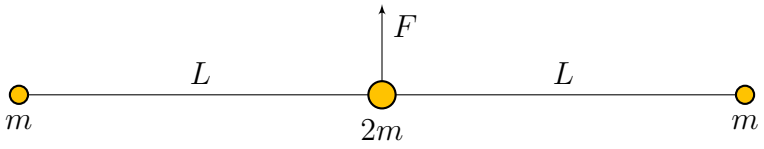
I don't understand anything,
but it looks like something epic awaits us.
Krash, «Kikoriki: PIN-Code»

Carom

Part 1

On the ends of two weightless rods of length L, there are two fixed kikopucks of mass m. Rods are connected by a kikohinge of mass $2m$. The system is placed on a smooth horizontal plane so that initially kikopucks and kikohinge are located in a line.



The kikohinge is acted upon by a constant horizontal force F directed perpendicular to the rods. It is occurred, that the next time when the distance between the kikopucks is equal to $L\sqrt{3}$, the angular velocity of the rods is zero.

Find:

1. *(1,5 points)* The amount of the heat released during the first collision of the loads;
2. *(1 point)* The amount of the heat released during the collision of the loads for a greater time;
3. *(3,5 points)* The velocity of the kikohinge at the moment of the next zeroing of the angular velocity of the rods (after the second collision).

All collisions have the same recovery factor.

Part 2

A homogeneous chain of length $2L$ and mass M is straightened up to a line and placed on a smooth horizontal plane. A constant force F is applied perpendicular to the center of the chain. Considering the chain links collision perfectly inelastic, find:

4. *(1,5 points)* How much energy is going to be released during all the chain links collisions?

Part 3. Non-central collision of kikopucks

In this part of problem, you will need to analyze partially elastic collisions of kikopucks with a recovery factor k, which can be defined by the following equation.

$$k = 1 - \frac{E_p}{W},$$

where E_p is an energy loss, and W is the maximum energy of the deformation during the collision.

For example, a kikopucks is falling from the height H and hits the floor. The maximum energy of the deformation is mgH. If the recovery factor equals k, the kikopucks energy after the collision is going to be equal to $mgHk$, and it lifts up to the height of Hk.

Two kikopucks with an identical radius R are placed on the horizontal plane. The surface friction coefficients of kikopucks are the same and equal to μ. Kikopuck with a mass m_1 bumped into the resting kikopuck with mass m_2. At the moment of collision with a recovery factor k the speed of the first kikopuck at the moment of contact is equal to v_0. After the collision, the second kikopuck before the stop moved to a distance L_2. Find:

5. *(1,5 points)* The amount of heat Q released during the collision;
6. *(1 point)* The distance L_1 traveled by the first after the collision.

There is no friction between kikopucks.

First hint — 25.04.2022 14:00 (Moscow time)
Second hint — 27.04.2022 14:00 (Moscow time)

Final of the second round — 29.04.2022 22:00 (Moscow time)