1. Charges in E *(8 points)* Two particles (the blue and the red) of mass m are connected with a spring, the stress-free length of which is L and stiffness k; the blue carries charge q ($q > 0$) and the red is chargeless. In the region $x > 0$, there is an homogeneous electric field E, antiparallel to the x-axis; In the region $x < 0$, there is no electric field. Initially, the "dumbbell" of charges moves in region $x < 0$ with velocity v, parallel to the x-axis; the dumbbell's axis is also parallel to the x-axis and the spring is stress-free. It is known that after a while, the dumbbell moves in the region $x < 0$ with velocity $-v$, and that the red particle never enters the region $x > 0$. Also, the spring's length achieves minimum only once.

i) (2.5 pt) How long time τ does the blue particle spend in the region $x > 0$?

The process takes place exactly as described, if one equality and one inequality are satisfied for the quantities m, v, k, q, E and L.

ii) (3 pt) Which equality must be satisfied?

iii) (2.5 pt) Which inequality must be satisfied?