**Series N° 03**

**KINEMATICS**

**Exercise n°1 :**

A body moves on the x axis according to the equation of motion:

$$x=2t^{3}+5t^{2}+5$$

where x is the displacement at time t.

1. Give the expression of the speed v(t) and the acceleration a(t) at each instant t.
2. Calculate the positions of the body its instaneaous speeds and accelerations at t1=2s and t2= 3s.
3. Deduce the average speed and acceleration of the body between t1 and t2.

**Exercise n°2:**

A bus with a maximum speed of 20m/s take 21s to travel 270m between two stops, in absolute value, its acceleration is twice its deceleration.

1. Draw the graph of v as a function of t, v(t).
2. Find acceleration and distance traveled at maximum speed.

**Exercise n°3**

A student is running at a constant speed of 4.5 m/s in order to catch up with the bus that is at a stop When the student is at a distance of 30 m from the stop, the bus starts and moves away with a constant acceleration of 0.15 m/s2

1. How long does the student have to run and how far to catch up with the bus?
2. Draw the graph x=f(t) for the student and the bus; Take x=0 as the student's initial position.
3. If the student's speed is 2.6 m/s, will he catch up with the bus.

**Exercise n°4**

The coordinates of a particle are given by the functions of time: $\left\{\begin{array}{c}x=4.t +3 \\y=t^{2}-5t+2\end{array}\right.$

Find:

1. the equation of trajectory y=f(x).
2. the component of speed and acceleration.
3. the tangential acceleration aT and normal acceleration aN
4. the radius of curvature R of the particle's trajectory.

**Exercise n°5 :**

Given a fixed reference frame (Oxyz), a point O' moves axis (Oy) with constant acceleration a. We connect to point O' a moving frame of reference (O'XYZ) which rotates around (O'Z) with a constant angular velocity a point M moves in the moving frame with coordinates coordinat: X=t2 , Y=t.

At the initial instant t=0, (O’X) is confused with (Ox)

Determine in the moving reference frame ($\vec{U\_{X}}, \vec{U\_{Y}}, \vec{U\_{Z}}) :$

 1. the relative speed and entrainment speed. Deduce the absolute speed.

2. Relative acceleration. Entrainment acceleration and Coriolis acceleration. From deduce absolute acceleration.