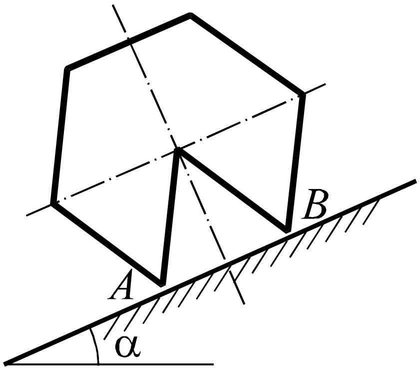
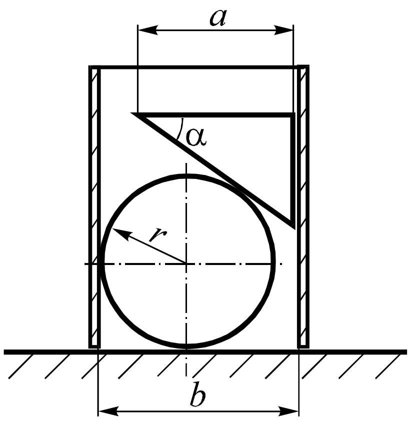
Problem C1–2015



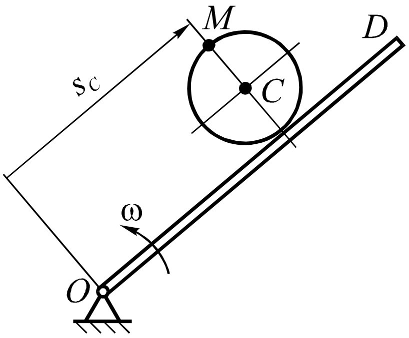
A prism rests on an inclined plane. The base of the prism is a regular hexagon with a equilateral triangle cutout. The friction coefficient in the point A is equal to f, in the point B – $3f$. Determine the values of the plane angle α for the case of prism equilibrium.

Problem C2–2015



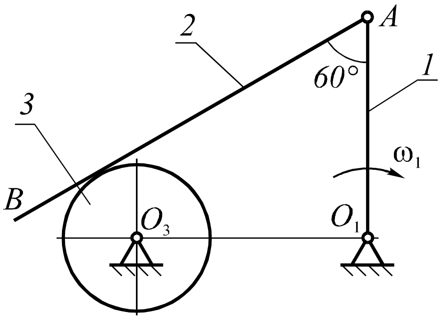
The homogeneous box of weight P and width b stands on horizontal surface. The box is symmetrical relative to a vertical plane. The homogeneous cylinder of radius r and prism with edge length a ($a < b$) are placed into the box. The prism angle α is also given. Friction forces can be neglected. Determine the values of the prism gravity force for the equilibrium of the system.

Problem К1–2015



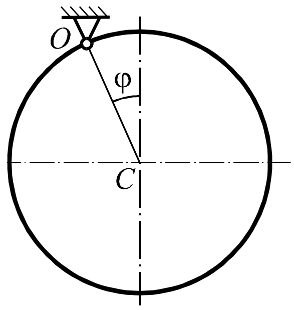
Disk of radius R = 0,2 m rolls without slipping along a straight rod OD. The displacement of the point C $s_C = 2t$ m. The rod OD rotates around the perpendicular to the plane axis passing through the point O with a constant angular velocity ω = 10 rad/s. Determine the absolute velocity and absolute acceleration of point M on the disc for t_1 = 0,5 s (CM is perpendicular to OD at this moment). Find out how the result can change for the case when the rod OD will rotate with the same angular velocity but in the opposite direction.

Problem К2–2015



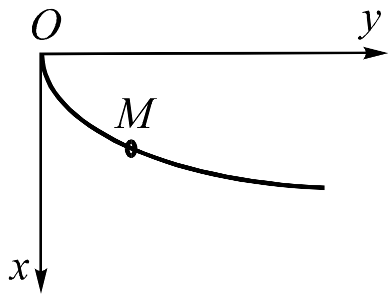
The rod O_1A of the mechanism shown in Figure rotates with a constant angular velocity ω_1. The rod AB rotates the disc 3 of radius r and there is no slipping between them. Determine the angular velocity and angular acceleration of the disk for the position shown in the Figure.

Problem D1–2015



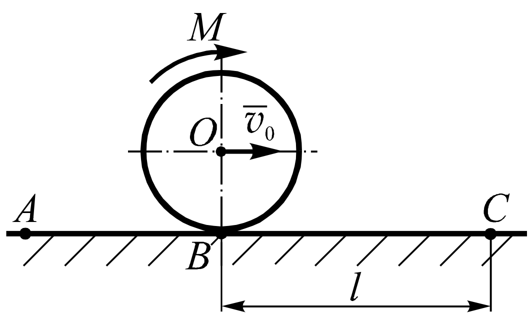
Inhomogeneous disk oscillates in the vertical plane around the axis O. The density of the disk is proportional to the distance from the axis C, crossing the center of the disc. Determine how many times the periods of small oscillations differ for the case of the considered inhomogeneous disk and a homogeneous disk with identical radius and mass.

Problem D2–2015



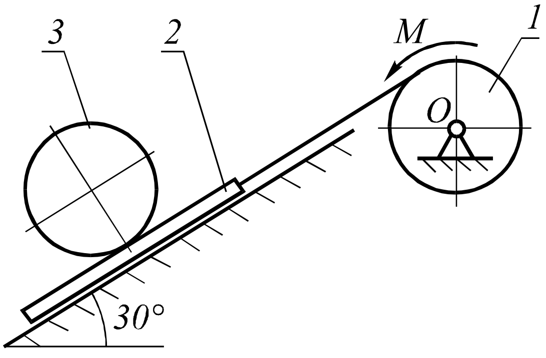
The ring M of mass m moves along the smooth wire of a parabola shape. The wire is located in a vertical plane. The ring starts to move from the top O of the parabola without initial velocity. Determine the maximum value of the interaction force between the ring and the wire if the wire shape is described by the equation $y = x^2$.

Problem D3–2015



A solid homogeneous cylinder of mass m and radius r rolls along a horizontal plane under the influence of a constant torque M. The rolling of the cylinder in the distance interval AB is without slipping. When the cylinder is at the point B the velocity of the cylinder center O is equal to v_0. In the distance interval BC of length l, the friction coefficient between the cylinder and the plane decreases linearly from f_0 at point B to zero at point C. Determine the velocity of the cylinder center point O at position C.

Problem D4–2015



The mechanical system is located in a vertical plane and it consists of a homogeneous cylinder 1 connected with the desk 2. A homogeneous cylinder 3 rolls on the desk 2 surface without slipping. Weights of each body is equal to m. The radii of the cylinders 1 and 3 are also identical and are equal to r. Determine the acceleration of the cylinder 3 center of mass for the case when the body 1 is under the torque $M = \dfrac{mgr}{3}$. Friction between the desk and the inclined plane, as well as about the hinge O can be neglected.