

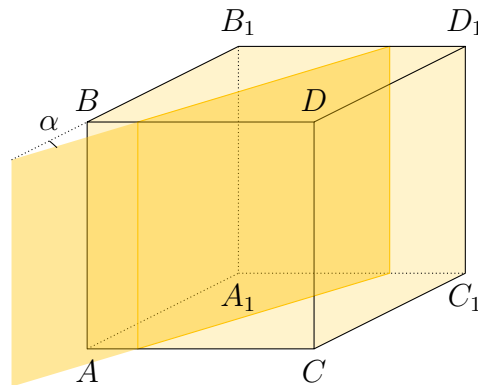


*The devil knows how it will end,
but it is to begin.*

*Andrzej Sapkowski
«Baptism of Fire»*

3d6

Two pairs 1 (ABB_1A_1 and CDD_1C_1) and 2 ($ABDC$ and $A_1B_1D_1C_1$) of opposite faces of a cube with edge length L are charged with surface charge densities $\sigma_1 = -\sigma$ and $\sigma_2 = \sigma$, respectively, where $\sigma > 0$ is a known value, and pair 3 is with some surface charge density σ_3 . A particle with mass m and charge $q > 0$ can move along a plane containing the center of the cube, perpendicular to pair 3 and forming a dihedral angle $\alpha = \pi/6$ with pair 1.



It turned out that when a particle is launched from the center of the cube in any direction in this plane with the same speed, its trajectory is a straight line segment of length $2a \ll L$.

There are no forces of gravity and friction. The electrical constant is equal to ε_0 .

1. (6 points) Determine the surface charge density of the third pair of faces σ_3 .
2. (4 points) Determine the speed of the particle v_0 when passing through the center of the cube.

First hint — 18.04.2022 14:00 (Moscow time)

Second hint — 20.04.2022 14:00 (Moscow time)

Final of the first round — 22.04.2022 22:00 (Moscow time)