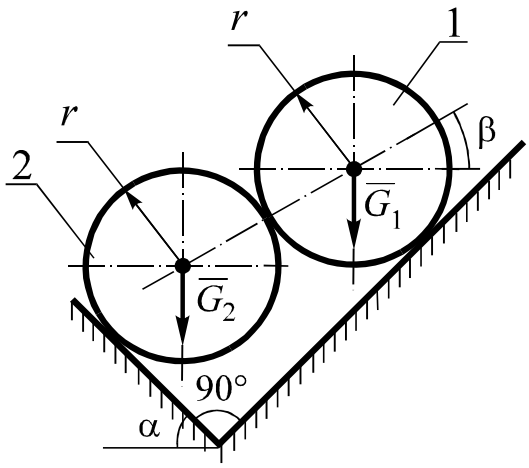
Problem S1–2020

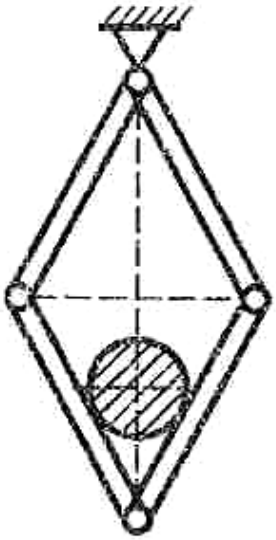


Two cylinders 1 и 2 lean on each other and on two inclined planes, as shown in the figure. The gravity force of the cylinder 2 is equal to G_2, angles $\alpha = 45°$, $\beta = 30°$.

1. Find the value of the gravity force G_1 for the case of system's equilibrium if all the surfaces are smooth.

2. Determine the range of the G_1 force values, ensuring the equilibrium of the system in the case when the friction coefficients between the first and the second cylinders and between each cylinder and the surface are the same and are equal to f. Resistance to rolling can be neglected.

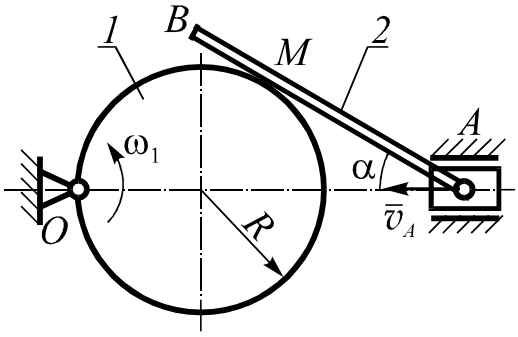
Problem S2–2020



Four identical homogeneous rods of weight G and length l each are pivotally connected to each other and form rhombus. The upper hinge of the rhombus is connected to the motionless support. A homogeneous cylinder of weight P is inside the rhombus in the equilibrium if the angle between the upper rods of the rhombus is equal to 2α.

Define the diameter of the cylinder if the friction can be neglected.

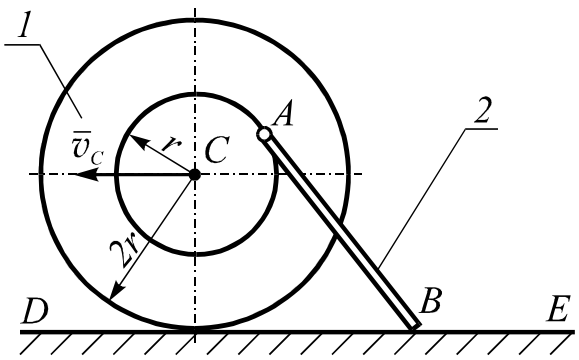
Problem K1–2020



The cam 1 of radius $R = 4\sqrt{3}$ cm rotates with the constant angular velocity $\omega_1 = 2$ rad/s and sets in motion the rod 2 resting on it at the point M. At the point A the rod is connected to the slider. The slider moves along the horizontal direction with the constant velocity equal to 3 cm/s.

Determine the velocity and acceleration of the contact point M in its motion relative to the rod 2 and to the cam 1 for the shown position of the mechanism at $\alpha = 30°$.

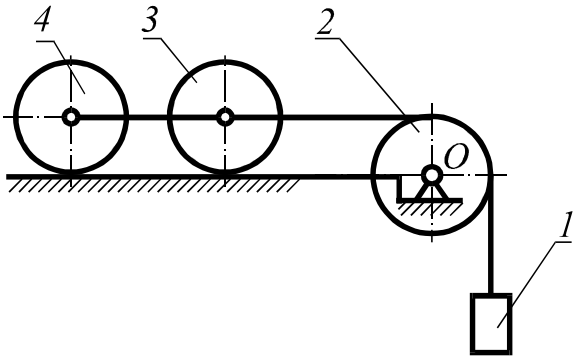
Problem K2–2020



The stepped wheel 1 has radii r and $2r$ and rolls along the plane DE without slipping. The center of the wheel C has a constant velocity v_C. At the point A the rod 2 is connected to the wheel by the hinge. The length of the rod 2 is equal to $3r$. The end B of the rod slides along DE.

Define the angular velocity of the rod 2 at the time moment when the point A is at its upper position.

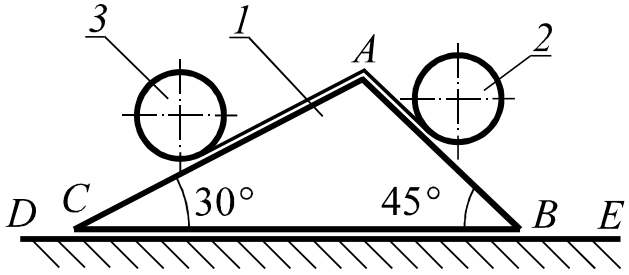
Problem D1–2020



The load 1 is suspended by a weightless thread which is thrown through the block 2. The block rotates around a fixed horizontal axis O. It sets in motion the rollers 3 and 4 on a horizontal plane. The masses of body 2, 3 and 4 are the same and are equal to m each. The pulley 2 and the roller 3 are the solid homogeneous discs, the mass of roll 4 is evenly distributed over its rim. Coefficient of friction between the rollers and the surface $f < 1$.

Find the values of the load 1 mass for the case when one roller rolls with slipping and the second one – without slipping. The resistance to rolling can be neglected.

Problem D2–2020



The triangular prism 1 of mass $2m$ is on a rough horizontal plane DE. The prism has smooth facets AB и AC and it can slip along the plane. Homogeneous solid cylinders 2 and 3 each of mass m are on the facets AB and AC correspondingly. The cylinders are connected by an inextensible weightless thread.

Define the values of the friction coefficient between the prism and the plane DE for the case when the prism remains stationary while the cylinders are moving.