Ex1

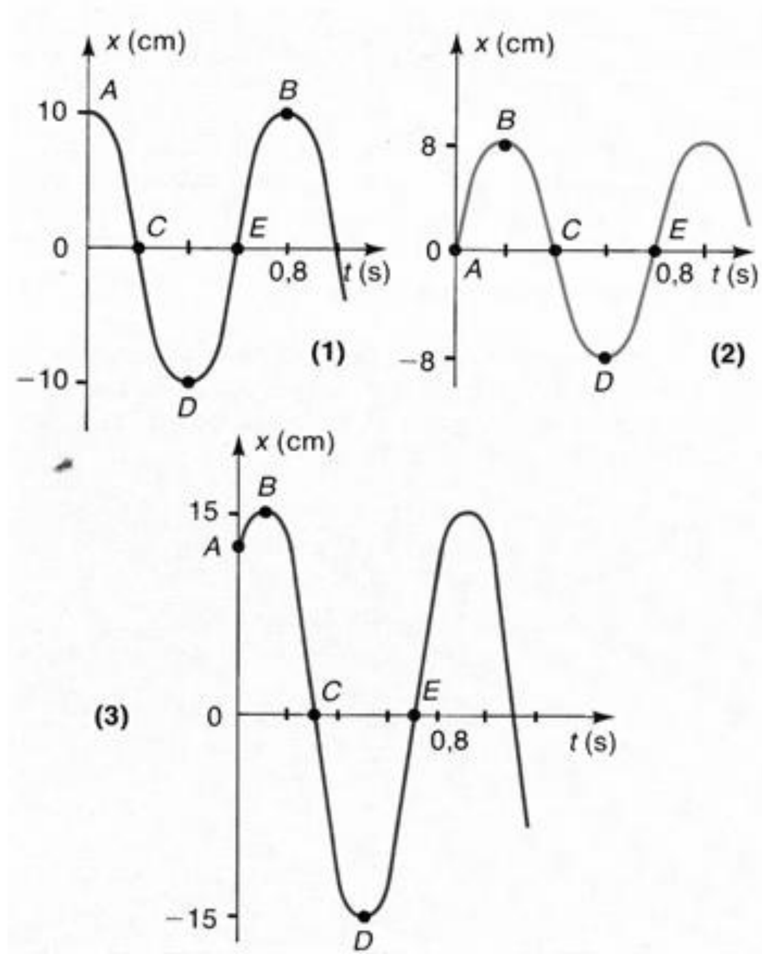
We consider an idealized horizontal elastic pendulum. Here are six propositions, which are true? :

1. The period of oscillations is greater as the mass m of the solid increases.
2. The pulsation does not depend on how the pendulum was thrown.
3. In a satellite, this system could not oscillate.
4. The total energy is proportional to the square of the magnitude of the velocity.
5. The total energy is proportional to the square of the amplitude of the elongations.
6. The potential energy when the spring is compressed is equal to $\frac{1}{2}.kx^2$.

Ex2

During tests, we recorded the oscillations of the same oscillator moving on an axis (diagram opposite).

1- Are the initial conditions identical?
2- Specify the direction of the speed vector at each point A,B,C,D and E.
3- Can this oscillator oscillate with different periods?
4- Why are the amplitudes not equal when is it the same oscillator?
5- Classify these situations by increasing mechanical energy.



Ex3

We consider an idealized horizontal elastic pendulum. We attach masses to the spring of stiffness k m1, m2 and m3 (respectively diagram 1, 2, 3)

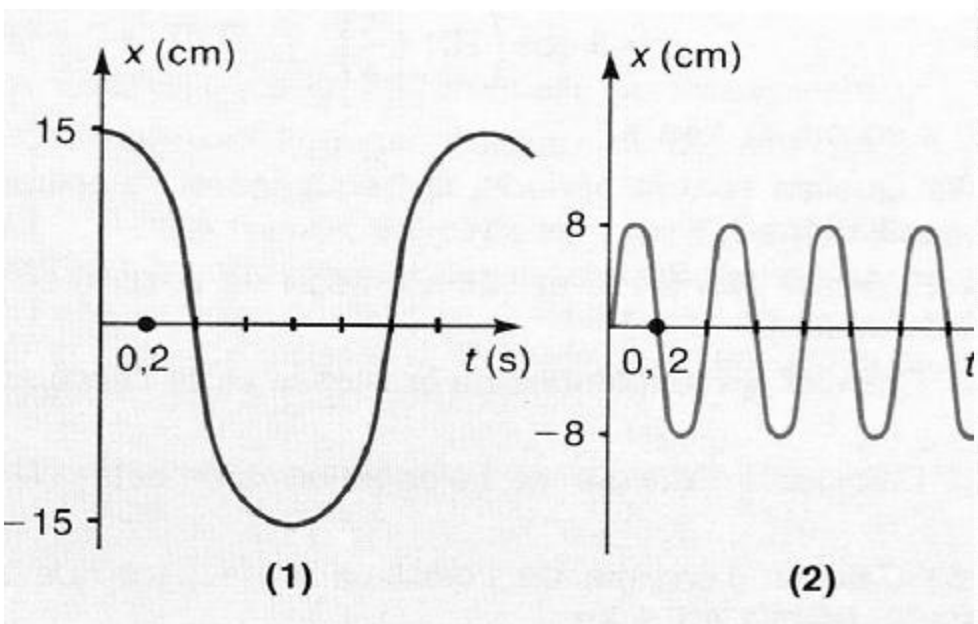
1- Indicate the diagram corresponding to:

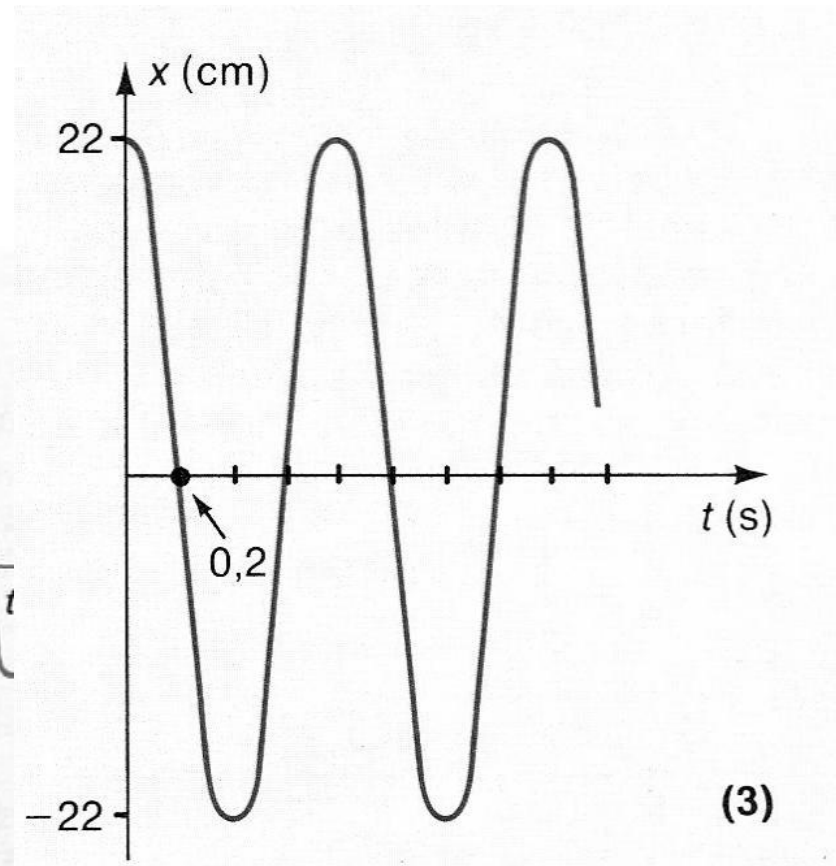
-the greatest amplitude

-the greatest frequency

-the greatest energy.

2- Sort the masses in ascending order.





Ex 4

The time equation of motion of a rectilinear and horizontal mechanical oscillator is given by the following relation:

$$x = 3\cos\left(20*t + \frac{\pi}{4}\right)$$

with **x in cm** and **t in s.**

a- Give the period, frequency and amplitude of the oscillations.
b- Give the expression for the speed and acceleration of the oscillator as a function of time.
c- Calculate the values of the amplitudes of the speed and acceleration.
d- Calculate the speed and the elongation for t = 0 and t = 4s
e- Calculate the energy of the oscillator, the moving mass being m = 0.1 kg.

Ex5

A solid **S** is likened to a material point of mass **m** which can slide without friction on a horizontal rod **AB**. The solid is fixed to a spring with non-contiguous turns of negligible mass and stiffness **k**. The other end of the spring is fixed at A to a support.

a- Give the most general expression for the abscissa x as a function of time t

b- calculate the elongation x and the algebraic value of the speed for **t = 0** in the following three cases: $\varphi = 60°$, $\varphi = 90°$ et $\varphi = -60°$

We give: $\mathbf{X_m.\cos\varphi = 5\ cm}$

$\mathbf{\omega = 2\ rad.s^{-1}}$

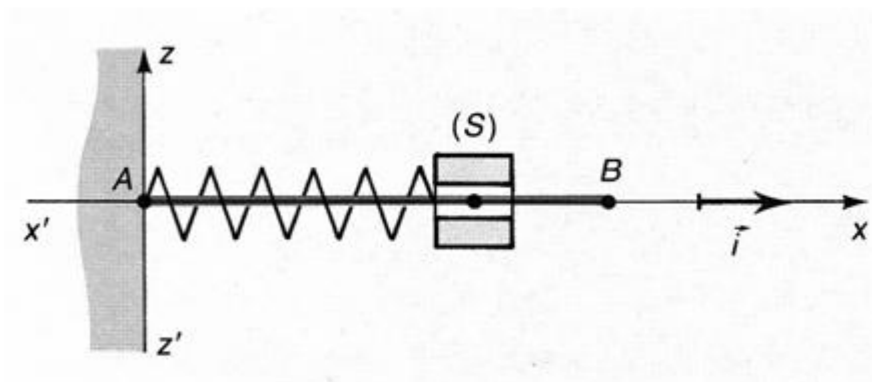
c- Express the mechanical energy ME of the system (spring + solid) at time t = 0 as a function of **Xm** and **k**.; then as a function of **m, ω** and **Xm**

d-Give the norm of the velocity vector when the spring passes through its equilibrium position.

e- Give the positions of the solid when the speed is zero.

Ex6

We consider the same device as in the previous exercise. We want to determine the time equations in various conditions relating to the values of the abscissa and the speed at time t = 0. Complete the following table and write in each case **x(t)** and $\dot{\mathbf{x}}(\mathbf{t})$



x_0 (m)	0,200	0	0	0,200	– 0,200
$\dot{x}_0$ ($m \cdot s^{-1}$)	0	0,200	– 0,500	0,400	0,500
X_m					
$\tan \varphi$					
φ					