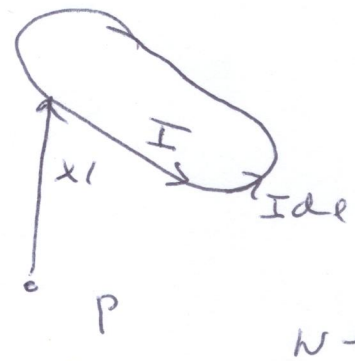
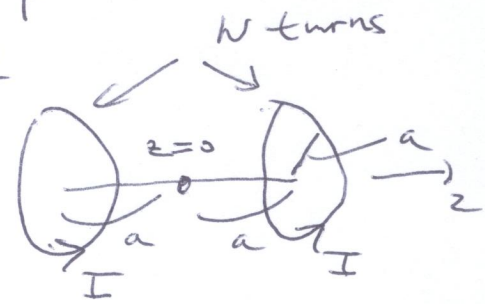
Homework set #5 Due March 11, 11.59 pm

1) show that the magnetic field at P is given by

$$B = \frac{I}{c}\vec{\nabla}\Omega$$ with Ω the solid angle of the loop seen from P



2) Consider a Helmholtz coil



a) Calculate the ~~B~~ z dependence of the $\vec{B}$ field on the z axis.

b) Use Mathematica to expand in powers of z. What is the first nonvanish order an what do you conclude from this.

3) Consider infinite cylinder of infinite length and radius a with surface current density $\vec{J}$.

a) Give symmetry argument to determine the direction of the $\vec{B}$ field.

b) Calculate the B field as a function of the distance ρ from the axis both for $\rho > a$ and $\rho < a$.

4) A current enters an infinite conducting plane with conductivity σ. If the current flow in uniform across the width Δ of the plane, find the electric potential at the point (ρ, ϕ) of the plane.