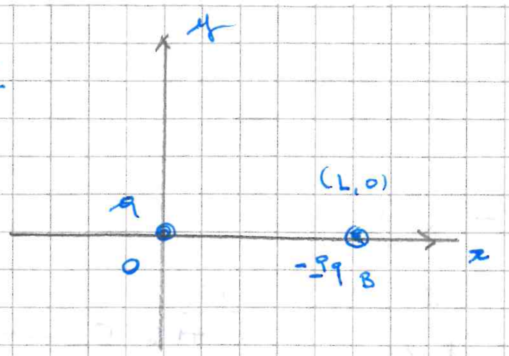
Es #2



$q>0$

a) Sia $P=(x,y)$ con $x>L$, $y=0$

$\vec{r}_{OP} = (x-0)\,\vec{i} = x\,\vec{i}$ $\qquad r_{OP} = x$

$\vec{r}_{BP} = (x-L)\,\vec{i}$ $\qquad r_{BP} = x-L$

$$\vec{E} = K_e \frac{q}{r_{OP}^2}\frac{\vec{r}_{OP}}{r_{OP}} + K_e \frac{-9q}{r_{BP}^2}\frac{\vec{r}_{BP}}{r_{BP}} = K_e q \left(\frac{1}{x^2} - \frac{9}{(x-L)^2}\right)\vec{i}$$

b) Sia $P'=(x,y)$ con $0<x<L$, $y=0$

$\vec{r}_{OP'} = (x-0)\,\vec{i} = x\,\vec{i}$ $\qquad r_{OP} = x$

$\vec{r}_{BP'} = (x-L)\,\vec{i}$ $\qquad r_{BP} = L-x$

$$\vec{E} = K_e \frac{q}{r_{OP}^2}\frac{\vec{r}_{OP}}{r_{OP}} + K_e \frac{-9q}{r_{BP}^2}\frac{\vec{r}_{BP}}{r_{BP}} = K_e q \left(\frac{1}{x^2} + \frac{9}{(x-L)^2}\right)\vec{i}$$

c)

$$\vec{E} = K_e \frac{q}{x_0^2}(-\vec{i}) + K_e \frac{-9q}{(x_0-L)^2}(-\vec{i}) = 0$$

$$\Rightarrow \frac{1}{x_0^2} = \frac{9}{(x_0-L)^2} \qquad (x_0-L)^2 = 9x_0^2 \rightarrow \begin{cases} x_0 = -L/2 \\ x_0 = L/4 \end{cases}$$

non accettabile perché $x_0 < 0$

d) $$V(x,y) = K_e \frac{q}{x} + K_e \frac{(-9q)}{x-L} + V_0$$

$$\lim_{x\to\infty} V(x,y) = V_0 = 0 \Rightarrow V(x,y) = K_e q \left(\frac{1}{x} - \frac{9}{x-L}\right)$$

e) $$V(x,y) = K_e \frac{q}{x} + K_e \frac{(-9q)}{L-x} + V_0$$

$$\lim_{x\to\infty} V(x,y) = V_0 = 0 \Rightarrow V(x,y) = K_e q \left(\frac{1}{x} - \frac{9}{L-x}\right)$$

f) Siano $H = (L/2, 0)$ $\quad K = (\frac{3}{2}L, 0)$

Lavoro fatto da $\vec{E}$ $\quad L_{HK} = e(V_H - V_K)$

$$V_H = k_e q \left(\frac{1}{x} - \frac{q}{L-x} \right) = k_e q \left(\frac{1}{L/2} - \frac{q}{L/2} \right)$$

NB H: $0 < x < L$

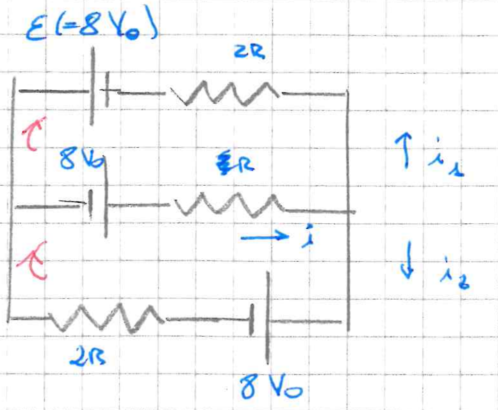
$$V_K = k_e q \left(\frac{1}{x} - \frac{q}{x-L} \right) = k_e q \left(\frac{1}{3L/2} - \frac{q}{L/2} \right)$$

K: $x > L$

$$L_{HK} = e\, k_e q \left(\frac{1}{L/2} - \frac{1}{3L/2} \right) = \frac{4}{3} k_e e q \frac{1}{L}$$

Es #3

Il circuito si riconduce a



a) LdK maglie per maglia sup. $\quad -8V_0 + i_1 2R + iR - 8V_0 = 0$

LdK maglie per maglia inf $\quad 8V_0 - iR - 8V_0 + i_2 2R = 0 \Rightarrow i_2 = -\frac{i}{2}$

LdK nodi $\quad i = i_1 + i_2 \Rightarrow i_1 = \frac{3}{2} i$

$\Rightarrow -16 V_0 + 3iR + iR = 0 \quad \Rightarrow \boxed{i = 4V_0/R}$

b) $i_1 = \frac{3}{2} i = 6V_0/R$

$i_2 = -i/2 = -2V_0/R \quad \Rightarrow P = i_1^2 (2R) + i^2 R + i_2^2 (2R) = \boxed{96 V_0^2/R}$

$i = 4V_0/R$

c) $V_A + i_1 R_{eq} = V_B \quad$ dove $\quad R_{eq} = 2R // 2R = R$

$V_A - V_B = -i_1 R = \boxed{-6V_0}$

d) LdK maglia sup. $\quad -\mathcal{E} + i_1 2R + iR - 8V_0 = 0$

LdK maglia inf $\quad 8V_0 - iR - 8V_0 + i_2 2R = 0 \Rightarrow i_2 = -i/2$

LdK nodi $\quad i = i_1 + i_2 \rightarrow i_1 = 3/2\, i$

Valgono per qualunque $\mathcal{E}$

Se i raddoppia $\Rightarrow$ ~~i_1~~ $i = 8V_0/R$

$\Rightarrow -\mathcal{E} + 3iR + iR - 8V_0 = 0 \Rightarrow \boxed{\mathcal{E} = 24 V_0}$

e) $V_A - V_B = 0$ se $i_1 = 0 \Rightarrow i = 0$

$-\mathcal{E} + i_1 2R + iR - 8V_0 = 0 \quad \Rightarrow \boxed{\mathcal{E} = -8V_0}$