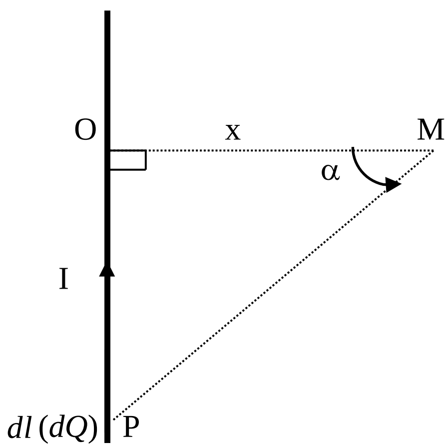
EPITA- S3
2020/2021

Exercise sheet n°3

Electrostatics: Continuous charge distributions

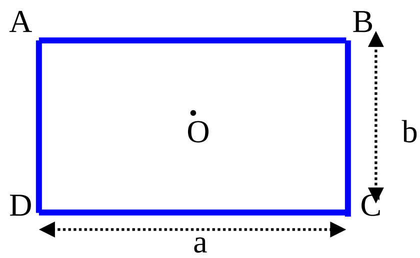
Exercise 1

The studied system is an infinite wire which is charged with a constant positive lineic density λ. One can write the elementary electrostatic field $dE_x(M)$ created by an elementary charge dQ at point M outside the wire as: $dE_x(x) = \frac{k.\lambda}{x}\cos(\alpha)d\alpha$



Deduce from it the total field E(M) created by the infinite wire.

2/ Let’s consider a rectangle ABCD of length a and width b, and charged with a positive constant lineic density λ.



Given data: (ABD) = 30°

a- By using the formula that was obtained at question 1-a, express the electric field created at point O by the edge [AB].

b- Deduce then the total electrostatic field at point O.

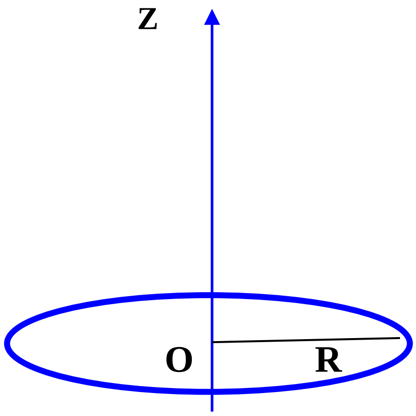
Exercise 2

A ring of radius R is charged with a positive constant linear density λ.

1/ Write the electrostatic field E(z)
created at some point M(z) located on the ring axis.

2/ Draw the variation of the field E(z).

3/ Deduce then the electrostatic potential V(z)
created by the ring at the same point M.



Exercise 3

We consider a disc of radius R a,d axis (Oz). carring a surface charge of density σ, constant and positive.

1) Deduce by charge distribution symmetry the direction and orientation of the electric field vector created on a point M on the (Oz) axis.
2) Express the elementary electric field dEz(M), deduce the electric field E(M) in terms of k, R, σ and z.
3) Express the elementary potential dV(M). Deduce the electric potential V(M) in function of k, R, σ and z.