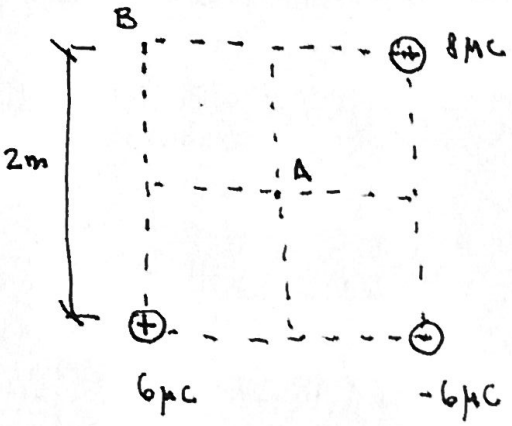
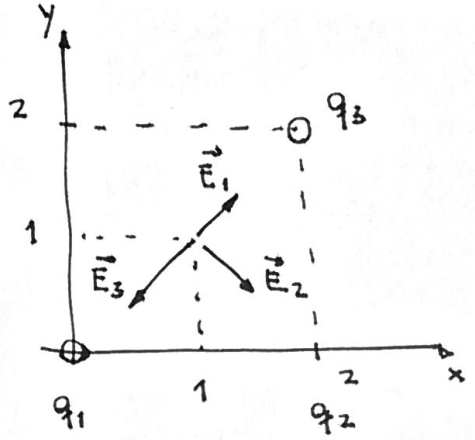


(a) Camp elèctric en el punt A (centre del quadrat)

Primer adoptem un marc de referència:



Calcularem els 3 camps i després els sumarem (vectorialment) per trobar el camp resultant:

$$\vec{E}_1 = k\frac{q_1}{r_1^2}\hat{r}_1 \quad (1)$$

on $q_1 = 6\times10^{-6}\,C$

$$\vec{r}_1 = \hat{i}+\hat{j} \;\Big/\; |\vec{r}_1| = \sqrt{1^2+1^2} = \sqrt{2} \;\Big/\; \hat{r}_1 = \frac{\vec{r}_1}{|\vec{r}_1|} = \frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{j}$$

Reemplaçant els valors anteriors en (1) obtenim:

$$\vec{E}_1 = k\frac{q_1}{r_1^2}\hat{r}_1 = 9\times10^9\,\frac{6\times10^{-6}}{2}\cdot\left(\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{j}\right) = \left(19092\,\hat{i}+19092\,\hat{j}\right)N/C$$

El camp creat per la càrrega q_2:

$$\vec{E}_2 = k\frac{q_2}{r_2^2}\hat{r}_2$$

on $q_2 = -6\mu C = -6\times10^{-6}\,C$

$$\vec{r}_2 = -\hat{i}+\hat{j} \;\Big/\; |\vec{r}_2| = \sqrt{1^2+1^2} = \sqrt{2} \;\Big/\; \hat{r}_2 = \frac{\vec{r}_2}{|\vec{r}_2|} = -\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{j}$$

$$\vec{E}_2 = k\frac{q_2}{r_2^2}\hat{r}_2 = 9\times10^9\,\frac{(-6\times10^{-6})}{2}\cdot\left(-\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{j}\right) = \left(19092\,\hat{i}-19092\,\hat{j}\right)N/C$$

El camp creat per la càrrega q_3:

$$\vec{E}_3 = k\frac{q_3}{r_3^2}\hat{r}_3 =$$

on $q_3 = 8\times10^{-6}\,C$.

$$\vec{r}_3 = -\hat{i} - \hat{j} \;/\; |\vec{r}_3| = \sqrt{2} \;/\; \hat{r}_3 = \frac{\vec{r}_3}{|\vec{r}_3|} = -\frac{1}{\sqrt{2}}\hat{i} - \frac{1}{\sqrt{2}}\hat{j}$$

$$\vec{E}_3 = k\frac{q_3}{r_3^2}\hat{r}_3 = 9\times10^9 \cdot \frac{8\times10^{-6}}{2}\cdot\left(-\frac{1}{\sqrt{2}}\hat{i} - \frac{1}{\sqrt{2}}\hat{j}\right) = (-25456\,\hat{i} - 25456\,\hat{j})\ N/C.$$

$$\vec{E} = \vec{E}_1 + \vec{E}_2 + \vec{E}_3 = (19092\,\hat{i} + 19092\,\hat{j}) + (19092\,\hat{i} - 19092\,\hat{j})$$
$$+ (-25456\,\hat{i} - 25456\,\hat{j}) = \boxed{(12728\,\hat{i} - 25456\,\hat{j})\ N/C.}$$

(b) El treball per portar una carrega $q = 6\,C$ des del'infinit fins al punt A.

El potencial en el punt A:

$$V_A = V_{1A} + V_{2A} + V_{3A} = k\frac{q_1}{r_1} + k\frac{q_2}{r_2} + k\frac{q_3}{r_3} = 9\times10^9\left(\frac{6\times10^{-6}}{\sqrt{2}} + \frac{(-6\times10^{-6})}{\sqrt{2}} + \frac{8\times10^{-6}}{\sqrt{2}}\right)$$

$$V_A = 50912\,V$$

El treball per portar la carrega des del infinit fins a A serà

$$W = \Delta U = q\Delta V = q(V_A - V_\infty) = qV_A = 6\cdot 50912 = \boxed{305472\,V}$$

Per traslladar del punt A al B:

$$W = q(V_B - V_A)$$

on $V_B = k\frac{q_1}{r_{1B}} + k\frac{q_2}{r_{2B}} + k\frac{q_3}{r_{3B}} = 9\times10^9\left(\frac{6\times10^{-6}}{2} + \frac{-6\times10^{-6}}{\sqrt{2^2+2^2}} + \frac{8\times10^{-6}}{2}\right)$

$$V_B = 43908\,V.$$

$$W = 6(43908 - 50912) = \boxed{-42024\,V}$$