University Centre Abdelhafid Boussouf-Mila
Institute of Math and Informatics
Department of Computer Science

1st Year licence
Physics 02

Exercises Series N°2

Exercise 1:

A uniformly charged rod of length ***L*** and total charge ***+q*** lies along the ***y*** axis from *y=0* to *y=L* as shown in the figure.1

a. **Calculate** the x- component $E_x(x)$ at the point x_0 on the **x- axis**.
b. As in (a) also calculate the y- component $E_y(x)$ at the point x_0 on the x- axis. Again leave your answer in integral form.
c. If now the charge density λ_0 of (a) becomes $\lambda(l)=\lambda_0\,(y/l)$, that is increasing function of y then indicate how this would modify your answers to parts (a) and (b) as you integrate over ***dq***.
d. Now assume that $x_0 >> l$, that is, $(y/x_0) << 1$. show that your result (b) can be written as the field from a dipole $E_y(x)=ql/8\pi\varepsilon_0 x_0^3$ by approximating the sqrt-root term in the integral by using the approximation $(1+z)^n = 1+nz$, and disregarding terms in y/x_0 so that the integral becomes trival.

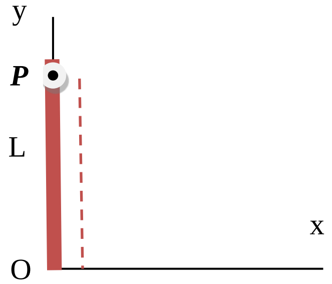

Figure.1

Exercise 2:

A circular disk of radius ***a*** is uniformly charged with surface charge density σ **(C/m²).** If the disk lies on the **z=0** plane (i.e., x-y plane) with its axis along the **z-axis**. Show that the electric field at the point **(0, 0, h)** is given by (using two methods):

$$\vec{E} = \frac{\sigma}{2\varepsilon_0}\left[1 - \frac{h}{\sqrt{h^2+a^2}}\right]\hat{a}_z$$

Exercise 3:

A sphere of radius ***r*** has electric charge uniformly distributed in its entire volume.

At a distance ***d*** from the center inside the sphere (**d<r**) the electric field intensity is directly proportional to:

A. 1/d

B. $1/d^2$

C. d

D. d^2

Exercice 4:

There are three charges q_1, q_2, and q_3 having charge *6 C*, *5 C* and *3 C* enclosed in a surface.

-Find the total flux enclosed by the surface.

Exercice 5:

A solid nonconducting sphere of radius ***R*** has a nonuniform charge distribution of volume charge density $\rho = \rho_s r/R$, where ρs is a constant and ***r*** is the distance from the center of the sphere. **Show** (a) that the total charge on the sphere is $Q = \pi\rho_s R^3$ and (b) that **gives** the magnitude of the electric field inside the sphere.

$$E = \frac{1}{4\pi\epsilon_0}\frac{Q}{R^4}r^2$$