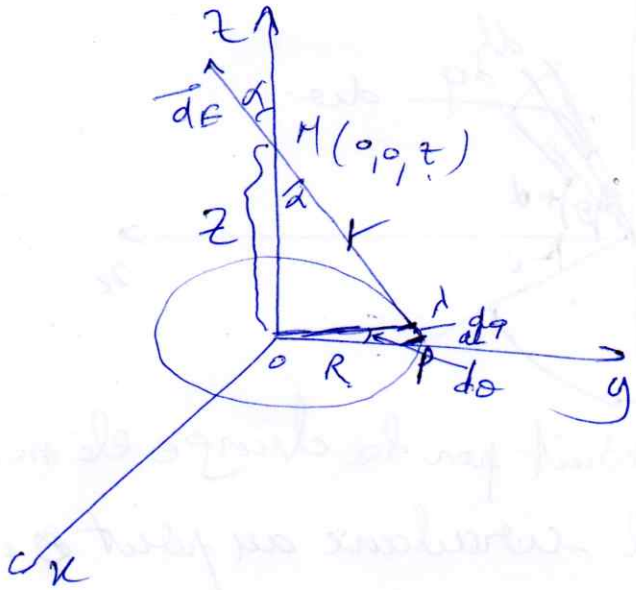
Ex 3



1) Le champ électrique élémentaire $\overrightarrow{dE_M(z)}$:

$$dE_z = dE\cos\alpha = \frac{k\,dq}{(PM)^2}\cos\alpha = \frac{k\,\lambda\,dl}{(PM)^2}\cos\alpha$$

$$= \frac{k\lambda R\,d\theta}{(z^2+R^2)}\cdot\frac{z}{\sqrt{z^2+R^2}}$$

$$\begin{cases} dq = \lambda\,dl \\ \cos\alpha = \dfrac{z}{\sqrt{z^2+R^2}} \\ dl = R\,d\theta \end{cases}$$

$$dE_z = \frac{k\lambda Rz}{(z^2+R^2)^{3/2}}\,d\theta$$

2) Le champ total $\overrightarrow{E_M(z)}$

$$E_M(z) = \int dE_z = \int_0^{2\pi} \frac{k\lambda Rz}{(z^2+R^2)^{3/2}}\,d\theta$$

$$= \frac{k\lambda Rz}{(z^2+R^2)^{3/2}}\int_0^{2\pi} d\theta$$

$$= \frac{2\pi k\lambda Rz}{(z^2+R^2)^{3/2}}$$

3) : $E(M)$ pour $z \geq 0$

$E(z,t) = 0$ pour $z = 0$

$E(z) \to 0$ pour $z \to +\infty$

$$\frac{dE(z)}{dz} = 0 \Rightarrow z = \frac{R}{\sqrt{2}}$$

pour $z = \frac{R}{\sqrt{2}} \Rightarrow E(z) = \frac{\lambda R^2}{2\varepsilon_0(\sqrt{3}R^2)}$