1. The abscissa of a particle is given by $x(t) = bt(1 - ct)$, where b=3, c=0,25 (in SI). Find:
   a) Measurement units for b and c.
   b) The velocity and the acceleration of the particle.
   c) The time until the particle returns to the origin.

2. A body moves according to the equation $x(t) = ae^{-\beta t} \sin \omega t$, where $\beta, \omega > 0$ are constant.). Find:
   a) Measurement units for β *and* ω.
   b) The velocity and the acceleration of the particle for t=0.
   c) The moments when the body attains extreme positions.

3. A body moves in the positive OX axis, its velocity varying according to the law $v(t) = b\left(1 - t/c\right)$, where b=10, c=5 (in SI). Find:
   a) Measurement units for$b$ and c.
   b) The coordinate $x(t)$. Its values at t=5 s and t=10 s.
   c) Moments at which $x(t)$=9m.

4. The position of a body is given by $x(t) = ae^{-t/\tau} \cos(\omega t + \alpha)$. Compute the constants a and α in two situations:
   a) Initial conditions are $x(0) = 0, v(0) = v_0$
   b) Initial conditions are $x(0) = x_0, v(0) = 0$

5. A particle moves along the Ox axis according to the law: $x(t) = A\cos\frac{2\pi}{T}t$. Find:
   a) The velocity and the acceleration of the body.
   b) The distance traveled by the body during the time interval from t=0 to t=T/8.
   c) The distance traveled in the time interval T.

6. The components of a particle's velocity are:
   $v_x = A\sin \omega t, \quad v_y = A\sin\left(\omega t + \frac{\pi}{2}\right), \quad v_z = 0$. Find the modulus of the velocity, the acceleration and its modulus, as well as the angle between $\vec{v}$ *and* $\vec{a}$. Discuss.

7. The time dependence of the coordinate of a particle is given by:
   $x = A\sin \omega t, \quad y = A\sin\left(\omega t + \frac{\pi}{2}\right), \quad z = 0$. Compute the position vector $\vec{r}$, the velocity $\vec{v}$ and the acceleration $\vec{a}$. Compute the angles between $\vec{r}$ and $\vec{v}$ and between $\vec{r}$ and $\vec{a}$. Discuss.

8. A particle is thrown from the origin of the frame xOy at the moment t=0, with velocity v_0 at a certain angle θ from the Ox axis. At the same moment another particle begins to fall freely from a wall with height h, situated at the distance d. Air resistance is neglected. Find the angle θ in order that the two bodies meet. What condition must satisfy the initial velocity v_0 ?

9. The potential energy of a particle is given by $U = \frac{kx^2}{2}$. Find the force acting on the particle and the work W done on it when the body moves from the point $A(1, 1, 2)$ to the point $B(2, 1, 2)$.

10. A pendulum of length $l = 1\text{m}$ and mass $m = 2$ kg moves in a vertical plane, the maximum deviation angle being $\alpha = 30^\circ$. Find:
    a) The kinetic and potential energies of the body during the movement.
    b) The angular momentum of the body measured with respect to the hook.