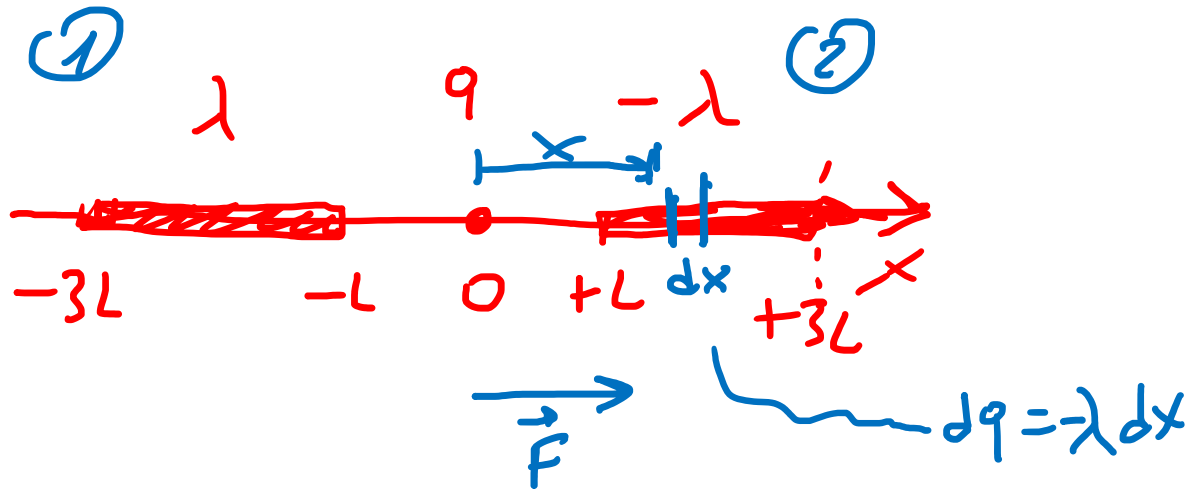
1)



$$\vec F = \vec F_1 + \vec F_2$$

$$|\vec F_1| = |\vec F_2|$$ PER SIMMETRIA

$$\vec F = \hat x\, 2|\vec F_2| = \hat x\, 2 F_2$$

calcolo $|F_2| = \left|\int_L^{3L} \frac{q\,dq}{4\pi\varepsilon_0 x^2}\right| = \left|\frac{q}{4\pi\varepsilon_0}\int_L^{3L}\frac{-\lambda\, dx}{x^2}\right| =$

$$= \left|\frac{-\lambda q}{4\pi\varepsilon_0}\int_L^{3L}\frac{dx}{x^2}\right| = \left|\frac{-\lambda q}{4\pi\varepsilon_0}\,\frac{x^{-2+1}}{-2+1}\Big|_L^{3L}\right| = \left|\frac{\lambda q}{4\pi\varepsilon_0}\,\frac{1}{x}\Big|_L^{3L}\right| =$$

P.2

$$F_{\textcircled{1}} = \left| \frac{\lambda q}{4\pi\varepsilon} \left[\frac{1}{3L} - \frac{1}{L} \right] \right| = \left| \frac{\lambda q}{4\pi\varepsilon L} \left[\frac{1}{3} - 1 \right] \right| =$$

$$= \left| -\frac{\lambda q\, 2}{6\,\cancel{2}\pi\varepsilon L} \right| = \frac{\lambda q}{6\pi\varepsilon L}$$

$$F = 2\left|F_{\textcircled{1}}\right|$$

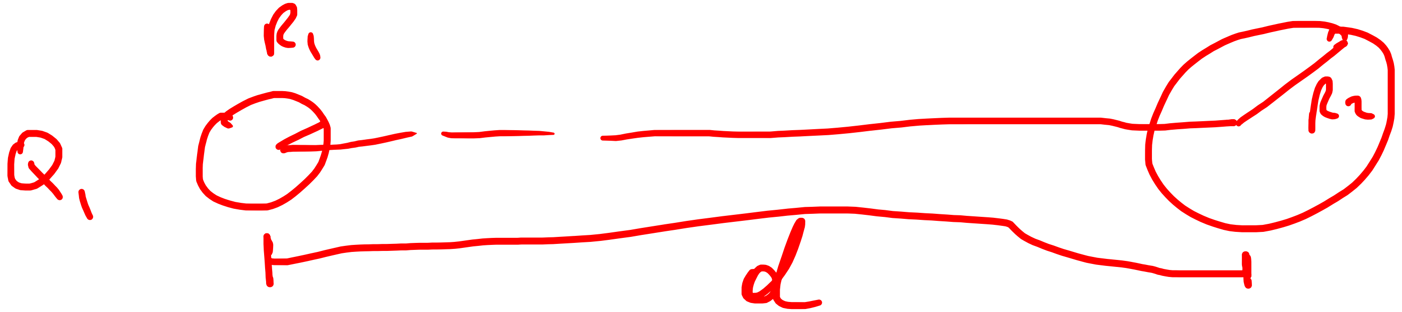
$$F = \frac{\cancel{2}\lambda q}{3\,\cancel{6}\,\pi\varepsilon L}$$

da cui

$$\lambda = \frac{3F\pi\varepsilon_0 L}{q}$$

2)

$d >> R_1, R_2$



$|\vec{F}_{12}| = |\vec{F}_{21}| = F$

$$F = \frac{Q_1 Q_2}{4\pi\varepsilon_0 d^2} \rightarrow Q_1 = \frac{4\pi\varepsilon_0 d^2 F}{Q_2}$$

$$Q_1' + Q_2' = Q_1 + Q_2$$
$$\shortparallel$$
$$Q_T$$

$$V_{Q_1'} = V_{Q_2'}$$

P.4

$$V_{Q'} = \frac{Q_1'}{4\pi\varepsilon_0 R_1} = \frac{Q_2'}{4\pi\varepsilon R_2} = V_{Q_2'}$$

FINE

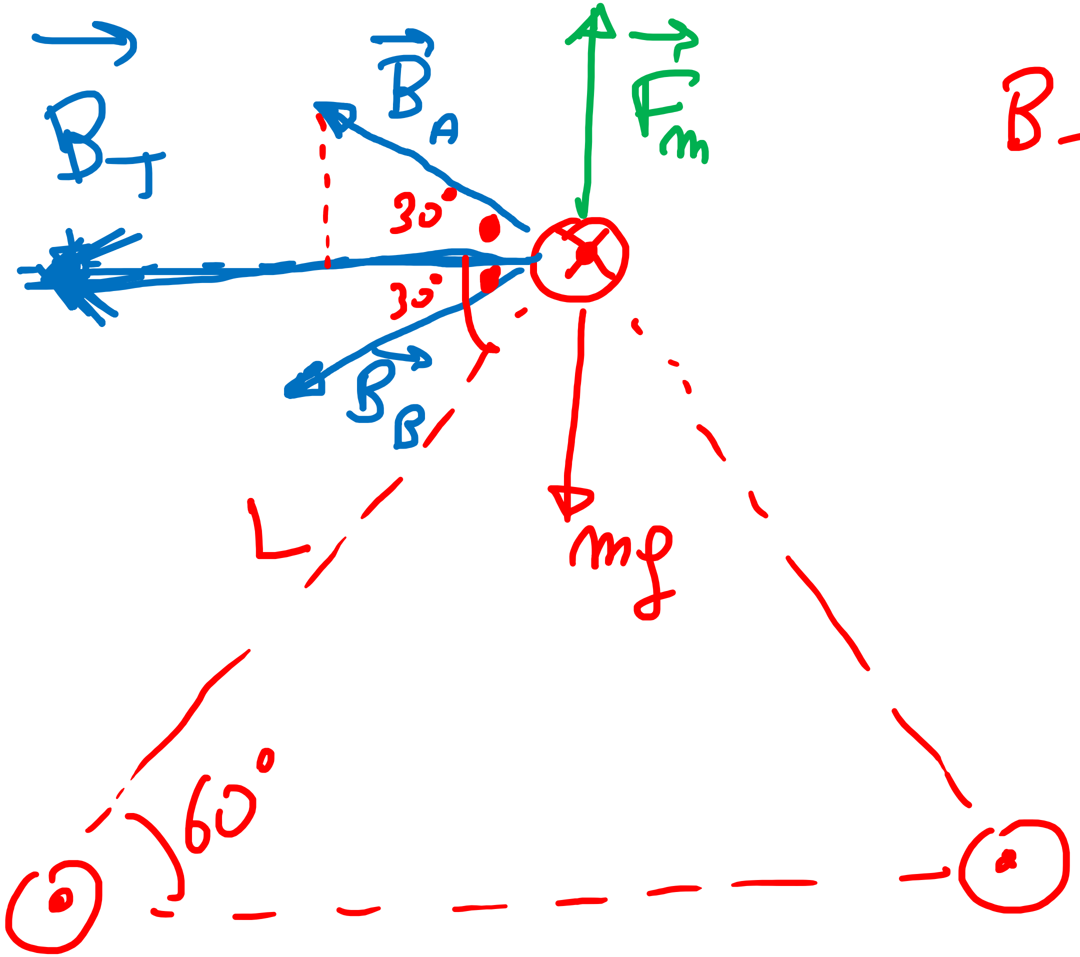
$$\boxed{V_{Q_1} = \frac{Q_1}{4\pi\varepsilon R_1}} \qquad \boxed{V_{Q_2} = \frac{Q_2}{4\pi\varepsilon R_2}}$$

$$\begin{cases} Q_1' + Q_2' = Q_T = Q_1 + Q_2 \\ \dfrac{Q_1'}{\cancel{4\pi}\varepsilon R_1} = \dfrac{Q_2'}{\cancel{4\pi\varepsilon} R_2} \end{cases} \rightarrow \begin{cases} \dfrac{Q_1'}{R_1} = \dfrac{Q_2'}{R_2} \\ Q_1' + Q_2' = Q_T \end{cases}$$

$$Q_2' = \frac{Q_T}{\left[1 + \frac{R_2}{R_1}\right]}$$

$$Q_1' = \frac{R_1}{R_2}\left[Q_T - Q_1'\right] \rightarrow Q_1'\left[1 + \frac{R_1}{R_2}\right] = Q_T \rightarrow Q_1' = \frac{Q_T}{\left[1 + \frac{R_1}{R_2}\right]}$$

3)



$$\vec{B}_T = \vec{B}_A + \vec{B}_B$$

$$B_T = 2 B_A \cos 30°$$

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

$$B_T = \frac{\cancel{2} \mu_0 i}{2\pi L} \cos 30°$$

$$B_T = \frac{\mu_0 i}{\pi L} \frac{\sqrt{3}}{2}$$

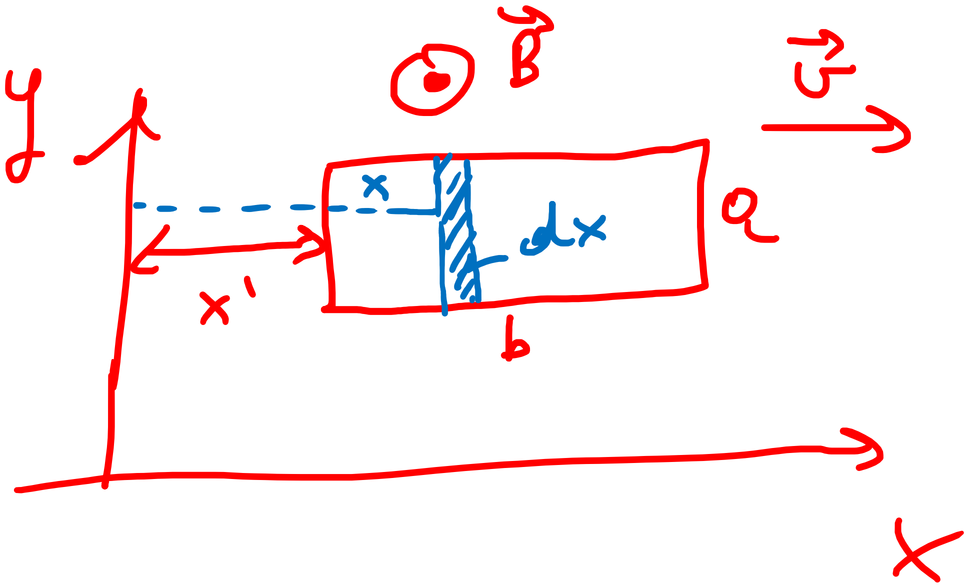
$\boxed{\lambda \ell = m}$ ipotizzo filo lungo "ℓ"

$$mg = F_m = i \ell B_T = i \ell \frac{\mu_0 i}{\pi L} \frac{\sqrt{3}}{2}$$

$$\shortparallel$$

$$\lambda \cancel{\ell} g = \frac{i^2 \cancel{\ell} \mu_0}{\pi L} \frac{\sqrt{3}}{2} \rightarrow i = \sqrt{\frac{2 \lambda g \pi L}{\mu_0 \sqrt{3}}}$$

4)



$B(x) = k x^2$

P.7

$x' = x_0 + vt$

$$d\phi(\vec{B}) = a B(x)\, dx = a k x^2 dx$$

$$\phi(B) = \int_{x'}^{x'+b} d\phi(\vec{B}) = \int_{x'}^{x'+b} a \cancel{k}\, x^2 dx = a \cancel{k} \int_{x'}^{x'+b} x^2 dx =$$

$$= \frac{ak}{3} x^3 \Big|_{x'}^{x'+b} = \frac{a}{3} k \left[(x' + b)^3 - x'^3 \right] =$$

$$\phi(\vec{b}) = \frac{ek}{3}\left[(x_0+vt+b)^3 - (x_0+vt)^3\right]$$

$$f_{eu} = -\frac{d\phi}{dt} = \frac{ek}{3}\left[3v(\underbrace{x_0+vt}_{x'}+b)^2 - 3v(\underbrace{x_0+vt}_{x'})^2\right]$$

$$f_{eu}(x') = \frac{ak}{\cancel{3}}\cdot\cancel{3}v\left[(x'+b)^2 - x'^2\right] =$$

$$= avk\left[\cancel{x'^2}+b^2-2bx'-\cancel{x'^2}\right] = avk\left[b^2-2bx'\right] =$$

$$= abvk\left[b-2x'\right]$$