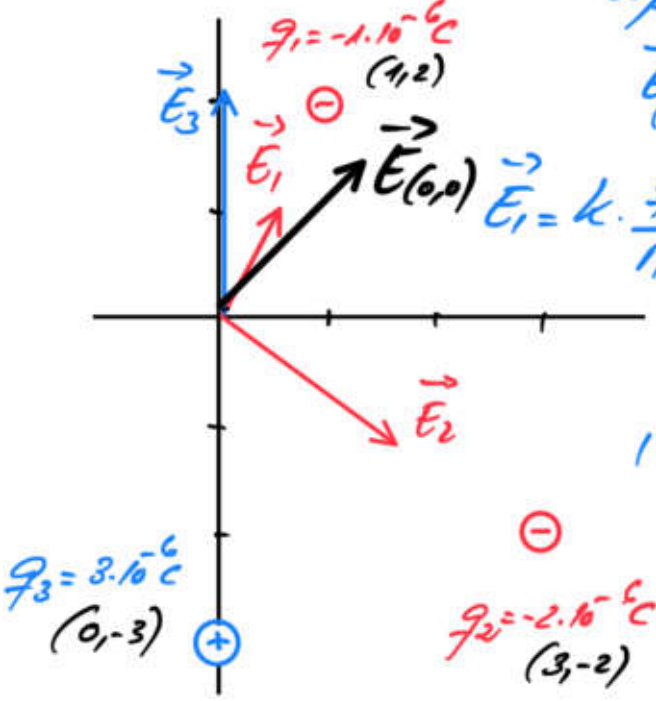
EJERCICIO FQBE2773:

a) Campo en el origen:

$$\vec{E}_{(0,0)} = \vec{E}_1 + \vec{E}_2 + \vec{E}_3$$



$$\vec{E}_1 = k\cdot\frac{q_1}{r_1^2}\frac{\vec{r}_1}{r_1} = 9.10^9\,\frac{-1.10^{-6}}{5}\,\frac{-\vec{i}-2\vec{j}}{\sqrt{5}} \Rightarrow$$

$$\vec{r}_1 = -\vec{i}-2\vec{j}$$

$$|\vec{r}_1| = \sqrt{5}\ m$$

$$\boxed{\vec{E}_1 = 804{,}98\vec{i} + 1609{,}97\vec{j}\ \frac{N}{C}}$$

$$\vec{E}_2 = k\cdot\frac{q_2}{r_2^2}\frac{\vec{r}_2}{r_2} = \ldots = 9.10^9\,\frac{-2.10^{-6}}{(\sqrt{13})^2}\,\frac{-3\vec{i}+2\vec{j}}{\sqrt{13}} \Rightarrow$$

$$\vec{r}_2 = -3\vec{i}+2\vec{j} \Rightarrow |\vec{r}_2| = \sqrt{13}\ m$$

$$\boxed{\vec{E}_2 = 1152{,}07\vec{i} - 768{,}05\vec{j}\ \frac{N}{C}}$$

$$\vec{E}_3 = k\,\frac{q_3}{r_3^2}\frac{\vec{r}_3}{r_3} = 9.10^9\,\frac{3.10^{-6}}{3^2}\,\frac{3\vec{j}}{3} \Rightarrow$$

$$\vec{r}_3 = 3\vec{j} \Rightarrow |\vec{r}_3| = 3\ m; \qquad \boxed{\vec{E}_3 = 3000\vec{j}\ \frac{N}{C}}$$

$$\vec{E} = \vec{E}_1 + \vec{E}_2 + \vec{E}_3 = \ldots = 1957{,}05\vec{i} + 3841{,}92\vec{j}\ \frac{N}{C}$$

$$|\vec{E}| = \sqrt{1957{,}05^2 + 3841{,}92^2}$$

$$\boxed{|\vec{E}| = 4311{,}66\ \frac{N}{C}}$$

5) Potencial en el origen:

$V(0,0) = V_1 + V_2 + V_3$

$V_1 = k\frac{q_1}{r_1} = 9.10^9 \frac{-1.10^{-6}}{\sqrt{5}} = -4024,92\ V$

$V_2 = k\frac{q_2}{r_2} = 9.10^9 \frac{-2.10^{-6}}{\sqrt{13}} = -4992,30\ V$

$V_3 = k\frac{q_3}{r_3} = 9.10^9 \frac{3.10^{-6}}{3} = 9000\ V$

$$\boxed{V(0,0) = -17,22\ V}$$

c) Trabajo que "tenemos que hacer" para $q_4 = -4.10^{-6}C$ desde $(0,0) \to \infty$

$W_{NOSOTROS} = q_4 \cdot \Delta V \quad (W_{Campo} = -q_4 \Delta V)$

$W = -4.10^{-6} \cdot (V_{final} - V_{inicial}) =$

$= -4.10^{-6} (V_\infty - V(0,0)) =$

$= -4.10^{-6} [0 - (-17,22)]$

$$\boxed{W_{NOS} = -6,89.10^{-5}\ J}$$

"No lo realizamos nosotros"

$W_{Campo} = 6,89.10^{-5} J \Rightarrow$ ¡Lo realiza el Campo!