11.s04.e03

Hint 2

IMPORTANT! The next task is both a hint and an alternative to the main task. Three important points:

1. You can continue to send the solution to the main problem.
2. At any moment before the final deadline you can start to solve the Alternative problem. If you do so, at the beginning of the solution write: *I am doing the Alternative problem!* In this case a penalty coefficient for the Alternative problem is

$$0{,}7 \cdot \sum_i \frac{k_i \cdot p_i}{10},$$

   where p_i is a point for the problem item, and k_i is a penalty coefficient for the corresponding problem's item at the moment of moving to the Alternative problem. In other words, maximal points for the alternative problem equals to the maximal points you can gain at the moment of moving to the alternative one multiplied by 0,7. Also, we remind you that a penalty coefficient can't be less than 0,1. Solutions of the main problems from that moment will not be checked. Be careful!
3. The task consists of several items. The penalty multiplier earned **before** is applied to all points. In the future, each item is evaluated as a separate task. If you send a solution without any item, this item's solution is considered as Incorrect. For more information about scoring points for composite tasks, see the rules of the Cup. **Since switching to an alternative selection, there is no opportunity to return to solving the main task.** Also, after switching to an alternative task **the points for the main task are reset**.

Alternative problem

A rod of mass m and of length l rests on the table. The coefficient of friction between the table and the rod is μ. The force of a normal reaction is evenly distributed.

1. *(4 points)*. Find the minimum force $F_{\min}$ that if applied to the end of the rod perpendicular to it causes the rod to move.

2. *(3 points)*. A force $F_{\min}$ is applied to the end of the rod so that it begins to move. Find the torque of the force of friction relative to the center of mass of the rod immediately after the start of movement.
3. *(3 points)*. The rod is quickly pulled by its end perpendicular to it. Prove that the instant center of rotation immediately after the start of motion is at a distance of $l/6$ from the center of mass of the rod.