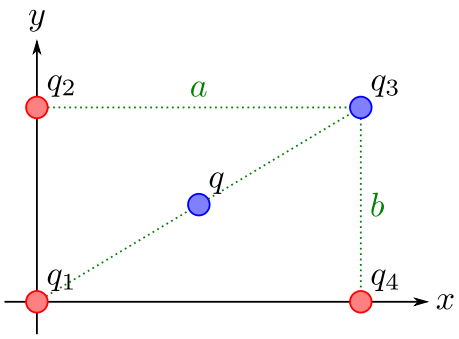
Tarea

Calcular la fuerza eléctrica (F_E) en q, dado que: $q = -2[\mu C]$, $q_1 = +1[\mu C]$, $q_2 = +2[\mu C]$, $q_3 = -1[\mu C]$, $q_4 = +3[\mu C]$, $a = 5[cm]$, $b = 3[cm]$.



Solución:

Los vectores de posición de las cargas son:

$$\vec{r} = 0.025\hat{u}_x + 0.015\hat{u}_y[m]$$
$$\vec{r}_1 = 0\hat{u}_x + 0\hat{u}_y[m]$$
$$\vec{r}_2 = 0\hat{u}_x + 0.03\hat{u}_y[m]$$
$$\vec{r}_3 = 0.05\hat{u}_x + 0.03\hat{u}_y[m]$$
$$\vec{r}_4 = 0.05\hat{u}_x + 0\hat{u}_y[m]$$

Por tanto $\vec{F}_E$ es:

$$\vec{F}_E = \sum_{i=1}^{4} \frac{1}{4\pi\epsilon_0} q q_i \frac{\vec{r} - \vec{r}_i}{|\vec{r} - \vec{r}_i|^3} = \frac{q}{4\pi\epsilon_0} \sum_{i_1}^{4} q_i \frac{\vec{r} - \vec{r}_i}{|\vec{r} - \vec{r}_i|^3}$$

$$\vec{F}_E = \frac{q}{4\pi\epsilon_0} \left(q_1 \frac{\vec{r} - \vec{r}_1}{|\vec{r} - \vec{r}_1|^3} + q_2 \frac{\vec{r} - \vec{r}_2}{|\vec{r} - \vec{r}_2|^3} + q_3 \frac{\vec{r} - \vec{r}_3}{|\vec{r} - \vec{r}_3|^3} + q_4 \frac{\vec{r} - \vec{r}_4}{|\vec{r} - \vec{r}_4|^3} \right)$$

Calculando el valor de las diferencias, obtenemos:

$$\vec{r} - \vec{r}_1 = 0.025\hat{u}_x + 0.015\hat{u}_y - 0\hat{u}_x - 0\hat{u}_y = 0.025\hat{u}_x + 0.015\hat{u}_y$$
$$\vec{r} - \vec{r}_2 = 0.025\hat{u}_x + 0.015\hat{u}_y - 0\hat{u}_x - 0.03\hat{u}_y = 0.025\hat{u}_x - 0.015\hat{u}_y$$
$$\vec{r} - \vec{r}_3 = 0.025\hat{u}_x + 0.015\hat{u}_y - 0.05\hat{u}_x - 0.03\hat{u}_y = -0.025\hat{u}_x - 0.015\hat{u}_y$$
$$\vec{r} - \vec{r}_4 = 0.025\hat{u}_x + 0.015\hat{u}_y - 0\hat{u}_x - 0.03\hat{u}_y = -0.025\hat{u}_x + 0.015\hat{u}_y$$
$$|\vec{r} - \vec{r}_1| = |\vec{r} - \vec{r}_2| = |\vec{r} - \vec{r}_3| = |\vec{r} - \vec{r}_4| = 0.029155$$
$$|\vec{r} - \vec{r}_i|^3 = 2.4782 \times 10^{-5}$$

Resultando:

$$\vec{F}_E = \left[\frac{-2\times10^{-6}}{4\pi(8.8542\times10^{-12})}\right]\left[(1\times10^{-6})\frac{(0.025\hat{u}_x+0.015\hat{u}_y)}{2.4782\times10^{-5}}+\right.$$
$$(2\times10^{-6})\frac{(0.025\hat{u}_x-0.015\hat{u}_y)}{2.4782\times10^{-5}}+$$
$$(-1\times10^{-6})\frac{(-0.025\hat{u}_x-0.015\hat{u}_y)}{2.4782\times10^{-5}}+$$
$$\left.(3\times10^{-6})\frac{(-0.025\hat{u}_x+0.015\hat{u}_y)}{2.4782\times10^{-5}}\right]$$

$$\vec{F}_E = (-18.134\hat{u}_x - 32.640\hat{u}_y)[N]$$