**SERIES 2: Mechanics of Multibody Systems**

**Exercise N°1:**

A system consists of three particles with masses m1= 3g located at (1,0,-1), m2= 5g located at (-2,1,3), and m3= 2g located at (3,-1,1). Find the coordinates of their center of mass.

**Exercise N°2:**

Two particles with masses m1 and m2​ are in motion. Show that the total kinetic energy of the system composed of the two masses is given by: T=v2+2  where:

* M=m1+m2 ​ is the total mass,
* =is the reduced mass of the system,
* is the velocity of the center of mass, and
* =− is the relative velocity between the two masses .

**Exercise N° 3:**

Find the centroid of a semi-circular surface with radius a.

**Exercise N°4:**

Suppose that the internal forces of a system of particles are conservative and are derived from a potential

Where is the distance between particles and

* Prove that where is the internal force on particle due to particle
* Evaluate the sum

**Exercise N°5:**

Find the centroid of an homogeneous hemisphere with radius a. Consider a simple integral by summing the disks of radius r from z=0 to z=a (see the figure below). 

Find the centroid of a homogeneous solid composed of a hemisphere with radius a and a cylinder with base radius a and height h. It is given that M1= and M2=H.

**Exercise N°6:**

A uniform plate is bounded by the parabola y=x2 and the line y=H in the xOyx plane. Determine the position of the center of mass."

 