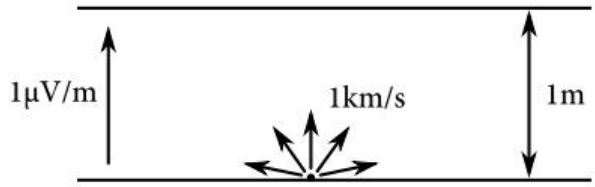
METÓDY RIEŠENIA FYZIKÁLNYCH ÚLOH 1 leto19 – Príklady 4

Cvičenie 11.4.2019

Príklad 1

22 V nekonečnom doskovom kondenzátore so vzdialenosťou dosiek 1 m a intenzitou elektrického poľa 1 μV/m je na spodnej elektróde umiestnený izotropný zdroj elektrónov. Elektróny z neho vylietajú rýchlosťou 1 km/s na všetky strany. Na akú plochu dosiek kondenzátorov dopadajú?

Výsledok uveďte s presnosťou na m^2.



Príklad 2

A cylinder of radius a and mass m contains a point mass, also of mass m located a distance $a/2$ from the symmetry axis. The cylinder is placed on an incline, which is initially horizontal, but is very slowly raised. Assuming the cylinder cannot slide on the incline, at what inclination angle α does the cylinder begin to roll down the incline?

Príklad 3

PROBLEM: If the solar system were immersed in a uniformly dense spherical cloud of weakly-interacting massive particles (WIMPs) then objects in the solar system would experience gravitational forces from both the Sun and the cloud of WIMPs such that

$$F_r = -\frac{k}{r^2} - br$$

Assume that the extra force due to the WIMPs is very small (that is $b \ll k/r^3$). Work to first order in b.

(a) Find the frequency of radial oscillations for a nearly circular orbit. 5

(b) Find the average angular velocity. 3

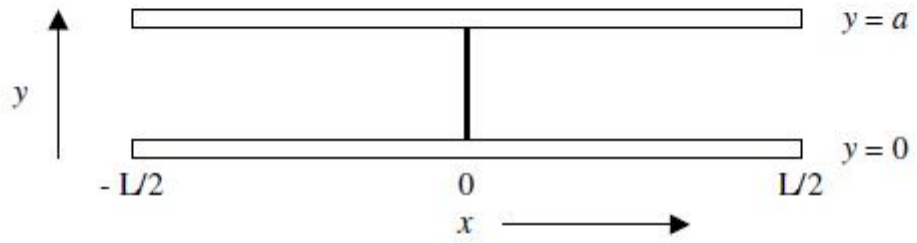
(c) Find the rate of precession of the perihelion to lowest order in b using the results of (a) and (b). 2

Príklad 4

The region $0 \leq x \leq L$ is filled with a material with a material with x dependent conductivity, $\sigma = a/x$, where a is a constant. The plane $x = 0$ is held at zero potential (grounded), while the plane $x = L$ is held at constant potential $V_0 > 0$. Consider the steady state situation, where all quantities are time independent. Find the current density $\vec{J}$, the electric field $\vec{E}$, and the charge density ρ in the entire region $0 \leq x \leq L$.

Príklad 5

PROBLEM: As shown in the figure, two parallel conducting plates of dimension $L \times L$ are separated by a distance $a \ll L \to \infty$ and are at electrical potential $V = 0$. A thin charged membrane of height a and length L is inserted perpendicular to the plates at $x = 0$. The potential on this membrane is $V(0, y) = V_0 \sin(\pi y/a)$. The plates and the membrane extend a distance L in the direction perpendicular to the plane of the figure.



(a) Find the electrical potential, $V(x, y)$, in the region between the plates to the right of the membrane (i.e., for $x > 0$). (You may ignore values of $x \geq L/2$.)

(b) Find the sign and magnitude of the charge density, $\sigma(x)$, on the conducting plates at $y = 0$ and $y = a$ to the right of the membrane, $x > 0$.

(c) Find the magnitudes and directions of the forces on the entire upper and lower plates.

Ak neviete, odpoveď na časť **a)** je:

V_0 e^(-pi x/a) sin(pi y/a)