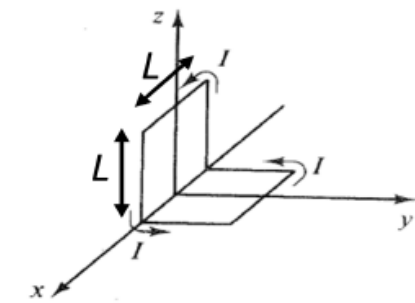
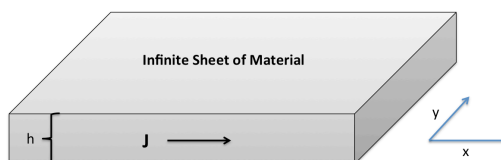


E&M I: Sample Questions on Chapters 5.3-6

Question 1 (10 points): Find the magnitude and direction of the magnetic dipole moment of the “L-shaped” current carrying loop shown at right.



Question 2 (15 points). Consider a sheet of material in the x-y plane, with a constant free current density J flowing in the x-direction, and thickness h .



2a (5 points). Use Ampere’s law to determine the magnitude and direction of H as a function of position inside and above and below the sheet. Be explicit about the Amperian loop(s) that you use to find H .

2b (5 points). Assuming that the sheet is made of a linear paramagnetic material with a linear magnetic susceptibility χ_m , find the magnetization M and the magnetic field B inside and above and below the sheet.

2c (5 points). From the magnetization you found above, compute the bound surface and volume current densities in and on the surface of the sheet. How are these related to the free current density?

Question 3 (15 points): Consider an infinitely long magnetized cylinder of radius R , with an axial magnetic field that increases linearly with radius from the center to the surface of the cylinder (i.e. $\vec{B}(\vec{r}) = ks\hat{z}$). Assume there is no free current inside or outside the cylinder.

3a (5 points). Find the bound volume current density (magnitude and direction) inside the cylinder.

3b (5 points). Find the bound surface current density (if any) on the surface of the cylinder.

3c (5 points). Find the magnetic field outside the cylinder.