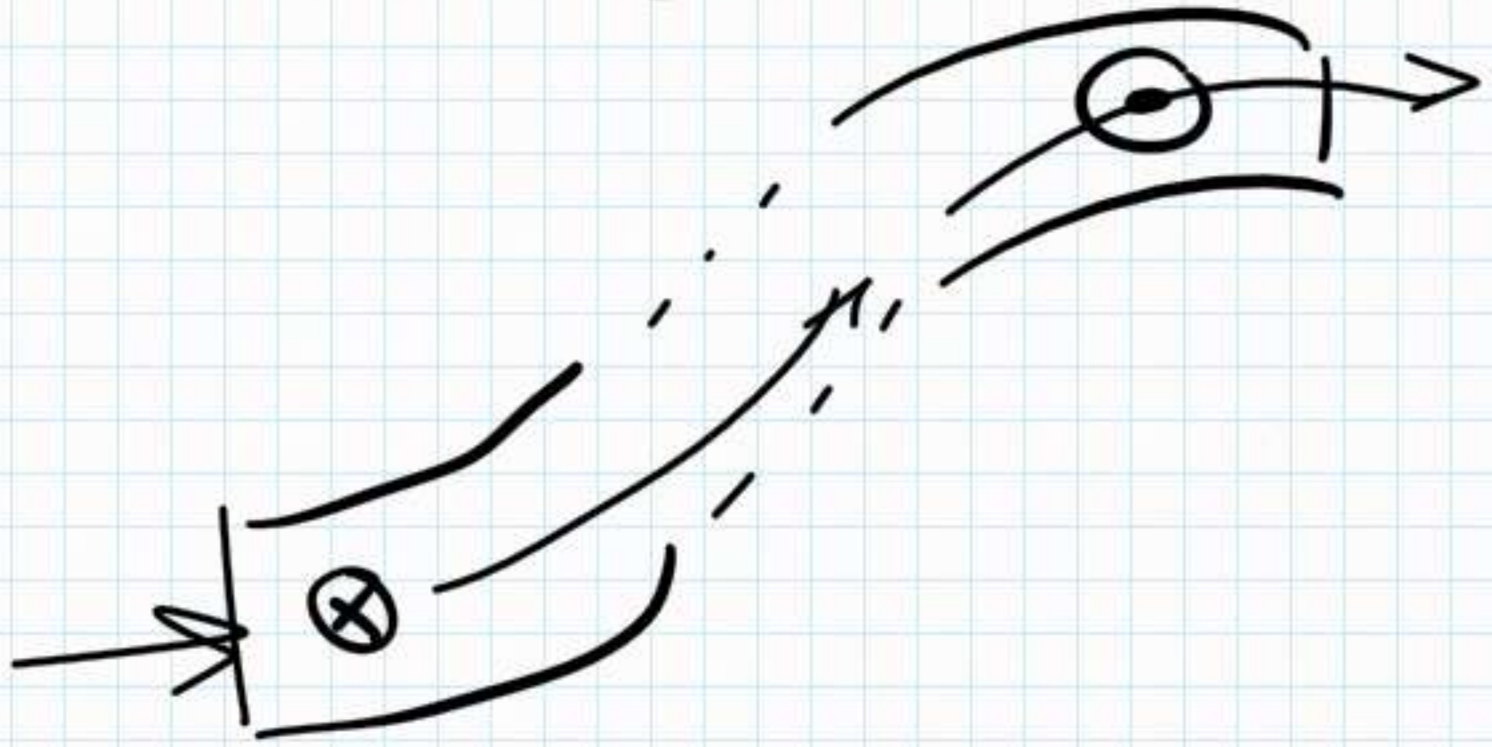
$\alpha = \frac{\pi}{6}$

$\Delta t = 5.5\ ns$ $\rightarrow \omega = \frac{\alpha}{\Delta t} \longrightarrow$ ... COME PRIMA ... $m_2 = \frac{q B_1' \Delta t}{\alpha}$

$$B_1' = \frac{m_2 \alpha}{q \Delta t} = 2 \frac{m_1 \alpha}{q \Delta t} = 2 B_1 = 2T$$

(3)

$$\vec{B}_2 = -\vec{B}_1$$



LEAN, 8/9/2020 EX2

$n = 200$ spire/m

$I_s = 5\ A$

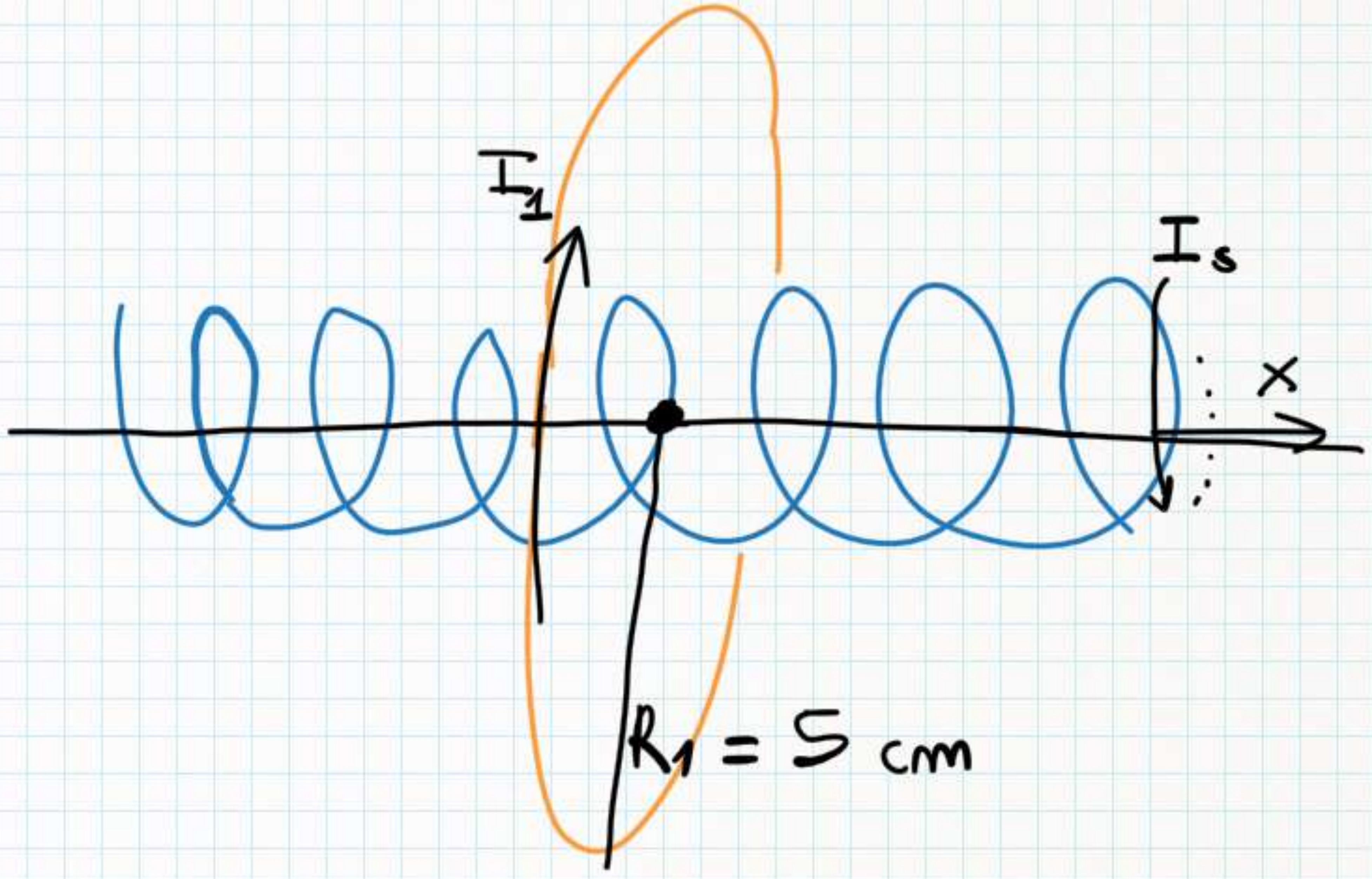
$I_1 = 300\ A$

(I) $\vec{B}(x;0;0) = ?$

(II) $\vec{B}(0;0;0) = ?$

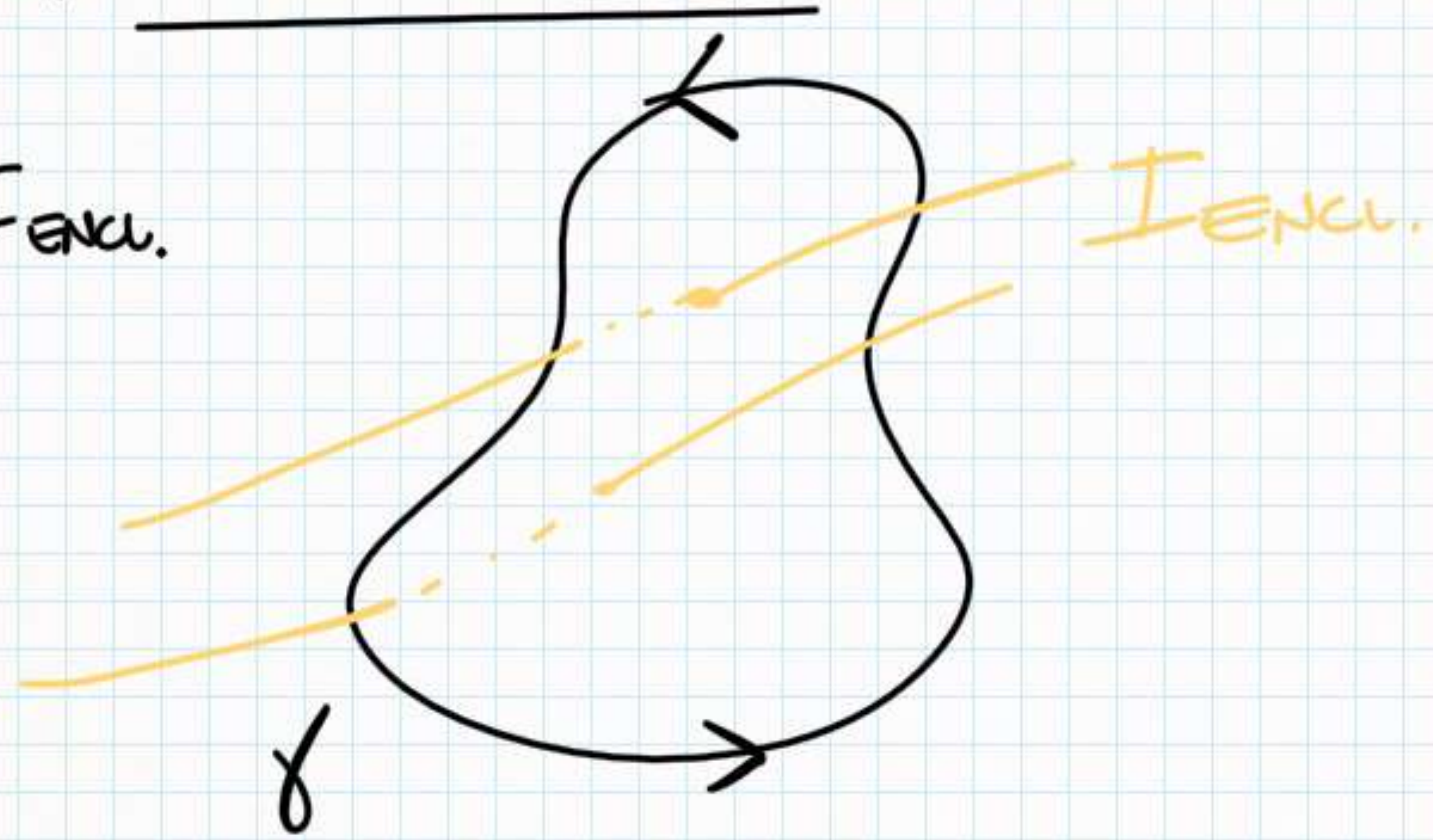
(III) $\vec{B}(x_0;0;0) = ?$ $x_0 = 10$ cm

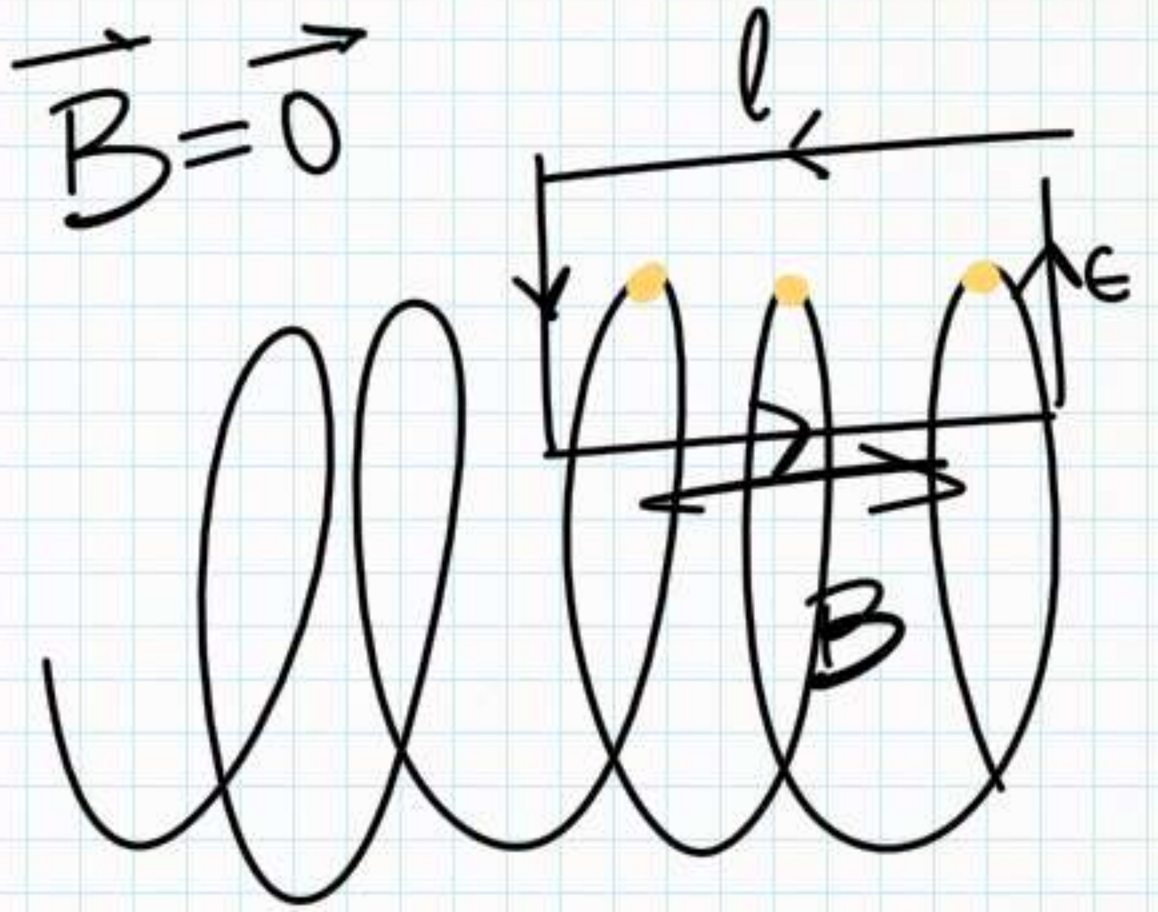
(IV) $\bar{x} \mid \vec{B}(\bar{x};0,0) = \underline{0}$



(I) SOLENOIDE : $\boxed{\vec{B}_s = \mu_0 i_s n\ \hat{x}}$

$$\oint_\gamma \vec{B}\, d\vec{l} = \mu_0 I_{ENCL.}$$

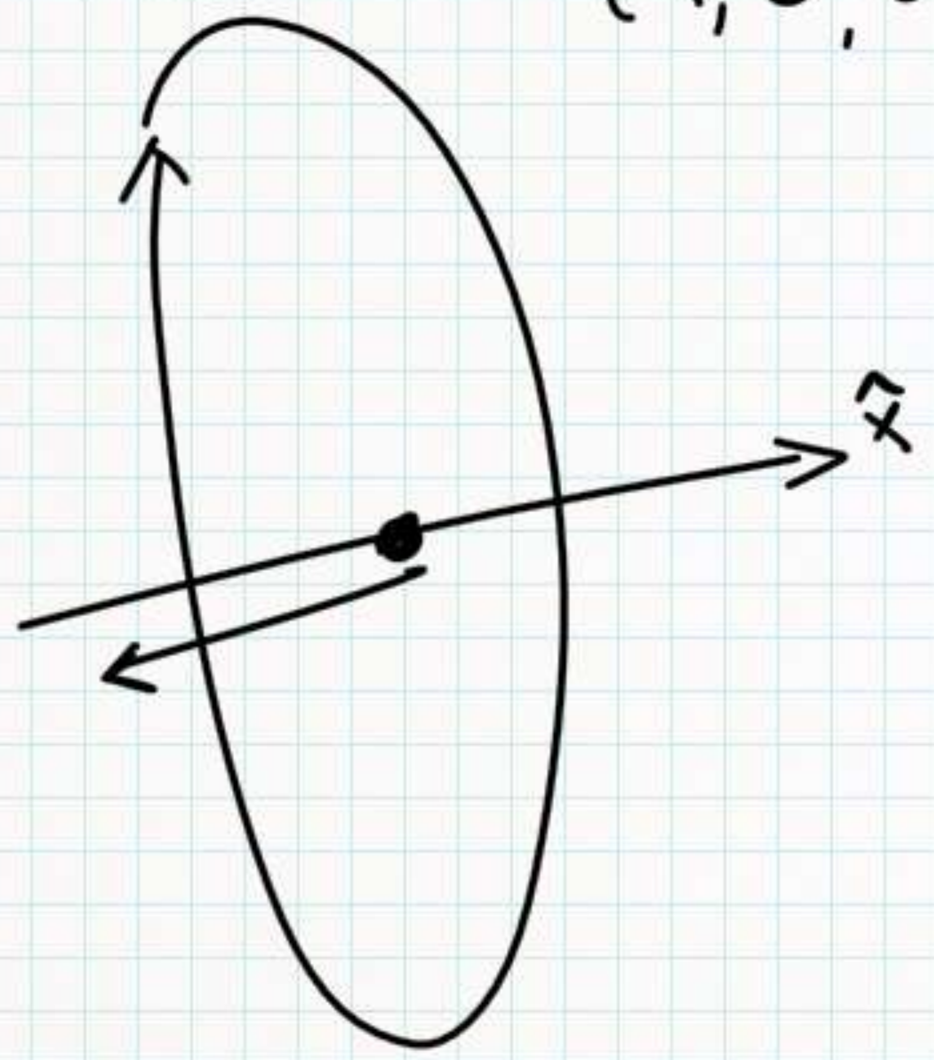




$$\underline{\vec{B} = \mu_0 n I_s \hat{x}}$$

$$\oint \vec{B}\, d\vec{l} = B \cdot l = \mu_0 I N = \mu_0 I_s n l$$

SPIRA



$(x, 0; 0)$

$$\vec{B}_1(x;0;0) = \frac{\mu_0}{2\pi}\frac{\vec{m}}{(R^2+x^2)^{3/2}}$$

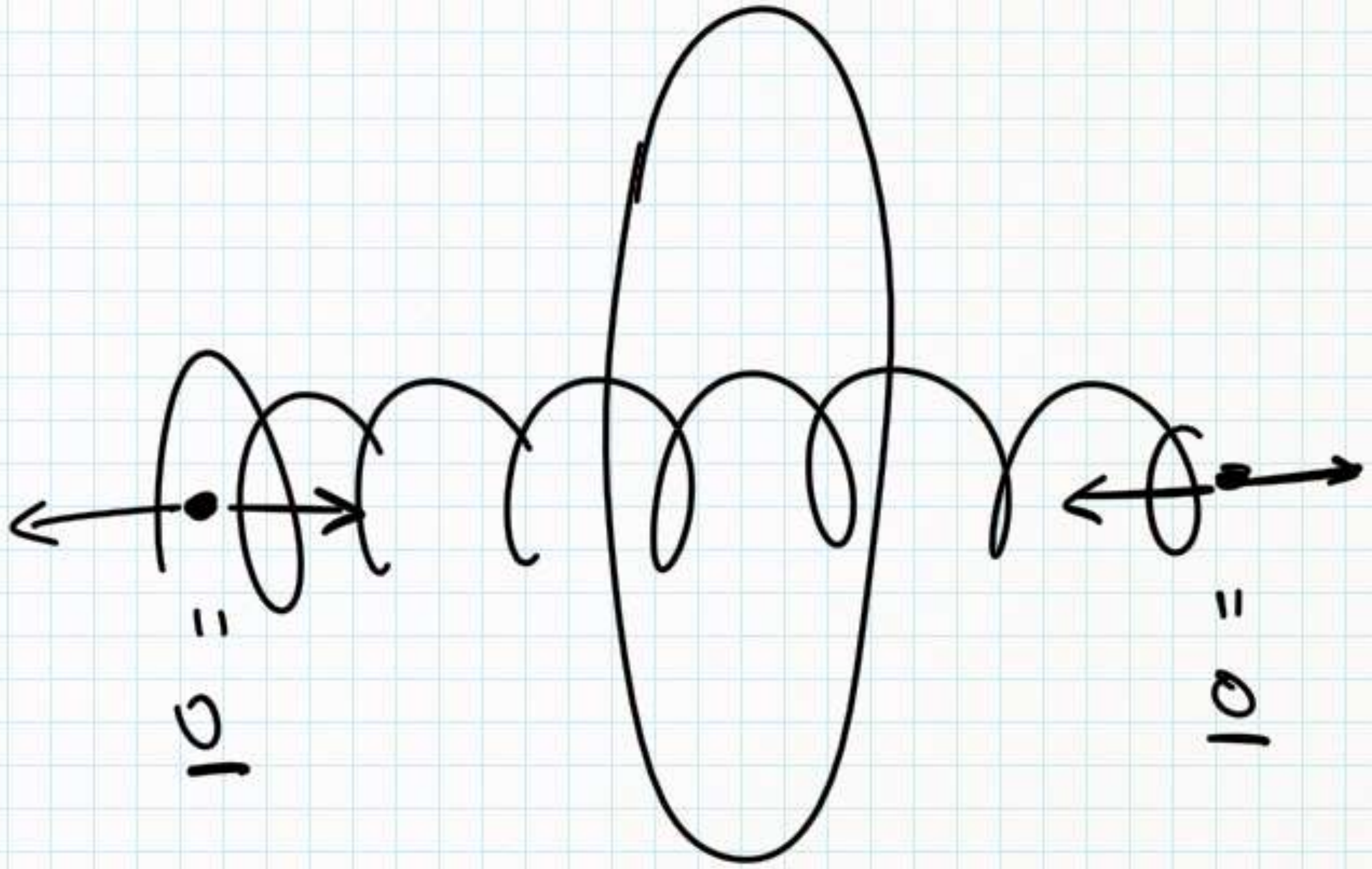
$$\vec{m} = \vec{S} I_1 = -\pi R^2 I_1 \hat{x}$$

$$\boxed{\begin{aligned}\vec{B}(x;0;0) &= \vec{B}_1(x;0;0) + \vec{B}_S(x,0,0) = \\ &= \hat{x}\left(\mu_0 I_s n - \frac{\mu_0 \cancel{\pi} R^2 I_1}{2\cancel{\pi}(R^2+x^2)^{3/2}}\right)\end{aligned}}$$

(II) $\vec{B}(0;0;0) = \hat{x}\left(\mu_0 I_s n - \frac{\mu_0 \cancel{R^2} I_1}{2 \ R\cancel{^3}}\right) = -2{,}51 \cdot 10^{-3}\ T \cdot \hat{x}$

(III) $\vec{B}(10\text{cm};0;0) = \dots = 9{,}2 \cdot 10^{-4}\ T \cdot \hat{x}$

(IV) $\vec{B}(\bar{x};0,0) = \vec{0}$



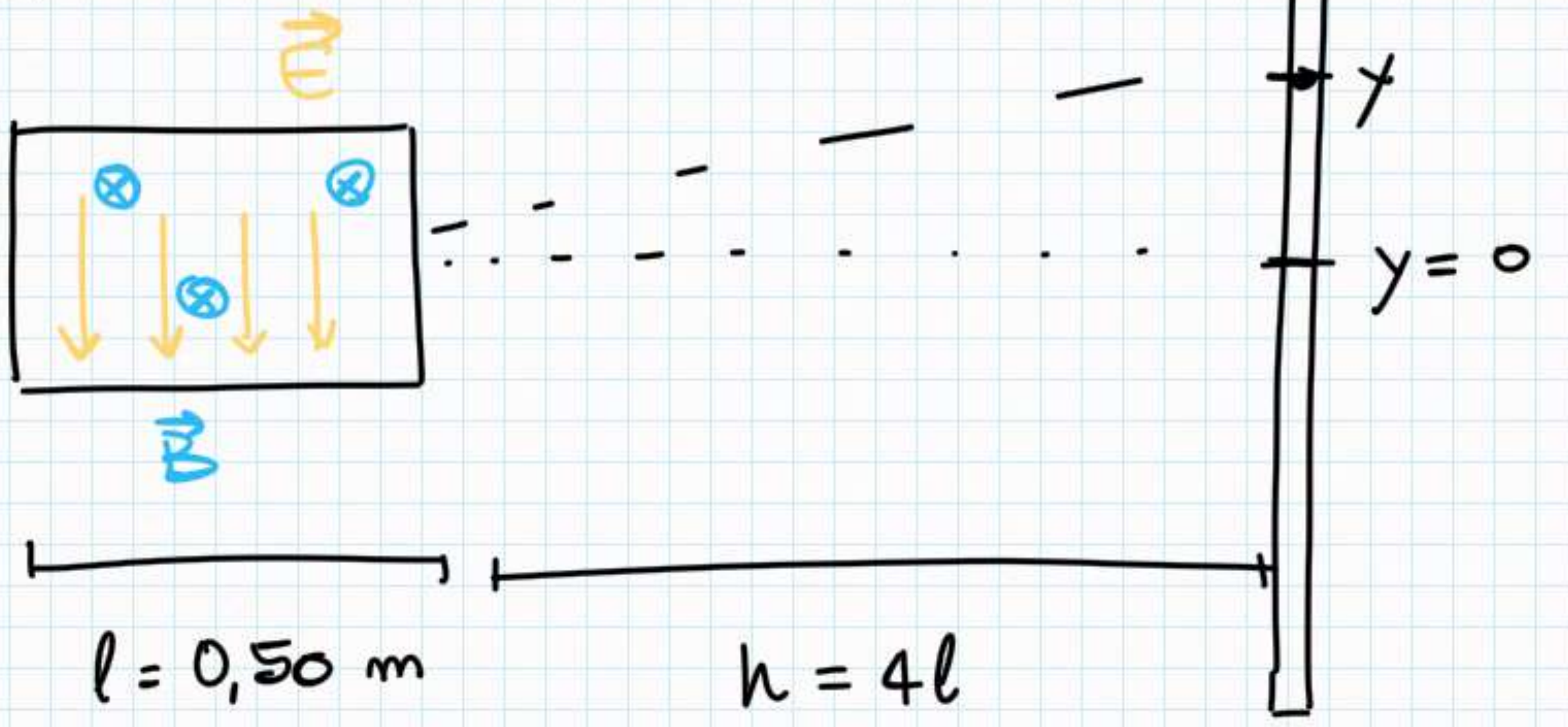
$$\bullet\ \cancel{\mu_0} n I_s = \frac{\cancel{\mu_0} I_1 R^2}{2(R^2+\bar{x}^2)^{3/2}}$$

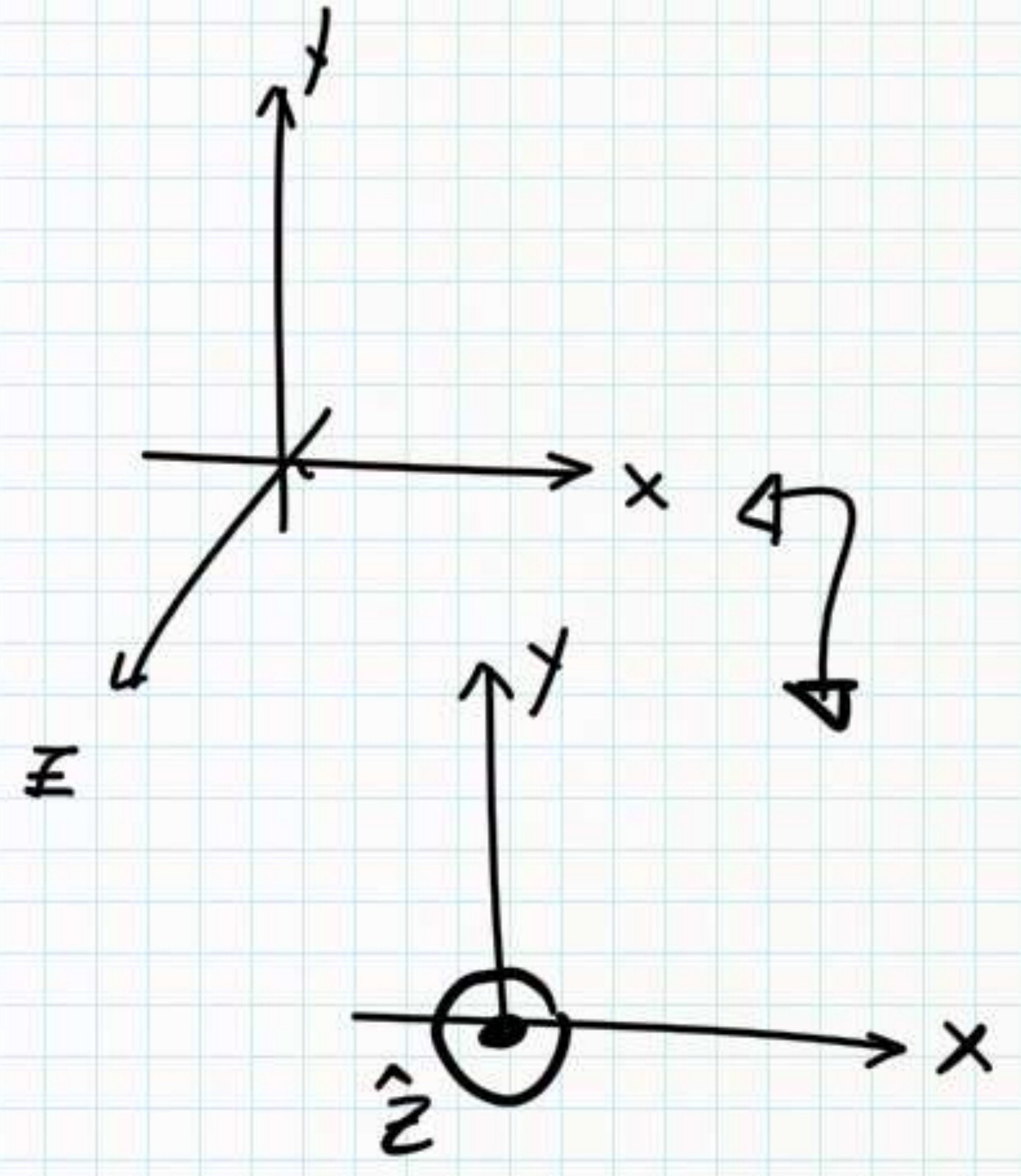
$$(R^2+\bar{x}^2)^{\cancel{\frac{3}{2}}\cdot\cancel{\frac{2}{3}}} = \left(\frac{I_1 R^2}{2 n I_s}\right)^{\frac{2}{3}}$$

$$\bar{x}^2 = \left(\frac{R^2 I_1}{2 n I_s}\right)^{2/3} - R^2$$

$$\bar{x} = \pm\sqrt{\left(\frac{R^2 I_1}{2 n I_s}\right)^{2/3} - R^2} = \pm 5{,}2 \text{ cm}$$

MOTO IN $\vec{B}$ ED $\vec{E}$:





$\vec{B} = 1.41\ mT\ (-\hat{z})$

$E = 3.83 \cdot 10^{2}\ V/m$

(1) TROVARE LE COMBINAZIONI DI (m, q, v_0) TALI CHE $y = 0$.

$$\vec{F} = \vec{F}_L + \vec{F}_E = q\vec{E} + q\vec{v}_0 \times \vec{B} = q(\vec{E} + \vec{v}_0 \times \vec{B}) = q(-E + v_0 B)\,\hat{y} \overset{!}{=} 0$$

$$\vec{F} = 0$$

$\boxed{(m, q)\ \text{QUALSIASI}}$

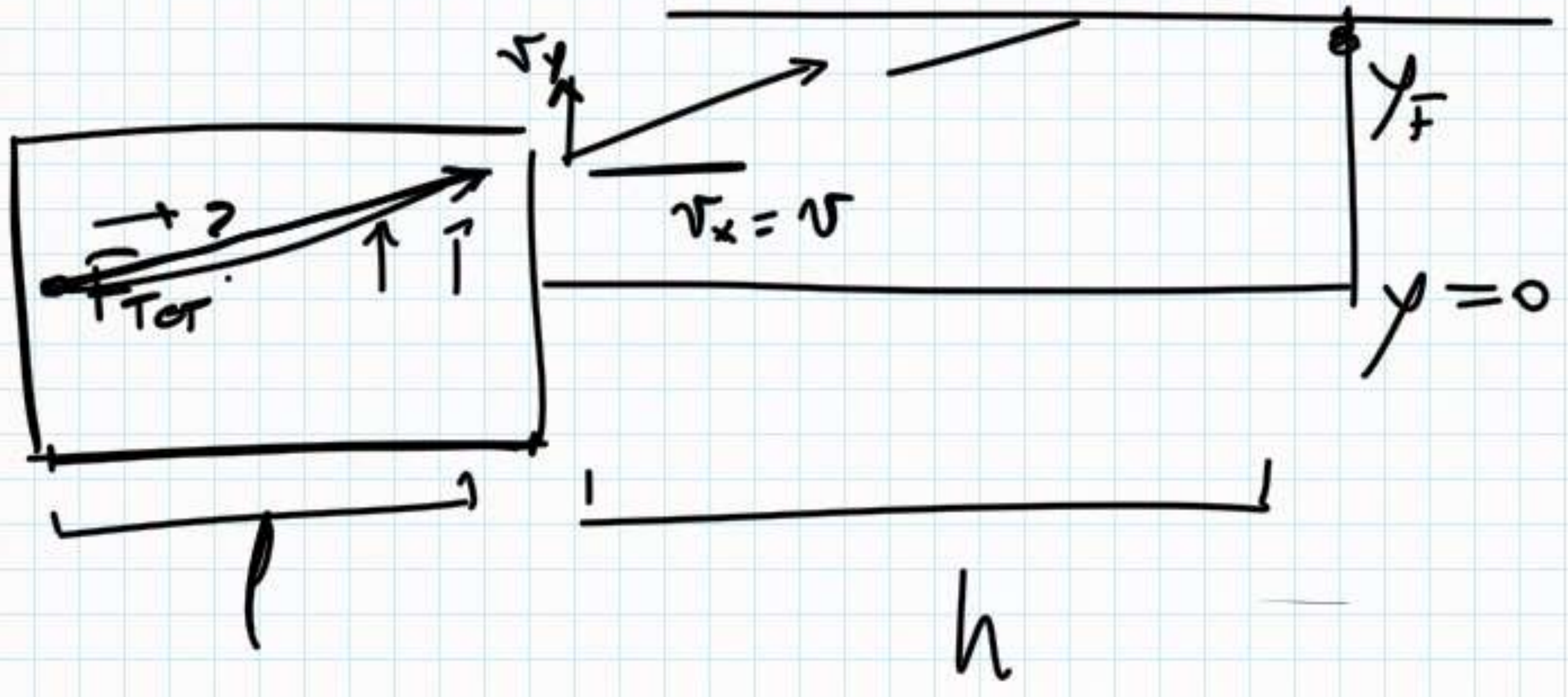
$$\boxed{v_0 = \frac{E}{B} = 2{,}72 \cdot 10^{5}\ m/s} \quad \upuparrows \hat{x}$$

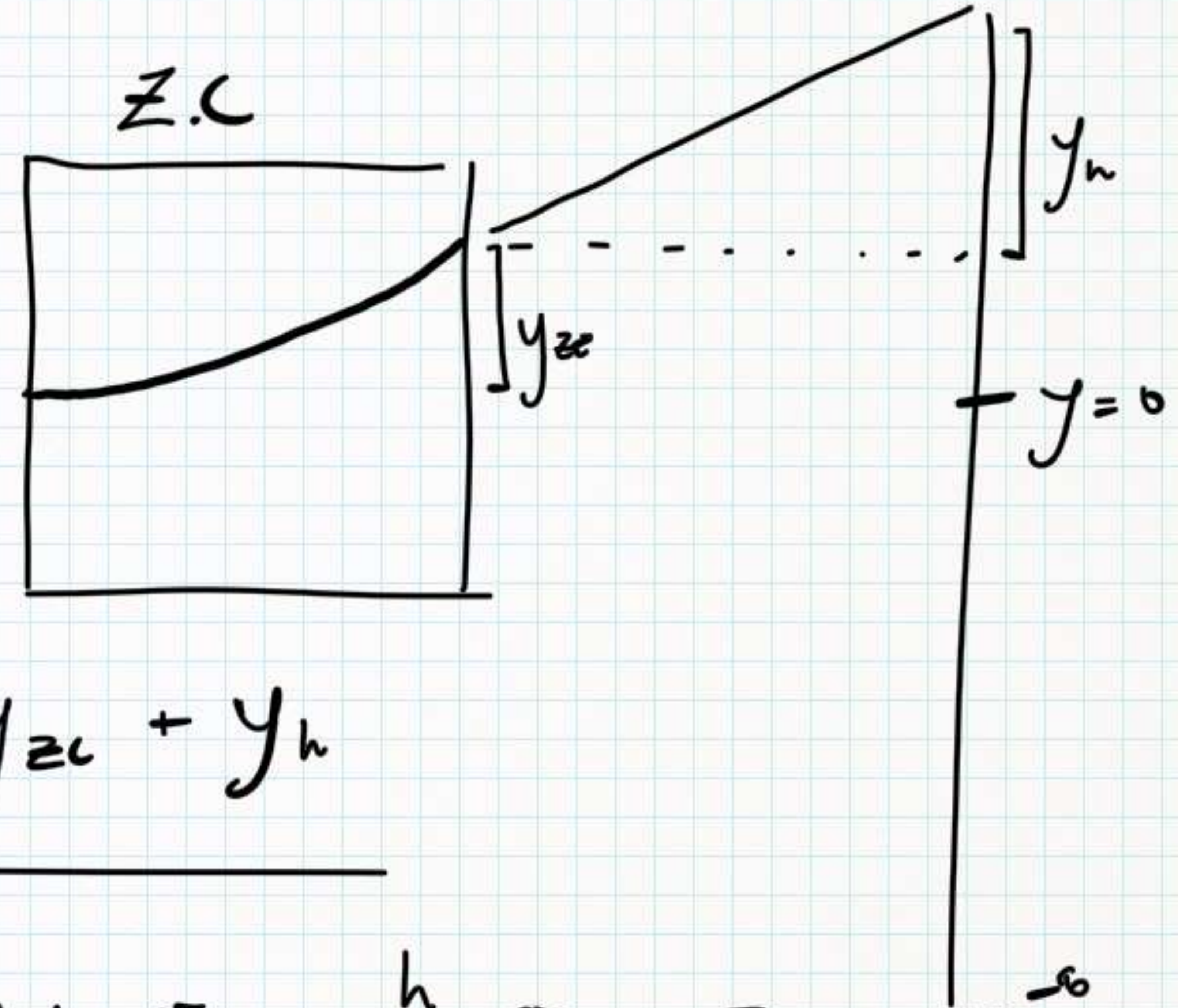
(11)

$$\begin{cases} v = 2 \cdot 10^6 \ m/s \\ q = 0{,}12 \ pC \\ m = 10^{-15} \ kg \end{cases}$$

$y_F = ?$

APPROSSIMAZIONE: INTERAZIONE ISTANTANEA





$$\vec{F}_{TOT} = q(-E + vB)\hat{y} = 2{,}92 \cdot 10^{-7} \ N \ \hat{y}$$

$$a_y = \frac{F_{TOT}}{m} = 2{,}92 \cdot 10^{8} \ m/s^2$$

$$v_y = \Delta t \cdot a_y \qquad \Delta t = ? \cong \frac{l}{v} = 0.25 \cdot 10^{-6} \ s$$

$$v_y = \Delta t \cdot a_y = 73.11 \ m/s$$

$$y_F = y_{zc} + y_h$$

$$y_h = \Delta t' \cdot v_y = \frac{h}{v_x} v_y = 73{,}11 \cdot 10^{-6} \ m$$

$$y_{zc} = \frac{1}{2} a_y (\Delta t)^2 =$$

$$= 0{,}0625 \cdot 10^{-12} \ \cancel{s^2} \ 0{,}5 \cdot 2{,}92 \cdot 10^{8} \frac{m}{\cancel{s^2}} =$$

$$= 9{,}125 \cdot 10^{-6} \ m$$

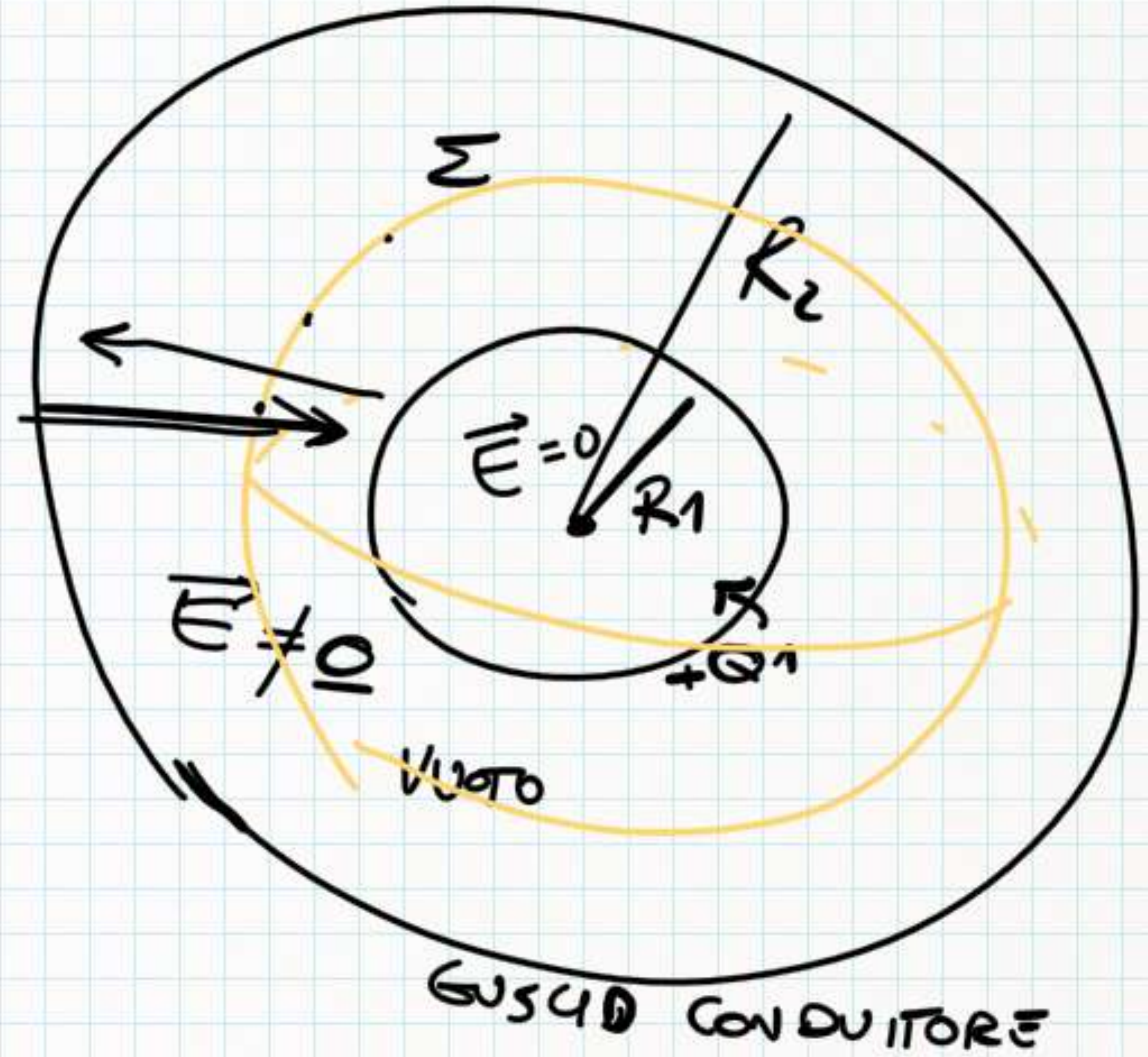
$$\boxed{y_F = y_{zc} + y_h = 8{,}22 \cdot 10^{-5} \ m}$$

20/09/2011 DECKER/GASPERO EX 1.

$$\begin{cases} R_1 = 2\,cm \\ R_2 = 3\,cm \\ Q_1 = +2\,nC \end{cases}$$

(1) CAPACITA' C ?

$$Q_1 = \Delta V \cdot C \rightarrow C = \frac{Q_1}{\Delta V}$$



• E ? → GAUSS

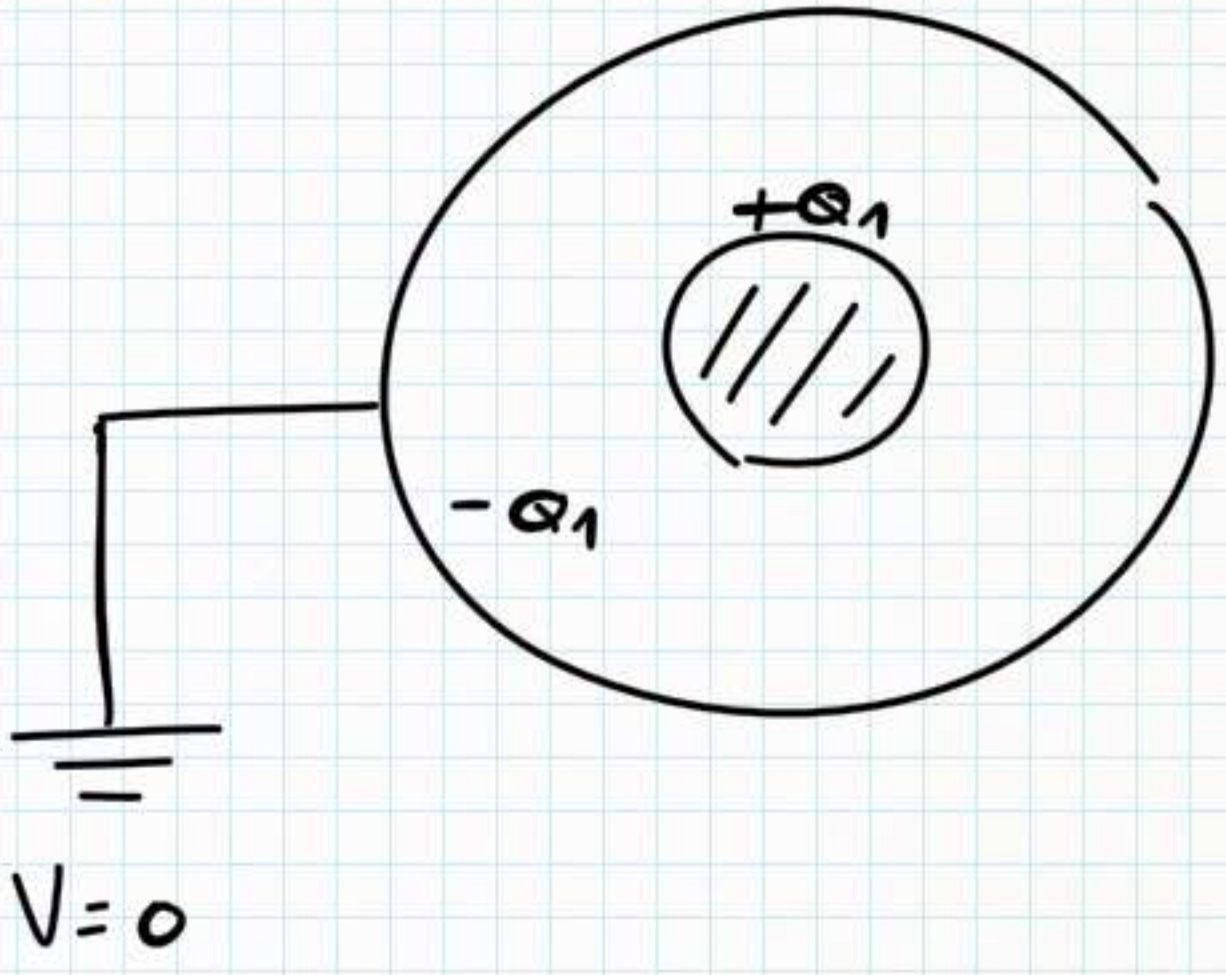
$$\left.\begin{array}{l} \Phi_\Sigma(\vec{E}) = \dfrac{Q_1}{\epsilon_0} \\ \quad \parallel \\ \displaystyle\iint_\Sigma \vec{E}\, d\vec{S} = E(r)\, 4\pi r^2 \end{array}\right\} \vec{E}(r) = \frac{Q_1}{4\pi\epsilon_0} \frac{\hat{r}}{r^2}$$

$$\Delta V = -\int_{R_2}^{R_1} \vec{E}\, d\vec{l} = -\int_{R_2}^{R_1} E(r)\, dr = -\frac{Q_1}{4\pi\epsilon_0} \int_{R_2}^{R_1} \frac{dr}{r^2} = \frac{Q_1}{4\pi\epsilon_0} \left(\frac{1}{r}\right)\Bigg|_{R_2}^{R_1} = \frac{Q_1}{4\pi\epsilon_0} \left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$= \frac{Q_1}{4\pi\epsilon_0} \frac{R_2 - R_1}{R_1 \cdot R_2} \longrightarrow \boxed{C = \frac{Q_1}{\Delta V} = 4\pi\epsilon_0 \frac{R_1 R_2}{R_2 - R_1} = 6{,}67\, pF}$$

(II) ENERGIA ELETTROSTATICA (R_2 A TERRA)

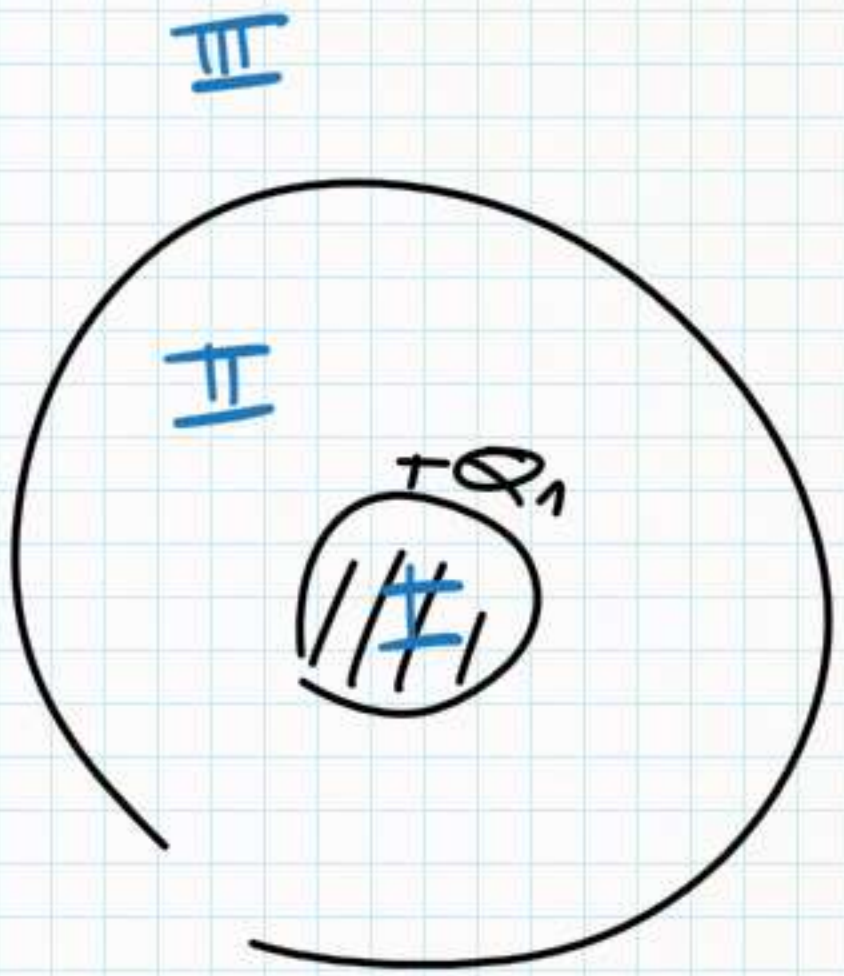
$$\mu_E = \frac{\epsilon_0}{2} \vec{E} \cdot \vec{E} \qquad U_{ES} = \int_V \mu_E \, d^3x$$



$$U_{ES} = U_{COND} = \frac{1}{2} Q_1 \Delta V =$$

$$= \frac{1}{2} \cdot \frac{Q_1^2}{4\pi\epsilon_0} \cdot \frac{R_2 - R_1}{R_2 \cdot R_1}$$

(III) GRAFICO DI V(r) (SE R_2 NON E' A TERRA)



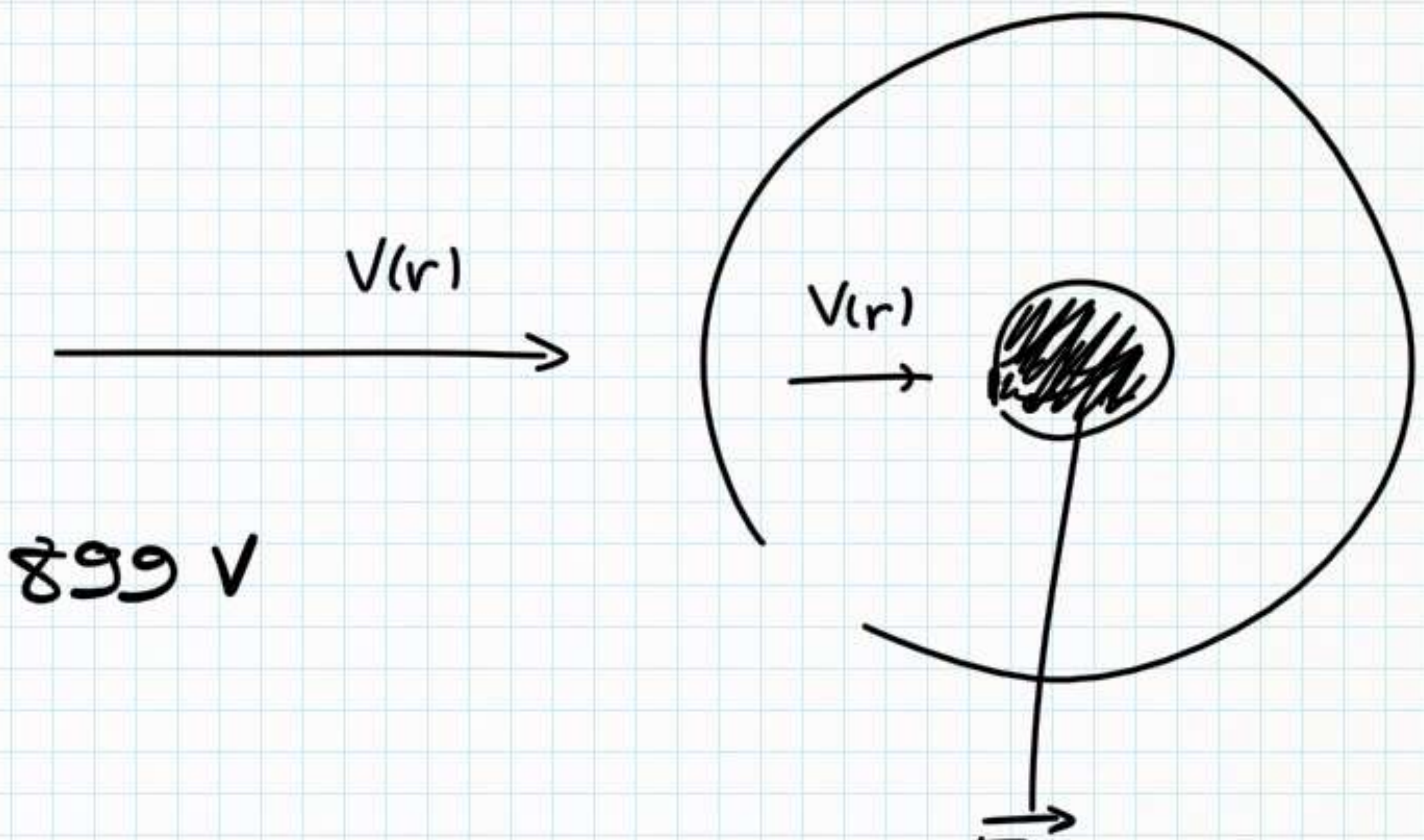
- $V(\infty) = 0$

$$\vec{E}_{III} = \frac{Q_1}{4\pi\epsilon_0} \frac{\hat{r}}{r^2} = \vec{E}_{II} \qquad \vec{E}_I = 0$$

$$V(r) = \frac{Q_1}{4\pi\epsilon_0}\,\frac{1}{r} \qquad r > R_1$$

$V(r < R_1) =$ cost ? $\quad V(r)$ DEVE

ESSERE CONTINUA $\rightarrow$ $V(r<R_1) = \dfrac{Q_1}{4\pi\epsilon_0}\cdot\dfrac{1}{R_1} = 899\ V$



$\vec{E} = 0$

$\vec{E} = -\vec{\nabla} V \qquad V =$ cost.