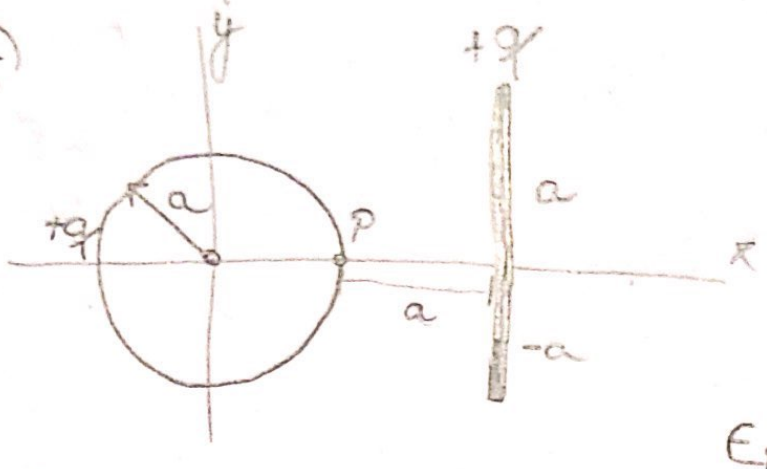
2.



$E_y = 0$

Simétrico

$E_P = E_{esfera} + E_{Barra}$

$r > R$

$$\Phi = \oint \vec{E}\, d\vec{A} = \frac{Q_{int}}{\epsilon}$$

$$\epsilon \oint_\Theta dA = \frac{Q}{\epsilon_0}$$

$$E_{r>R} = \frac{Q}{4\pi\epsilon_0 r^2}$$

$$E = \frac{4\pi \cdot 9.10^9\, q}{4\pi\, a^2}$$

$$E_{esfera} = \frac{9.10^9\, q}{a^2}$$

$$E_{Barra} = \frac{1}{4\pi\epsilon_0}\int \frac{dq}{(a^2+x^2)} \cos\theta$$

$$= \frac{\lambda}{4\pi\epsilon_0 a^2}\int \frac{dx}{\left(1+\frac{x^2}{a^2}\right)} \cos\theta$$

$$= \frac{\lambda}{4\pi\epsilon_0 a}\int \cos\theta\, d\theta$$

$$= \frac{\lambda \operatorname{sen}\theta}{4\pi\epsilon_0 a}$$

$$= \frac{\lambda}{4\pi\epsilon_0 a}\left[\frac{a}{\sqrt{a^2+a^2}} - \frac{(-a)}{\sqrt{a^2+a^2}}\right] = \frac{\lambda\sqrt{2}}{4\pi\epsilon_0 a}$$

$E_P = E_{esfera} + E_{Barra}$

$$E_P = \frac{q}{4\pi\epsilon_0 a^2} + \frac{\lambda\sqrt{2}}{4\pi\epsilon_0 a}$$

$$\boxed{E_P = \frac{1}{4\pi\epsilon_0 a}\left(\frac{q}{a} + \lambda\sqrt{2}\right)}$$

Igor Eiki
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