Problem 1 (20 marks)
A point charge e is moving on a circle of radius R with constant speed v, so that $x(t) = R\cos(vt/R)$, $y(t) = R\sin(vt/R)$, $z(t) = 0$ are the charge's cartesian co-ordinates as a function of time t. Find the retarded potentials for points on the z axis.

Problem 2 (20 marks)
A spherical shell of radius R with charge e uniformly distributed over its surface rotates about an axis through its center at an angular frequency ω as shown in the figure. What is the electric field $\vec{E}(\vec{r})$, both inside and outside the sphere? Determine the magnetic dipole moment $\vec{\mu}$, and use it to state the magnetic field $\vec{B}(\vec{r})$, both inside and outside the sphere.

Problem 3 (20 marks)
Apply the relativistic version of Larmor's energy loss formula, found in Exercise 33, to a charge e that moves with constant speed $v \lesssim c$ on a circular orbit of radius R, and thus re-derive the total radiated power of synchrotron radiation of equation (10.3.15) in the lecture notes.