

Corrected version of Problem 19 on p. 150 of the Course Notes.

An electric charge q of mass m moves with velocity $\mathbf{v} = (v_1, v_2, v_3)$ in a region of space where there is a magnetic field $\mathbf{B} = (0, 0, B)$ of constant strength. According to the laws of physics, the motion of the charge is given by the following equations:

$$m \frac{dv_1}{dt} = qBv_2, \quad m \frac{dv_2}{dt} = -qBv_1, \quad m \frac{dv_3}{dt} = 0.$$

Assume an initial condition of the form $\mathbf{v}(0) = (u_1, u_2, u_3)$.

Part b) should be corrected as follows

b) Show that the quantity $\omega_c = \frac{qB}{m}$ has the dimensions of a frequency, thus justifying its name, which is the “*cyclotron frequency*” (or “*gyrofrequency*”).