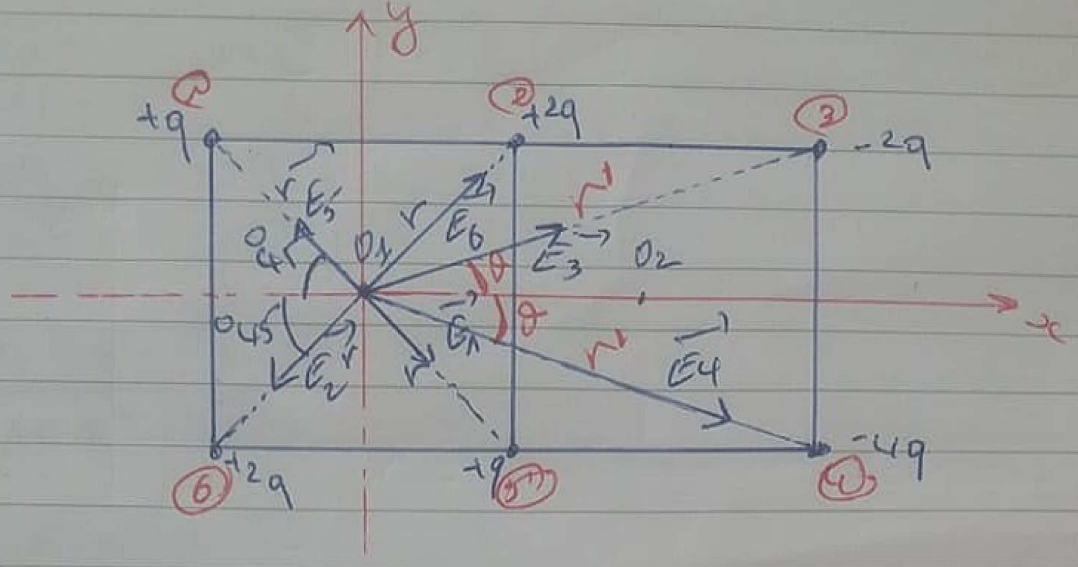
Solution 2



$$\vec{E}_T = \vec{E}_1 + \vec{E}_2 + \vec{E}_3 + \vec{E}_4 + \vec{E}_5 + \vec{E}_6$$

$$\|\vec{E}_1\| = \|\vec{E}_5\| = \frac{K|q|}{r^2}$$

$$\|\vec{E}_2\| = \|\vec{E}_6\| = \frac{K|2q|}{r^2} \quad / \; r^2 = \frac{a^2}{4} + \frac{a^2}{4} = \frac{a^2}{2}$$

$$\|\vec{E}_3\| = \frac{K|-2q|}{r'^2}$$

$$\|\vec{E}_4\| = \frac{K|-4q|}{r'^2} \quad / \; r'^2 = \frac{a^2}{4} + \frac{9a^2}{4} = \frac{10a^2}{4}$$

$$\cos\theta = \frac{\frac{3a}{2}}{\sqrt{10}\,\frac{a}{2}} = \frac{3}{\sqrt{10}}$$

$$\sin\theta = \frac{\frac{a}{2}}{\sqrt{10}\,\frac{a}{2}} = \frac{1}{\sqrt{10}}$$

$$\perp(Ox) : E_x = (E_1 + E_6 - E_2 - E_5)\cos 45^\circ + (E_3 + E_4)\cos\theta$$

$$E_1 - E_5 = 0 \text{ et } E_6 - E_2 = 0$$

$$E_x = (E_3 + E_4)\cos\theta$$

$$E_x = \left(\frac{Kq}{\frac{10a^2}{4}} + \frac{Kq}{\frac{10a^2}{4}} \right) \cdot \frac{3}{\sqrt{10}}$$

$$= \left(\frac{8Kq}{10a^2} + \frac{16Kq}{10a^2} \right) \frac{3}{\sqrt{10}}$$

$$= \frac{24Kq}{10a^2} \times \frac{3}{\sqrt{10}}$$

A.N : $E_x = \frac{24 \times 9 \times 10^9 \times 2 \times 10^{-4}}{10 \times 36 \times 10^{-4}} \times \frac{3}{\sqrt{10}}$

$$\boxed{E_x = 1,138 \times 10^9 \ \frac{N}{C}}$$

(oy) : $E_y = \underbrace{(E_5 + E_6 - E_1 - E_2)}_{=0} \sin 45 + (E_3 - E_4) \sin \theta$

$$E_y = (E_3 - E_4) \sin \theta$$

$$= \left(\frac{Kq}{\frac{10a^2}{4}} - \frac{Kq}{\frac{10a^2}{4}} \right) \frac{1}{\sqrt{10}}$$

$$= \left(\frac{8Kq}{10a^2} - \frac{16Kq}{10a^2} \right) \frac{1}{\sqrt{10}}$$

$$= \frac{-8Kq}{10a^2} \cdot \frac{1}{\sqrt{10}}$$

A.N : $E_y = \frac{-8 \times 9 \times 10^9 \times 2 \times 10^{-4}}{10 \times 36 \times 10^{-4}} \times \frac{1}{\sqrt{10}}$

$$\boxed{E_y = -0,126 \times 10^9 \ \frac{N}{C}}$$

(2)

$$\vec{E_T} = E_x \vec{\imath} + E_y \vec{\jmath}$$

$$= \left[1,138 \times 10^{+9} \vec{\imath} - 0,126 \times 10^{9} \vec{\jmath}\right] \frac{N}{C}$$

$$\|\vec{E_T}\| = \sqrt{E_x^2 + E_y^2} = 1,145 \times 10^{9} \frac{N}{C}$$

2) $\vec{F} = \vec{E} \cdot Q = \left(1,138 \times 10^{9} \vec{\imath} - 9126\, 10^{9} \vec{\jmath}\right) 4 \times 10^{-6}$

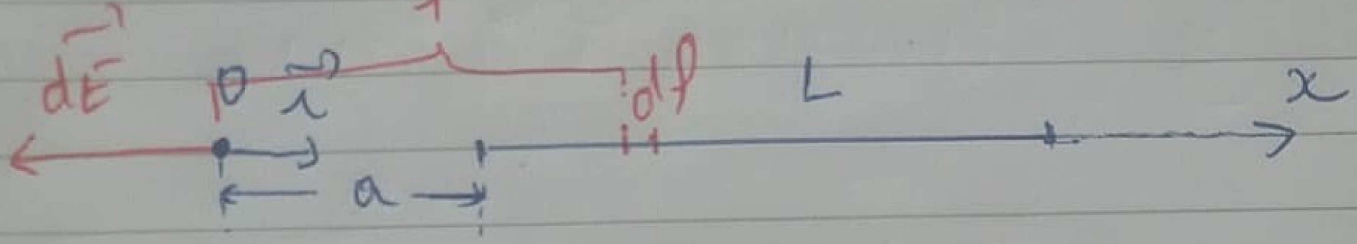
$$\vec{F} = \left[4,552 \times 10^{3} \vec{\imath} - 0,504 \times 10^{3} \vec{\jmath}\right] N$$

$$\|\vec{F}\| = \|\vec{E}\| \times |Q|$$

$$\Rightarrow = 1,145 \times 10^{9} \times 4 \times 10^{-6}$$

$$\|F\| = 4,58 \times 10^{3} N$$

Solution 2



$$\vec{dE} = \frac{-K\,dq}{l^2}\vec{i}, \quad dq = \lambda\,dl.$$

$$\vec{dE} = -\frac{K\lambda\,dl}{l^2}\vec{i}$$

$$\vec{E} = \int_a^{(a+L)} -K\lambda\frac{dl}{l^2}\vec{i} = K\lambda\int_a^{(a+L)} -\frac{dl}{l^2}\vec{i}$$

$$\int \frac{-dl}{l^2} = \frac{1}{l} \quad \text{donc :}$$

$$\vec{E} = K\lambda\left[\frac{1}{l}\right]_a^{a+L}\vec{i}$$

$$\boxed{\vec{E} = K\lambda\left[\frac{1}{a+L} - \frac{1}{a}\right]\vec{i}}$$