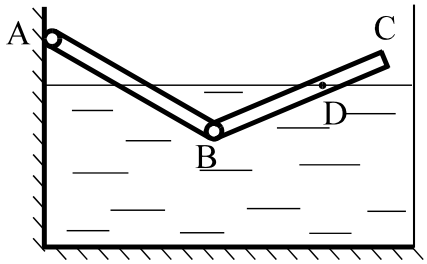
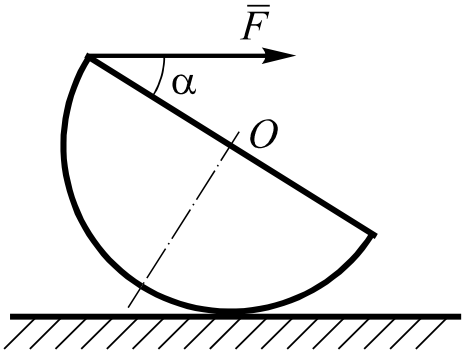
Problem S1-2009



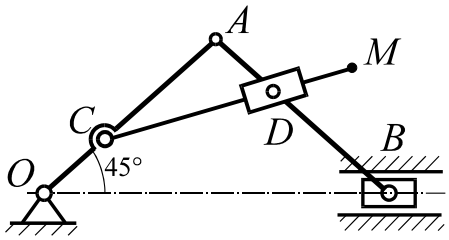
Two identical uniform rods with length *l*, joined together by hinge were hinged to liquid-filled reservoir wall *A* point. Being in the position of equilibrium the rod *AB* turned to be in the liquid exactly up to the middle. Find above the liquid *CD* length of *CB* rod when the system is in equilibrium.

Problem S2-2009



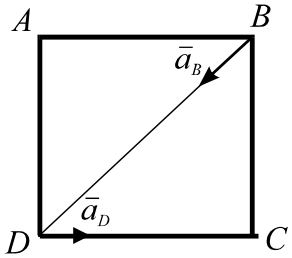
The semicylinder in the scheme contacts with the rough surface and is loaded with a certain horizontal force *F*. The coefficient of friction between the semicylinder and the surface is *f*. The cylinder density is linearly varying according to the distance from the semicylinder selected point to the centre *O*. And the curvilinear surface material density is twice as high as the density at *O* point. Find the maximal angle α when the system is balanced.

Problem K1-2009



In the depicted mechanism *OC=AD=l*, *OA=AB=CM=3l*. *OA* crankshaft is rotating with a uniform angular velocity ω. Calculate the *M* point velocity for the depicted position.

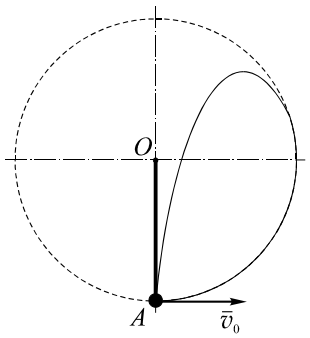
Problem K2-2009



A square plate is moving in its plane, and at some moment the velocities of *A*, *B* and *D* points are equal. The accelerations of *B* and *D* points are equal too and their vectors are directed as in the figure.

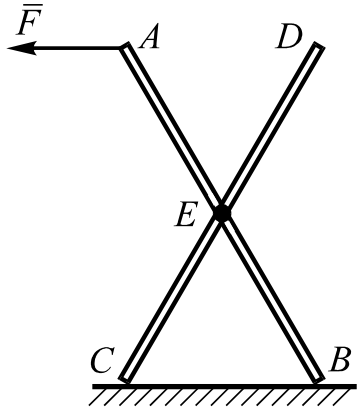
Find velocities and accelerations ratio of *A* and *C* points.

Problem D1-2009



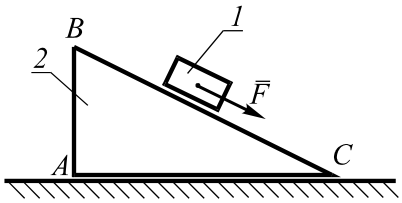
The load is hanged on a weightless thread with length *l*, the other end of which is fastened to the fixed point *O*. At start time the thread was in the lower vertical position *OA* and the load was given a certain initial velocity v_0. On further movement at a certain moment of time the thread got loose and the load began its free fall. Find at which initial velocity v_0 the thread will be tighten back just at the very moment when the load comes back to the origin *A* point.

Problem D2-2009



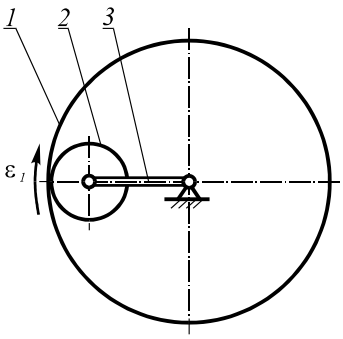
The X-shaped construction consisted of two equal fixedly connected rods is placed on a smooth level floor. *AE=BE=BC=CE=ED*. At a certain moment of time force *F* was applied to *A* point. Find the force if it is known that at the moment when the force effect started the acceleration of *A* point was 4 times as high as the acceleration of *C* point. The mass of the construction is *m*.

Problem D3-2009



Load 1 with weight *m* is sliding on side face prism 2 with weight *2m* moving on the horizontal plane. Force *F* parallel to prism 2 *BC* face is applied to the load. There is no friction between the bodies. The prism may be made with different length ratios of its *AB* and *AC* edges. Find the maximum possible acceleration of prism 2.

Problem D4-2009



Planetary gear train is placed in the vertical plane. The central wheel 1 with radius *R* is moving with a uniform angular acceleration ε_1. Wheel 2 – a homogeneous disk with radius *r* – is rolling skidless over the inner surface of central wheel 1. At some moment crankshaft 3 articulated with the centre of wheel 2 takes a horizontal position. At this moment the velocity of all points of the system is equal zero. Neglecting crankshaft weight find its angular velocity at the moment when it takes the vertical position for the first time.