**METÓDY RIEŠENIA FYZIKÁLNYCH ÚLOH zima22 – Príklady 3**

Cvičenie 20.10.2022

Príklad 1

PROBLEM: A thin rod of length l is supported at one end by a smooth floor (see figure). The rod is released from a configuration where it makes an angle θ_0 relative to the horizontal. Write down the Lagrangian for this system. Determine how long it takes for the rod to fall to the floor (*the answer in terms of a definite integral will be sufficient.*) Also determine how far the lower end moves during this time.
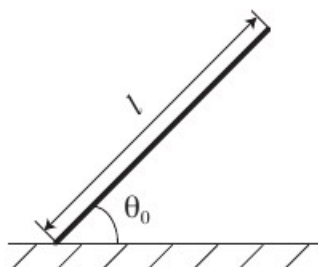
Príklad 2

A dielectric sphere of radius R is hollowed-out in the region $0 \leq r \leq s$ and a thin, grounded, conducting shell inserted at $r = s$. The sphere is placed in a uniform, external E−field $E = E_0 \hat{z}$ along the z-axis. The dielectric constant is ϵ_r.

(a) Calculate the potential in the region $r \geq R$.

(b) Roughly sketch the polarization and induced charge in the region $r \leq R$.
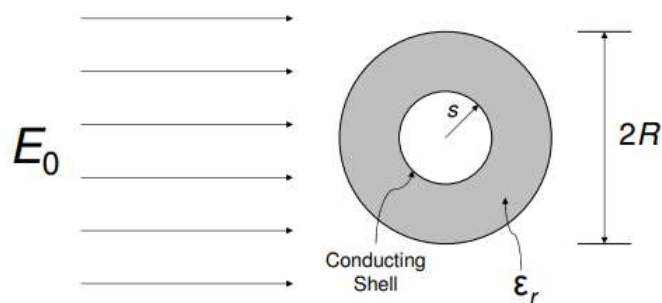
Príklad 3

Problem. Assume that the water exerts drag force F on the boat, directly proportional to the boat's speed: $F = kv$, where k is a (nonzero) constant. How far from its initial position will the boat end up after the man walks from one end of the boat to the other? Everything starts at rest. The two masses and the length of the boat are given (m, M, L).