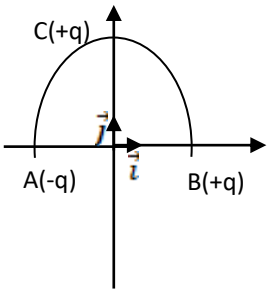
University of Tlemcen
Faculty of Sciences
Department of Mathematics

U.Y: 2024/2025
1st year LMD-M and MI

SW N° 01 of Electricity
Electrostatic
Part 1 : Point charges

Exercise 1 :

Consider three point charges q_A, q_B and q_C placed at three points A, B and C such that : **$q_A = -q$, $q_B = q_C = +q$** and **OA=OB=OC=R**.



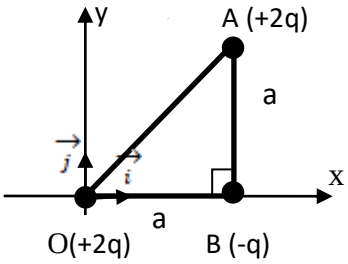
1. Calculate the potential at point O.
2. Calculate the electric field at point O.
3. Place a charge q' = (+q) at point O. Deduce the resultant of the electrostatic forces acting on this charge.

Exercise 2 :

Three points charges **q_A=+2q, q_B=-q and q_O=+2q** are placed,

respectively at the vertices of a right-angled triangle(OAB)

(**AB= OB= a**).



1- Calculate the electric field $\overrightarrow{E_O}$ at point O.
2- Deduct the electrostatic force $\overrightarrow{F_O}$ applied to a load q_O placed at point O.
3- Calculate the electrostatic potential V_O at point O.

Exercise 3:

Consider three negative electric charges (q_C=q_B= -q and q_A= - 2q) located at the apex of an equilateral triangle, and a fourth positive charge (+q') located at the center of gravity G of the triangle.

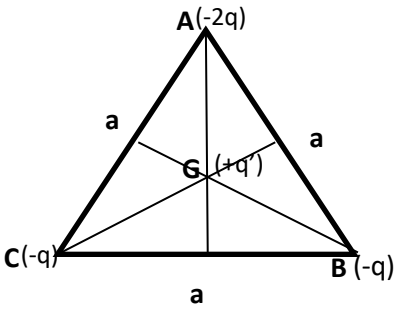
1- Calculate the resultant of the electrostatic forces exerted on the charge

(+q') located at G and represent this force.

2- Deduce the electrostatic field at point G.

3- Calculate the potential at point G.

Let's say that: AG=BG=CG=$\frac{a}{\sqrt{3}}$



Exercise 4:

Four point charges are placed at the vertices ABCD of a square with side a=1m, and center O, origin of an orthonormal reference frame Oxy of unit vectors.

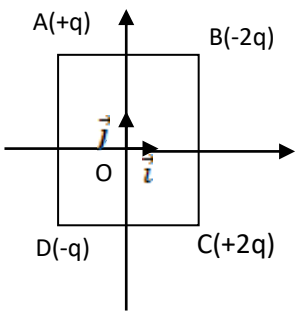
1. Calculate the resultant of the electrostatic forces exerted on the charge

(-q) located at D.

2. Determine the electric field at center O of the square. Specify the direction

and norm of this field.

3. Express the potential V at O created by the four charges.

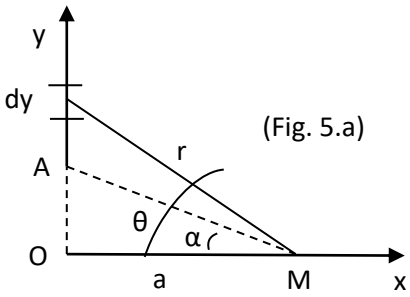


Part 2 : Continuous charges distributions

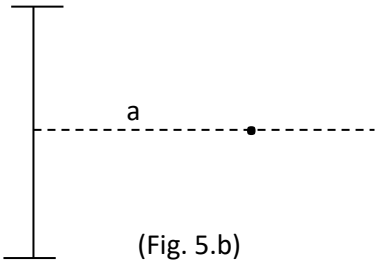
Exercise 1:

Consider a straight wire (Ay), carrying a linear density of charge, and a point M in space defined by distance OM=a and angle $\alpha = (\overrightarrow{OM}, \overrightarrow{MA})$(Fig 5.a).

1. Express the electric field components dEx and dEy resulting from the charge in the elementary element of length dy defined by the angle θ.
2. Deduce the Ex and Ey components of the electric field created by the wire (Ay) and its modulus.
3. Deduce the expression of the electric field at point M equidistant from the ends of the wire of length 2L (Fig.5.b).
4. Deduce the expression for the electric field created by an infinite rectilinear wire



(Fig. 5.a)



(Fig. 5.b)

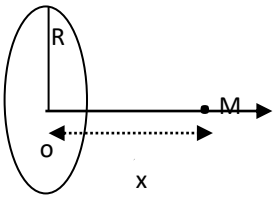
Exercise 2 :

A linear charge (λ>0) is distributed uniformly over a turn (ring) of radius R.

1. Calculate the electrostatic field produced by the coil at point M

located on axis (Ox) at distance x from center O.

2. Calculate the electrostatic potential at point M.



Exercise 3 :

Consider a circular disk of radius R, center O, carrying a surface charge density.

1. Determine the electrostatic potential at point M on axis (Oy), with y=OM, as a function of σ, R and y.
2. Deduce the electrostatic field strength at point M.
3. What happens to the field as the disk radius R tends towards infinity?