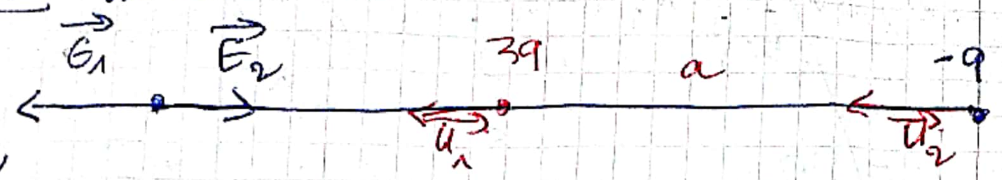
Ex1

on considèr que ce champ crée en un point M telque $OM = x$.

D'aprés le principe de superposition

$$\vec{E}(M) = \vec{E_1}(M) + \vec{E_2}(M) = k\frac{q_1}{(OM)^2}\vec{u_1} + k\frac{q_2}{(AM)^2}\vec{u_2}$$

1ère cas : $x < 0$.

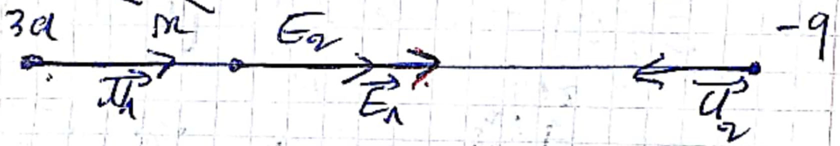


$\vec{OM} = -x$

$AM = -x + a$. puisque $x < 0$ $\vec{u_1} = -\vec{i}$; $\vec{u_2} = -\vec{i}$.

$$\vec{E}(M) = kq\left(-\frac{3}{x^2} + \frac{1}{(-x+a)^2}\right)\vec{i}$$

2ème cas : $0 < x < a$.

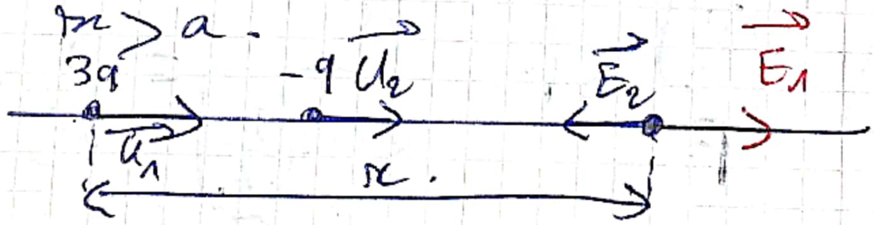


$OM = x$

$AM = a - x$ $\vec{u_1} = \vec{i}$; $\vec{u_2} = -\vec{i}$.

$$\vec{E}(M) = kq\left(\frac{3}{x^2} + \frac{1}{(a-x)^2}\right)\vec{i}$$

3ème cas : $x > a$.

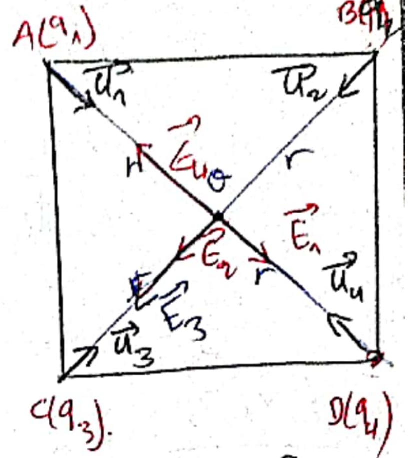


$$\vec{E}(M) = kq\left(\frac{3}{x^2} - \frac{1}{(x-a)^2}\right)\vec{i}$$

TDN2

Exo1: le champ électrostatique généré au centre O:

principe Superposition



$$\vec{E}(O) = \vec{E}_1(O) + \vec{E}_2(O) + \vec{E}_3(O) + \vec{E}_4(O).$$

on a:

$$\vec{E}_1(O) = k\frac{q_1}{(AO)^2}\vec{U}_1 \quad ; \quad \vec{E}_3(O) = k\frac{q_3}{(CO)^2}\vec{U}_3$$

$$\vec{E}_2(O) = k\frac{q_2}{(BO)^2}\vec{U}_2 \quad ; \quad \vec{E}_4(O) = k\frac{q_4}{(DO)^2}\vec{U}_4.$$

$AO = BO = CO = DO.$

avec: $AD^2 = Dc^2 + CD^2.$

$$\frac{AD^2}{2} = \frac{Dc^2 + CD^2}{2} \Rightarrow \frac{AD}{2} = \frac{\sqrt{Dc^2 + CD^2}}{2}$$

on a $AD = 2r.$

donc: $$\frac{\cancel{2}r}{\cancel{2}} = \frac{\sqrt{b^2+b^2}}{2} \Rightarrow r = \frac{\sqrt{2b^2}}{2} = \frac{\sqrt{2}}{2}b.$$

on a: $\boxed{2 = \sqrt{2}\cdot\sqrt{2}}$

$\vec{U}_1 = \vec{i}$; $\vec{U}_2 = -\vec{j}$ | $\vec{U}_3 = \vec{j}$; $\vec{U}_4 = -\vec{i}.$

$$\vec{E}(O) = k\frac{q_1}{r^2}\vec{U}_1 + k\frac{q_2}{r^2}\vec{U}_2 + k\frac{q_3}{r^2}\vec{U}_3 + k\frac{q_4}{r^2}\vec{U}_4.$$

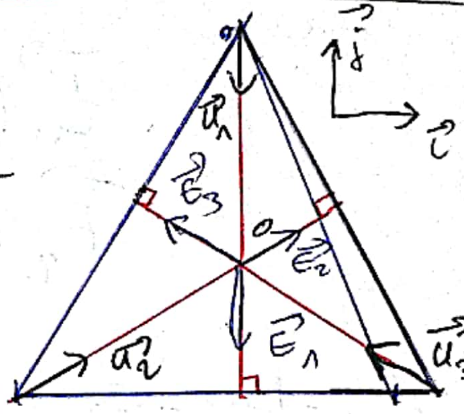
$$\vec{E}(O) = k\frac{q}{r^2}\vec{i} + \frac{k\,2q}{r^2}(-\vec{j}) + \frac{k(-4)q}{r^2}\vec{j} + \frac{2q}{r^2}(-\vec{i})$$

$$\vec{E}(0) = \frac{kq}{r^2}\left(\vec{i} - 2\vec{j} - 4\vec{j} - 2\vec{i}\right).$$

$$\vec{E}(0) = \frac{2kq}{\sqrt{2}\,b}\left(-\vec{i} - 6\vec{j}\right). \Rightarrow \boxed{\vec{E}(0) = \frac{\sqrt{2}\,kq}{b}\left(-\vec{i} - 6\vec{j}\right)}$$

$$\boxed{\vec{E}(0) = -\frac{\sqrt{2}\,kq}{b}\left(\vec{i} + 6\vec{j}\right)}$$

Exo 3 : $AO = BO = CO = r$.



Pour calculer cette distance, on procède comme suite.

$$\cos\left(\frac{\pi}{6}\right) = \frac{\left(\frac{a}{2}\right)}{r} \rightarrow r = \frac{a}{2\underbrace{\cos\left(\frac{\pi}{6}\right)}_{\frac{\sqrt{3}}{2}}}$$

$$= \frac{a}{\sqrt{3}} = \frac{a\sqrt{3}}{3}.$$

D'après le principe superposition

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

$$= k\frac{q_1}{(AO)^2}\vec{u}_1 + k\frac{q_2}{(BO)^2}\vec{u}_2 + k\frac{q_3}{(CO)^2}\vec{u}_3.$$

$$\vec{E}(0) = k\frac{q}{r^2}\left(\vec{u}_1 + \vec{u}_2 + \vec{u}_3\right)$$

La somme $(\vec{u}_1 + \vec{u}_2)$ donne un vecteur porté par l'axe (Oy) telque : $\vec{u}_1 + \vec{u}_2 = \vec{j}$.

sachant que $\vec{u}_1 = -\vec{j}$, il s'ensuit que : $\vec{u}_1 + \vec{u}_2 + \vec{u}_3 = \vec{0}$

Par conséquent : $\boxed{\vec{E}(0) = \vec{0}.}$