7. Charged rod (6 points) — *Jaan Kalda.* A rod of mass m carries a charge q; both the charge and the mass are homogeneously distributed over its entire length l. The system is in homogeneous magnetic field of strength B, parallel to the z-axis whereas the rod is in the x–y-plane. Neglect any forces except for the Lorentz force. One end of the rod is painted red, and the other — blue.

i) *(2 points)* Consider the case when the rod rotates around its centre of mass. What should be the angular speed ω for the mechanical tension force at the centre of the rod to be zero?

ii) *(4 points)* Consider now a case when initially the blue end of the rod is at the origin ($x = y = 0$), and the red end at $x = l$. The blue end's initial speed is zero while the red end's speed is v, parallel to the y-axis. It turns out that after a certain time t, the red end passes through the origin. Find the smallest possible value for t and express the corresponding value of v in terms of m, q and l.