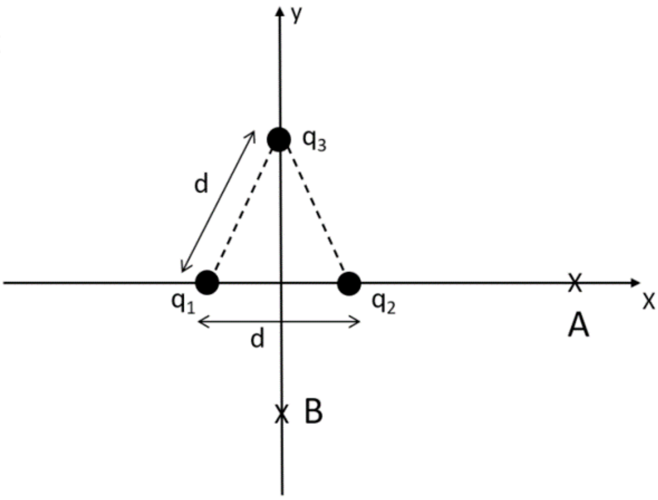
En los vértices de un triángulo equilátero se encuentran 3 cargas puntuales, como se muestra en la figura. Calcular el trabajo que hay que hacer para llevar una carga q_0 desde el punto A hasta el punto B

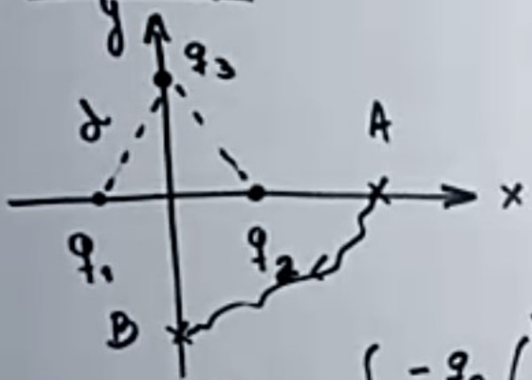
Datos:

$q_1 = 2\ \mu C$ $\quad q_2 = -3\ \mu C$ $\quad q_3 = 7\ \mu C$ $\quad q_0 = 1\ \mu C$

d = 40 cm $\quad \vec{r}_A = 1{,}5\ m\ \hat{x} \qquad \vec{r}_B = -0{,}8\ m\ \hat{y}$



W 3 cargas



$q_1 = 2\mu C \qquad d = 0{,}4 m$

$q_2 = -3\mu C \qquad \bar{r}_A = 1{,}5 m\,\hat{x}$

$q_3 = 7\mu C \qquad \bar{r}_B = -0{,}8 m\,\hat{y}$

$q_0 = 1\mu C$

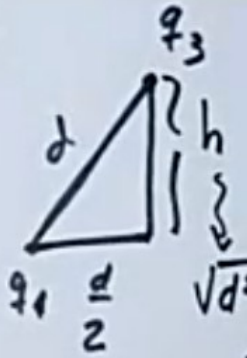
$\iint_S \bar{E}\cdot d\bar{S}$

$$W^{AB}_{\bar{F}_{ext}} = \begin{cases} -q_0 \int_A^B \bar{E}\cdot d\bar{l} \\ q_0\, \Delta V^{AB} = q_0\left(V(B) - V(A)\right) \end{cases}$$

$$V(B) - V(A) = \frac{1}{4\pi\varepsilon_0}\left[q_1\left(\frac{1}{|\bar{r}_B - \bar{r}_1|} - \frac{1}{|\bar{r}_A - \bar{r}_1|}\right) + q_2\left(\frac{1}{|\bar{r}_B - \bar{r}_2|} - \frac{1}{|\bar{r}_A - \bar{r}_2|}\right) + q_3\left(\frac{1}{|\bar{r}_B - \bar{r}_3|} - \frac{1}{|\bar{r}_A - \bar{r}_3|}\right)\right]$$

②

$\bar{r}_1 = -\frac{d}{2}\hat{x}$; $\bar{r}_2 = \frac{d}{2}\hat{x}$; $\bar{r}_3 = \frac{\sqrt{3}}{2} d \hat{y}$



$h = \sqrt{d^2 - \frac{d^2}{4}} = \frac{\sqrt{3}}{2} d$

$|\bar{r}_B - \bar{r}_1| = \cancel{1{,}21\ m}$ 0,82 m

$|\bar{r}_A - \bar{r}_1| = \cancel{0{,}58\ m}$ 1,7 m

$|\bar{r}_B - \bar{r}_2| = 0{,}82$ m

$|\bar{r}_A - \bar{r}_2| = 1{,}3$ m

$|\bar{r}_B - \bar{r}_3| = 1{,}15$ m

$|\bar{r}_A - \bar{r}_3| = 1{,}54$ m

C/m

$$V(B) - V(A) = \underbrace{9\times 10^{9} \frac{N m^2}{C^2}}_{k = 1/4\pi\varepsilon_0} \underbrace{\left[1{,}25\times 10^{-6} \frac{C}{m} - 1{,}33\times 10^{-6} \frac{C}{m} + 1{,}53\times 10^{-6} \right]}_{1{,}45 \times 10^{-6} \frac{C}{m}}$$

③

$$\Delta V^{AB} = V(B) - V(A) = 13{,}05 \times 10^{3}\ V \rightarrow \left(\frac{Nm}{C}\right)$$

$$W^{AB}_{\bar{f}ext} = \underbrace{q_0}_{1\mu C} \Delta V^{AB} = 0{,}0131\ J \rightarrow (N.m)$$