Name:

E-mail:

THEORETICAL MECHANICS – KINEMATICS
(midterm exam – 19.04.2019)

I. 1. Obtain the formulas of velocity and acceleration in the Frenet frame of coordinates.
    2. Poisson formulas.

II. On a step of height h is leaning continuously a rigid bar AB. The extremity A of the bar is moving on the horizontal axis O_1x_1 with the velocity v_A (Fig.1). Find the space and body centrode and the instantaneous angular velocity of the bar.
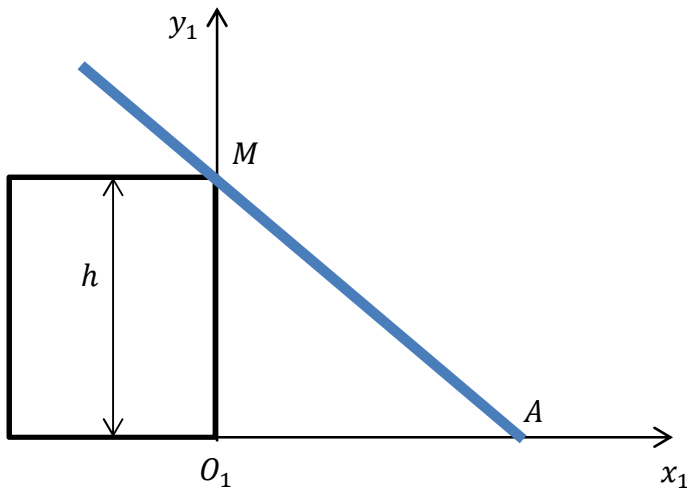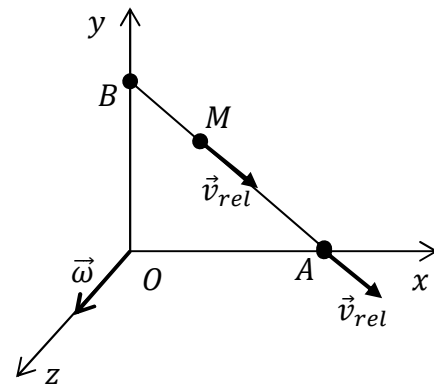

Fig.1.

Fig. 2.

III. Consider a rigid body. In the mobile frame $Oxyz$ three points of the body $O(0,0,0)$, $A(1,1,0)$ and $B(1,1,1)$ have the velocities $\vec{v}_O(2,1,-3)$, $\vec{v}_A(0,3,-1)$ and $\vec{v}_B(-1,2,-1)$. Find the equations of the instantaneous helical axis, the translation velocity $\vec{v}_{tr}$ and the angular velocity $\vec{\omega}$.

IV. An isosceles right triangle OAB, $m(\hat{O}) = \frac{\pi}{2}$, rotates in his plane about the fixed point O with the angular velocity $\omega = $ const. A material point M moves uniformly along the side $AB = c$ (from B to A) with the speed $v_M = \frac{c\omega}{2\pi}$. Find the absolute velocity and acceleration of M when it reaches the point A.