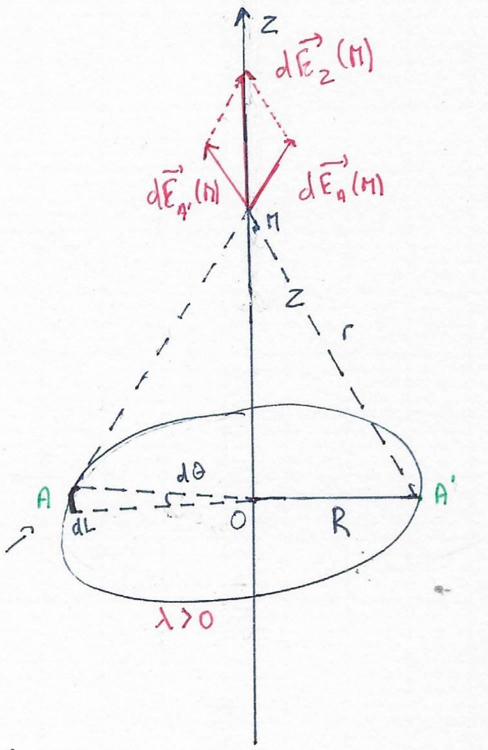
• Symmetry.

• Forces.



chunk of the circle as a point.

↳ Needs a small angle $d\theta$

⇒ Charge of A (dQ) is λdL

Exo 2 TD3 (Physics)

2)

Variation : Small chunk of the figure.

$$d\vec{E}_A(M) = k \frac{\lambda dL}{r^3} \vec{r} \quad \left(\text{Similar to } k \frac{q}{r^3} \vec{r}, q \right.$$

$$r = \sqrt{z^2 + R^2} \quad \text{and} \quad \vec{r} = \left(\vec{AO} + \vec{OM} \right)$$

$$d\vec{E}_A(M) = k \frac{\lambda dL}{\left(\sqrt{z^2+R^2}\right)^3} \left(-R\vec{u_r} + z\vec{u_z} \right)$$

$$dL = R d\theta$$

$$dE_A(M) = k \frac{\lambda R d\theta}{(z^2+R^2)^{3/2}} \left(-R\vec{u_r} + z\vec{u_z} \right)$$

Problem $d\vec{E}_z(M) \neq d\vec{E}_A(M)$

$\vec{u_r}$ gets cancelled through symmetry

$$\boxed{d\vec{E}_z(M) = k \frac{\lambda R z}{(z^2+R^2)^{3/2}} d\theta \, \vec{u_z}}$$

So $\vec{E}_z(M)$ (taking the whole circle) $= \int_0^{2\pi} d\vec{E}_z(M)$

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

$$= 2\pi \, k\lambda R z$$

So $\vec{E_z}(M)$ (taking the entire circle)

$$\int_0^{2\pi} d\vec{E_z}(M) = \frac{k \lambda R z}{(z^2+R^2)^{3/2}} \int_0^{2\pi} 1 \, d\theta \, \vec{u_z}$$

$$\boxed{\vec{E_z}(M) = 2\pi \frac{k \lambda R z}{(z^2+R^2)^{3/2}} \vec{u_z}}$$