Problems - Magnetostatics - I
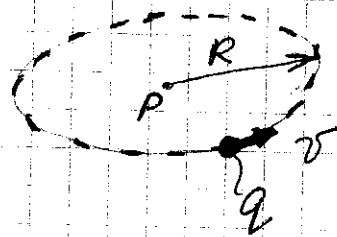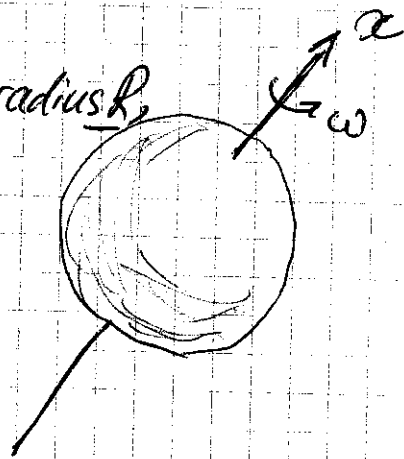
① A point charge q spins on a circular orbit around the point P with the velocity v.

- Find the magnitude of magnetic field at point P
- Find the magnetic moment created and it's direction depending on the sign of q

② A conducting shell of radius R, mass m and charge q spins around the axis x with the angular velocity ω.
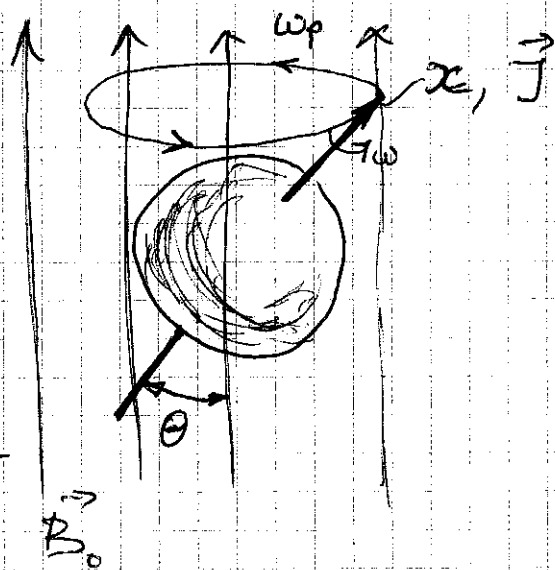
Find:

- magnetic dipole moment created
- the ratio of magnetic dipole moment to it's angular moment

③ Add an external homogeneous magnetic field B_0 parallel and antiparallel to the magnetic moment in problem ①. How the velocity of the charge will change, assuming that R is constant?

④ We add an external magnetic field $\vec{B_0}$ to the problem ② such that it forms the angle θ with the shell's angular momentum $\vec{J}$. The vector $\vec{J}$ will precess (much like a spinning cone).

- How the angular frequency ω_p of this precession depends on the strength of external magnetic field B_0?