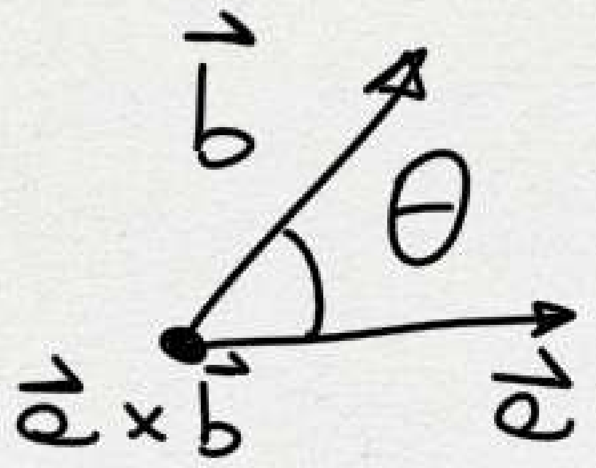
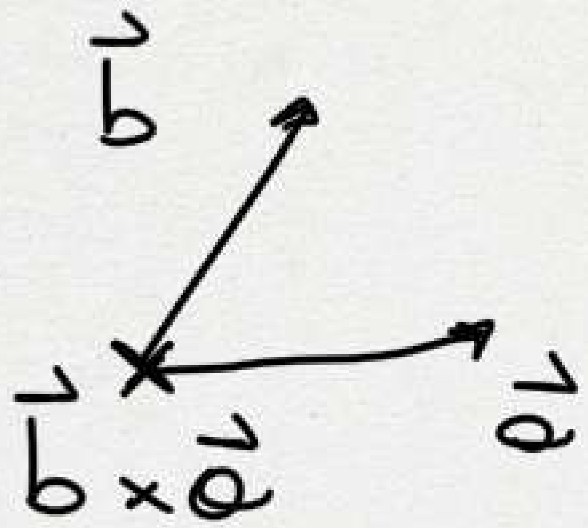
$$\vec a \times \vec b = \vec c$$





① $|\vec c| = a b \sin\theta$

② $\vec c \cdot \vec a = \vec c \cdot \vec b = 0$

③ $\vec a \times \vec b = -\vec b \times \vec a$

$$\boxed{\begin{array}{l} \hat x \times \hat x = \hat y \times \hat y = \hat z \times \hat z = 0 \\ \left\{\begin{array}{l} \hat x \times \hat y = \hat z \\ \hat y \times \hat z = \hat x \\ \hat z \times \hat x = \hat y \end{array}\right. \quad \longrightarrow \quad \begin{array}{l} \hat y \times \hat x = -\hat z \\ \hat z \times \hat y = -\hat x \\ \hat x \times \hat z = -\hat y \end{array} \end{array}}$$

$xyzxyz$ $(+)$

$zyxzyx$ $(-)$

① $\vec a = 3\hat x - \hat y$, $\vec b = 5\hat x + \hat z$

calcolate $\vec a \times \vec b$ e controllate che

$(\vec a \times \vec b)\cdot \vec a = (\vec a \times \vec b)\cdot \vec b = 0$

② $\vec a = (-3, 0, -1)$, $\vec b = (-1, 1, 2)$

calcolate $\vec a \times \vec b$

③ $\vec a = (1, -1, c)$, $\vec b = (-2, c, 1)$

calcolate $\vec a \times \vec b$. Esiste c : $\vec a \parallel \vec b$?

① $\vec{a} = 3\hat{x} - \hat{y} = (3,-1,0)$

$\vec{b} = 5\hat{x} + \hat{z} = (5,0,1)$

$$(3\hat{x} - \hat{y}) \times (5\hat{x} + \hat{z}) = \cancel{15\,\hat{x}\times\hat{x}} + 3\,\hat{x}\times\hat{z} - 5\,\hat{y}\times\hat{x} - \hat{y}\times\hat{z} =$$

$$= -3\hat{y} + 5\hat{z} - \hat{x} = (-1,-3,5) \equiv \vec{c}$$

$\vec{c}\cdot\vec{a} = -3+3 = 0$ ✓

$\vec{c}\cdot\vec{b} = -5+5 = 0$

② $\vec{a} = (-3,0,-1)$, $\vec{b} = (-1,1,2)$, $\vec{a}\times\vec{b} = \hat{x} + 7\hat{y} - 3\hat{z}$

③ $\vec{a} = (1,-1,c)$, $\vec{b} = (-2,c,1)$, $\vec{a}\times\vec{b} = -(1+c^2)\hat{x} - (2c+1)\hat{y} + (c-1)\hat{z} = (0,0,0)$

$$\begin{cases} -(1+c^2) = 0 \leftarrow \\ -(2c+1) = 0 \\ (c-1) = 0 \end{cases}$$

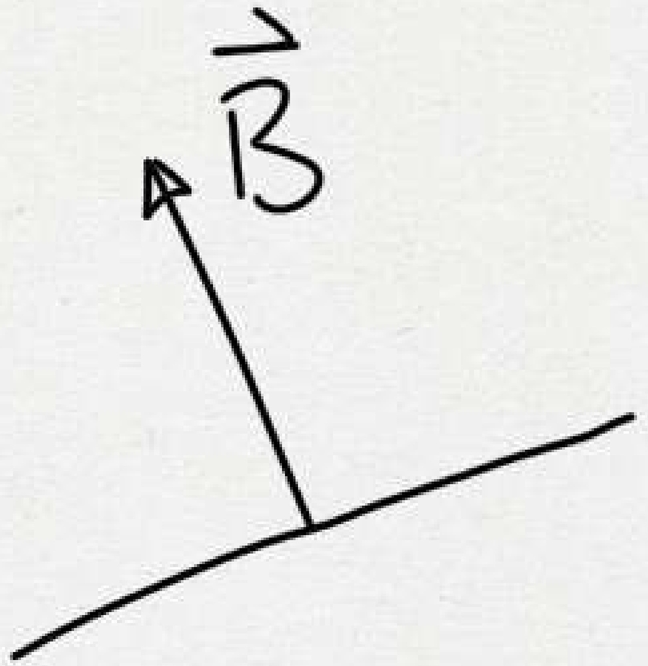
$\vec{B} = (B_x, B_y, B_z)$, q , $\vec{v} = (v_x, v_y, v_z)$

1) calcolare per quali condizioni la $\vec{F}_L$ è diretta lungo $\hat{x}$ o lungo $\hat{y}$ o lungo $\hat{z}$

$$\vec{F}_L = q\left[(v_y B_z - v_z B_y)\hat{x} + (v_z B_x - v_x B_z)\hat{y} + (v_x B_y - v_y B_x)\hat{z}\right]$$

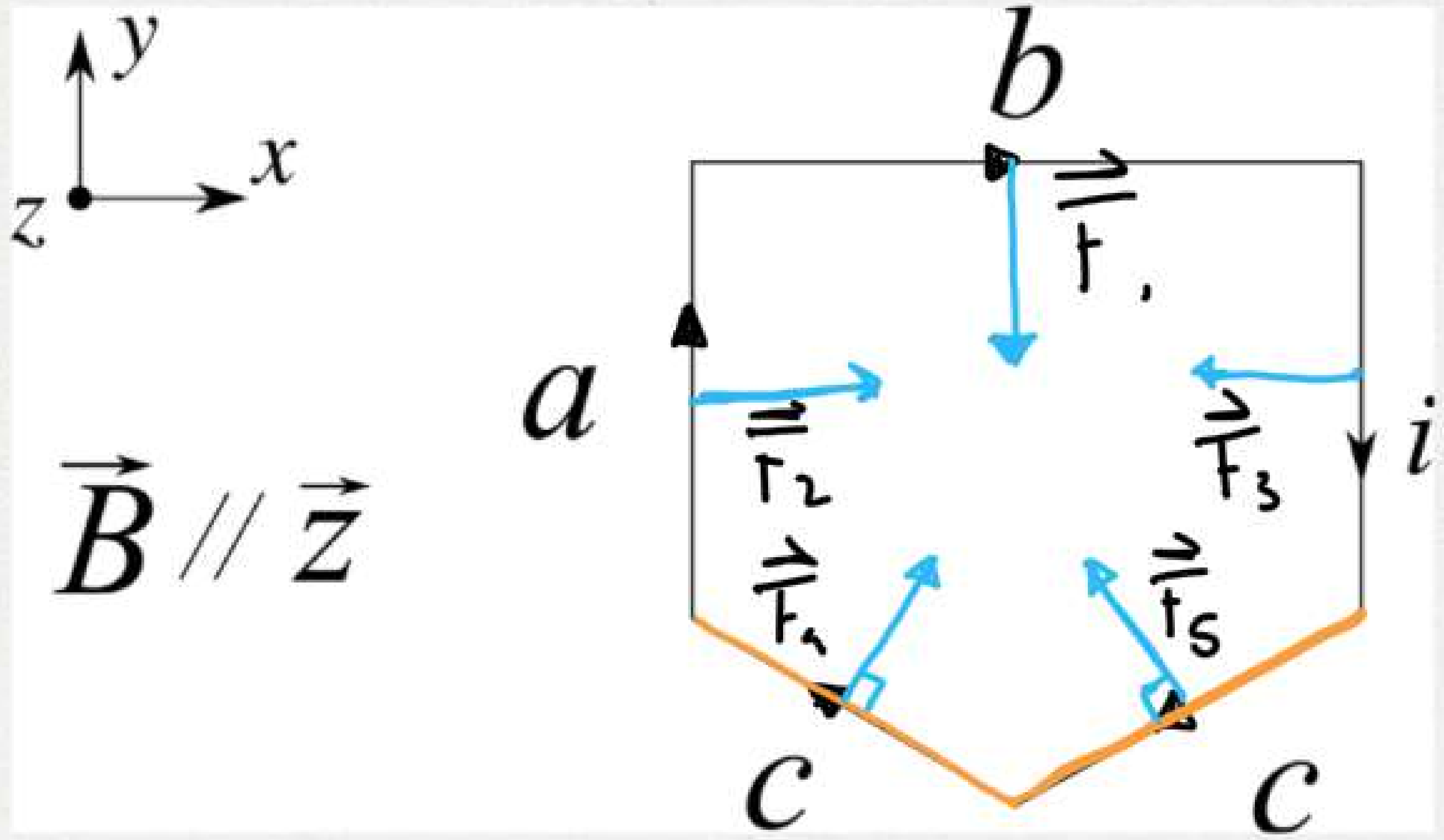
2) $\vec{B}_1 = (0, -3, 4)$ G   se $q > 0$ trovare $\vec{v}$: $\vec{F}_L$ lungo $\hat{x}$, $\hat{y}$, o $\hat{z}$

$\vec{B}_2 = (3, 15, -1)$ G



3) calcolare per quali condizioni la traiettoria di q è limitata ad un piano

(sia con $\vec{B}_1$ che con $\vec{B}_2$)

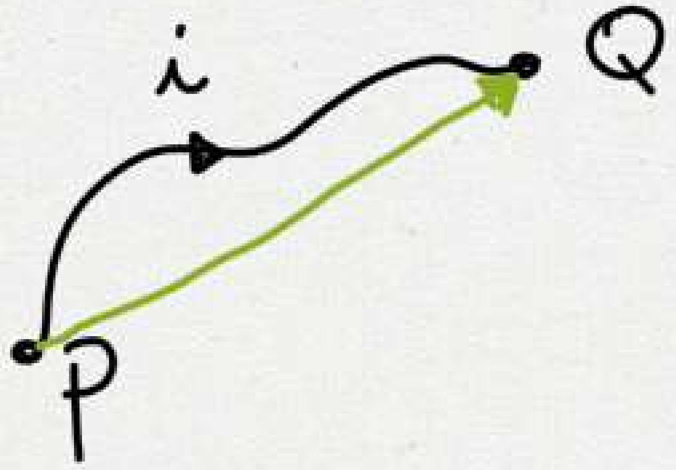


$\vec{B}$ UNIFORME e $\vec{B} = B\hat{z}$

① determinare la forza agente su ogni segmento

② " la forza totale agente sulla parte inferiore della spira

③ calcolare la forza totale agente sulla spira



$$\vec{F}_{PQ} = i\,\vec{PQ}\times\vec{B} \rightarrow |\vec{F}_{PQ}| = i\ell B\sin\theta$$

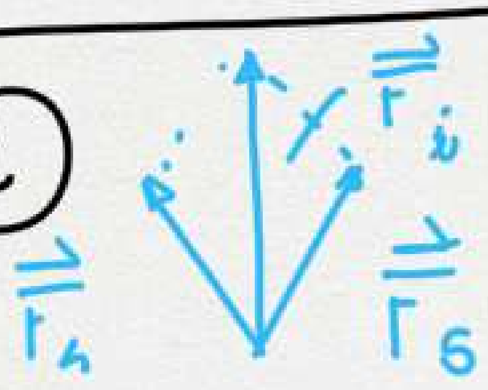
① $\vec{F}_1 = ib\hat{x}\times B\hat{z} = ibB\,\hat{x}\times\hat{z} = -ibB\hat{y}$

$\vec{F}_2 = ia\hat{y}\times B\hat{z} = iaB\hat{x}$

$F_1 = ibB,\quad F_2 = F_3 = iaB$

$F_4 = F_5 = icB$

②

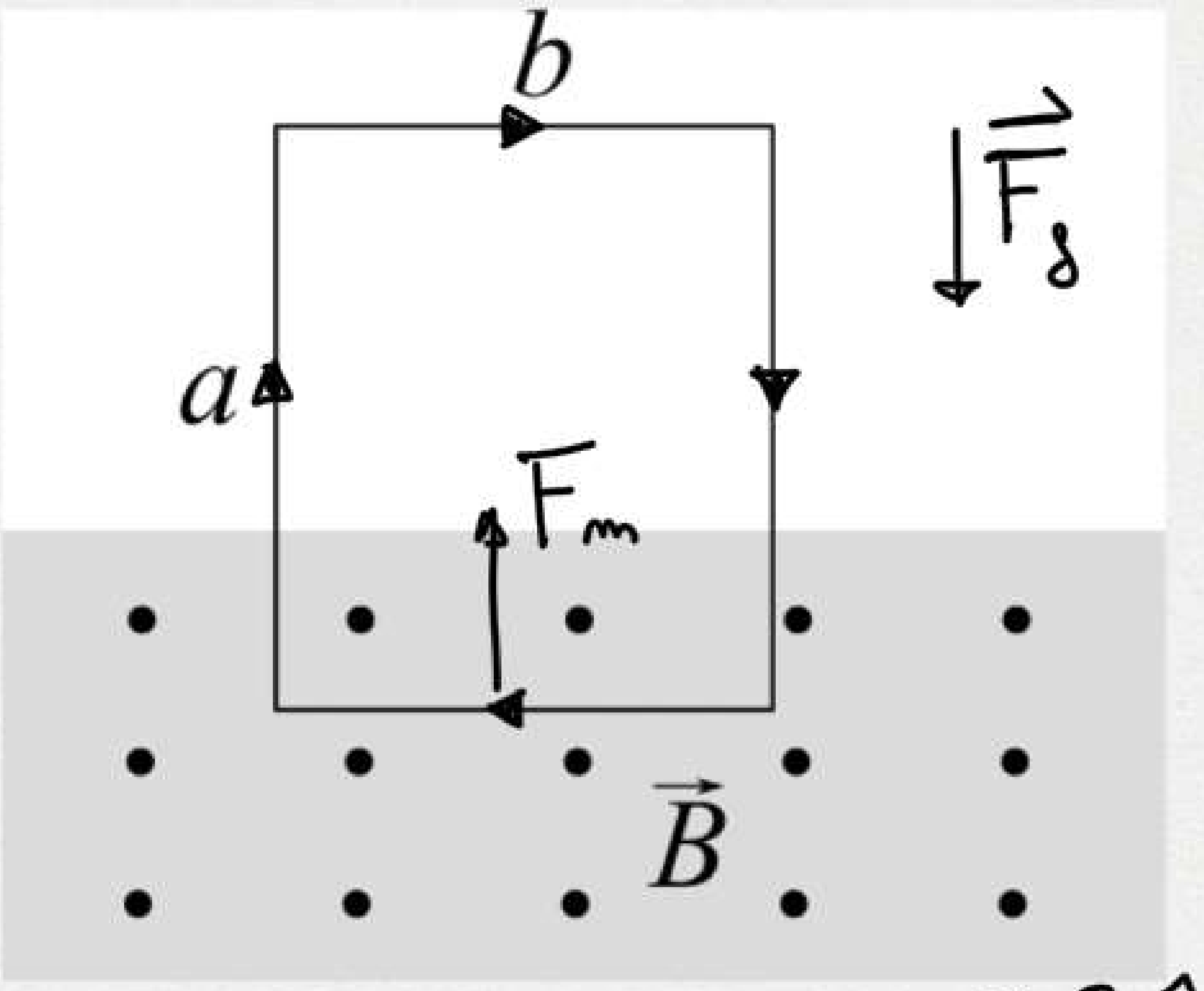


$\vec{F}_{TOT} = 0 = (0,0,0)$

$\vec{F}_1 + \vec{F}_i = 0 \Rightarrow \vec{F}_i = -\vec{F}_1$

$F_i = F_1$

③ $\vec{F}_{TOT} = 0$



$m = 4 \cdot 10^{-2}\, g$, $a = 3\, cm$, $b = 2\, cm$, $|i| = 1\, A$

① il verso di i

② il modulo di $\vec{B}$

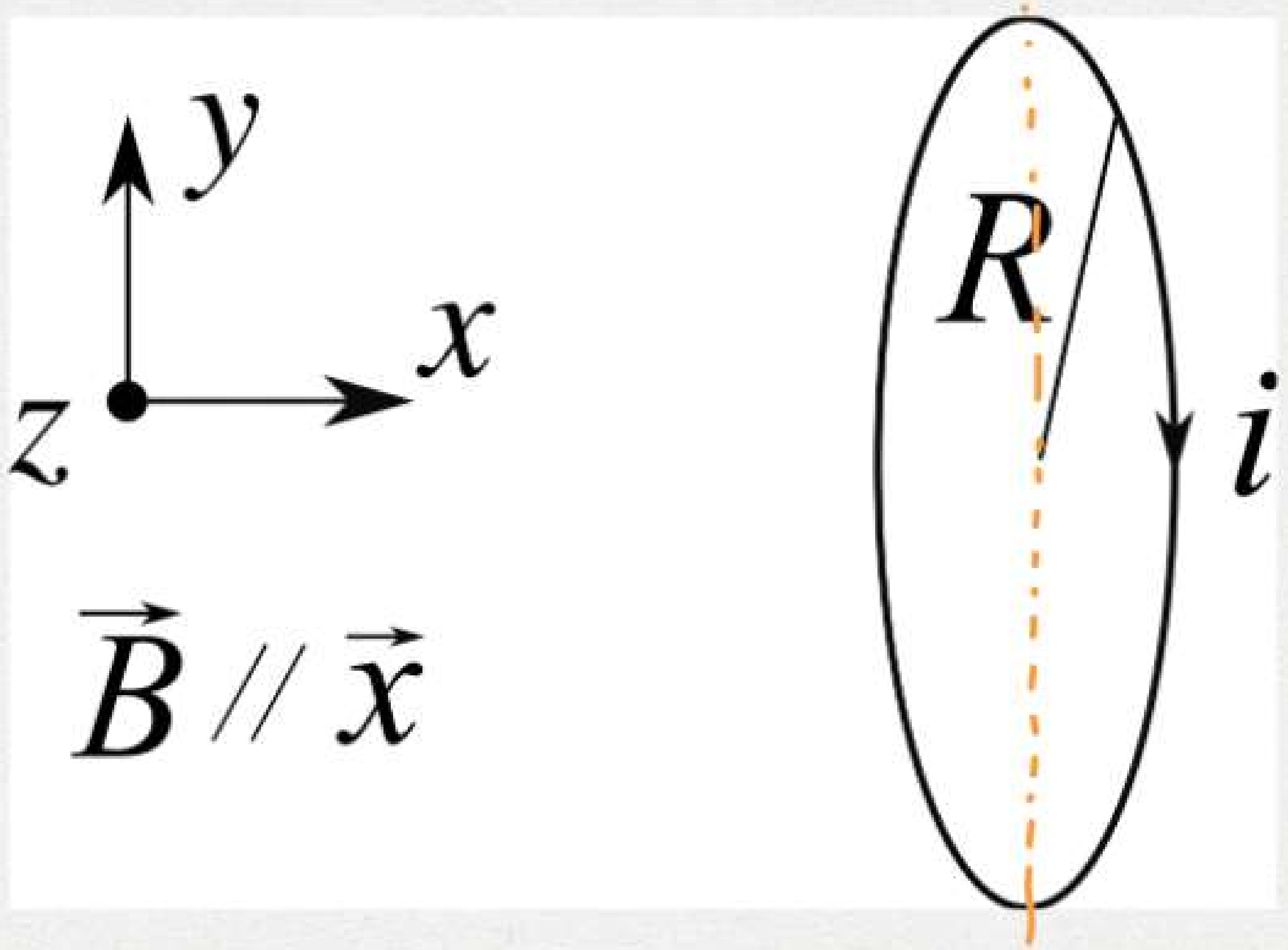
$$\vec{F}_g + \vec{F}_m = 0 \Rightarrow F_m - F_g = 0 \Rightarrow mg = F_m$$

$$\vec{F}_m = i\,\vec{b} \times \vec{B}$$

$\vec{b} \parallel \hat{x}$: $ibB\,\hat{x} \times \hat{z} = -ibB\,\hat{y}$

$\vec{b} \parallel -\hat{x}$: $-ibB\,\hat{x} \times \hat{z} = ibB\,\hat{y}$

$$mg = ibB \Rightarrow B = \frac{mg}{ib} = 196\ G$$



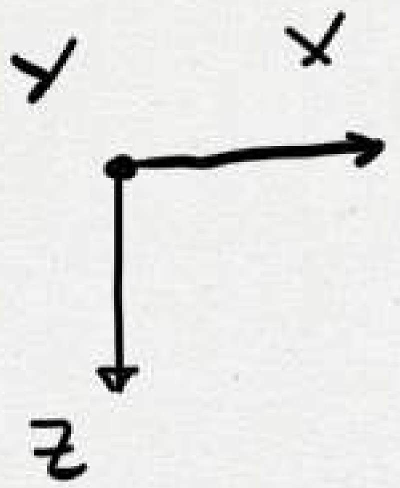
$$\vec{B} = B_0\,\hat{x} \quad , \quad I$$

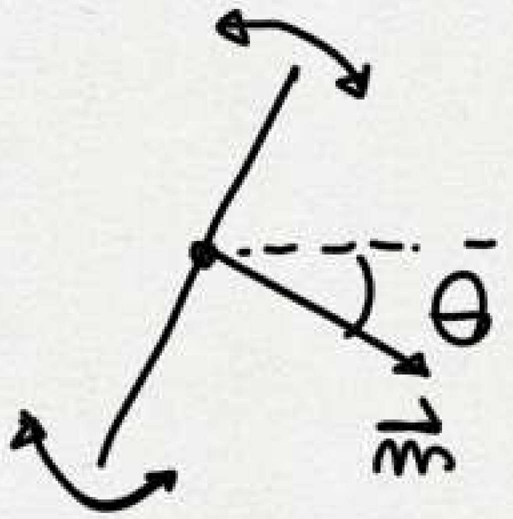
1) ω_0 velocità angolare massima, calcolare θ quando $\omega = \frac{\omega_0}{3}$

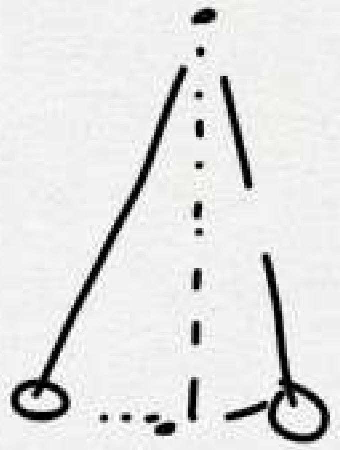
$$U_0 = \frac{1}{2} I\omega^2 - \vec{m}\cdot\vec{B} = \overbrace{\frac{1}{2} I\omega_0^2 - mB_0} \Rightarrow$$

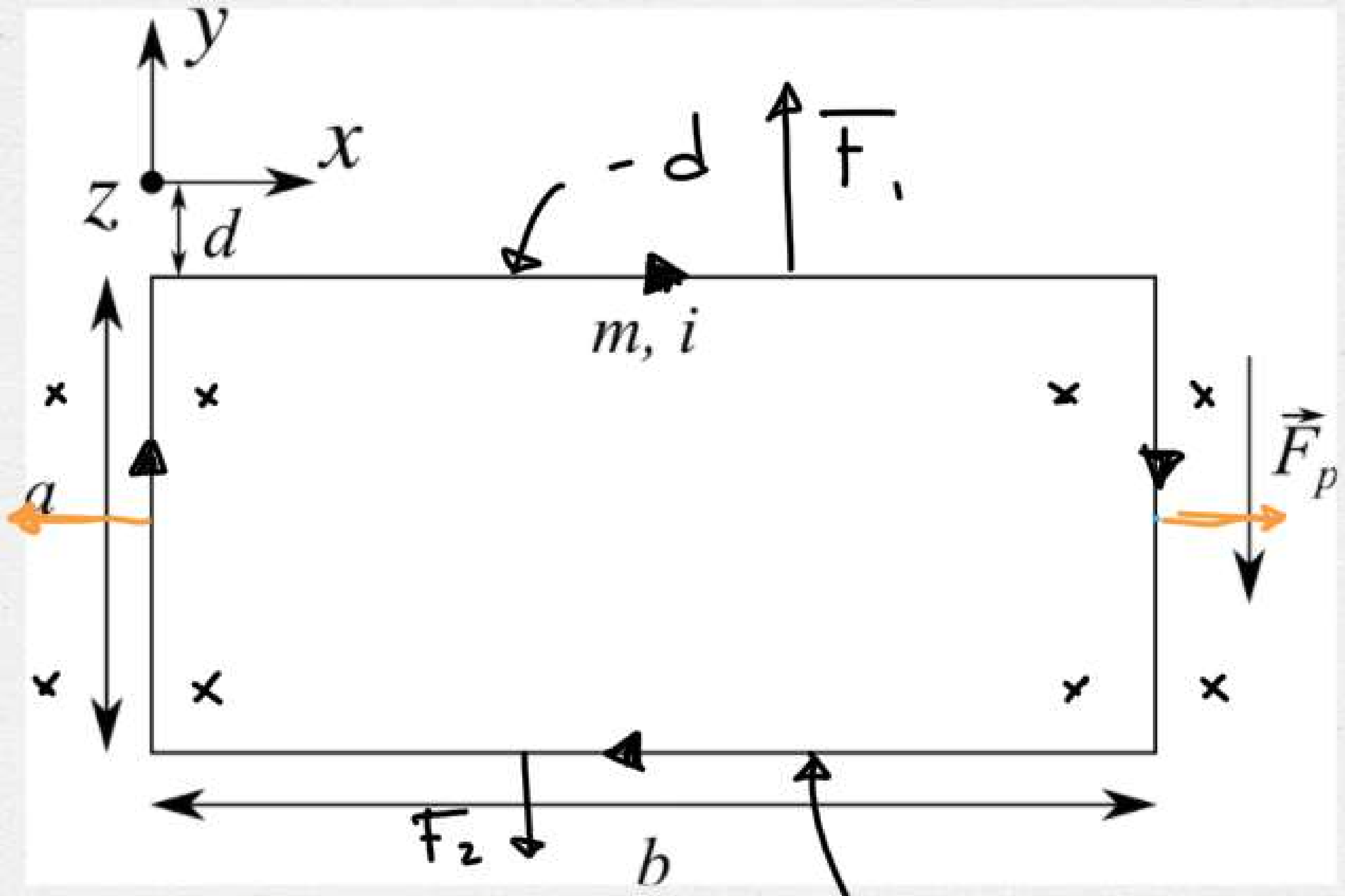
$$U_0 = \frac{1}{2} I \frac{\omega_0^2}{9} - mB_0\cos\theta \Rightarrow$$

$$\cos\theta = \left(\frac{1}{2} I \frac{\omega_0^2}{9} - U_0\right)\frac{1}{mB_0} \quad , \quad m = i\Sigma = i\pi R^2$$









$y = -(a+d)$

$a = 40$ cm, $b = 1$ m, $m = 1$ g, $d = 1$ cm

$\vec{B} \parallel -\hat{z}$, $B(y) = \left|\frac{A}{y}\right|$, $A = 6 \cdot 10^{-6}$ Tm

① determinare verso e intensità di i

② si aggiunge un campo uniforme $\vec{B}_{ADD} = B_{ADD}\hat{z}$, $B_{ADD} = 1$ T. Come cambia i?

NON CAMBIA

$F = i l B \cancel{\sin\theta}$

$F_1 > F_2$ perché $B(d) > B(a+d)$

$F_1 = F_2 + mg \Rightarrow i = \ldots$

$\vec{F} = i\vec{l} \times \vec{B}_{TOT} = i\vec{l} \times (\vec{B} + \vec{B}_{ADD}) = i\vec{l} \times \vec{B} + i\vec{l} \times \vec{B}_{ADD}$