VE230: Electromagnetics I
Homework VI
Due: July 24, 11.59pm

P.6-4 A current I flows lengthwise in a very long, thin conducting sheet of width w, as shown in Fig 1.

a) Assuming that the current flows into the paper, determine the magnetic flux density $\boldsymbol{B_1}$ at point $P_1(0, d)$.

b) Use the result in part (a) to find the magnetic flux density $\boldsymbol{B_2}$ at point $P_2(2w/3, d)$.

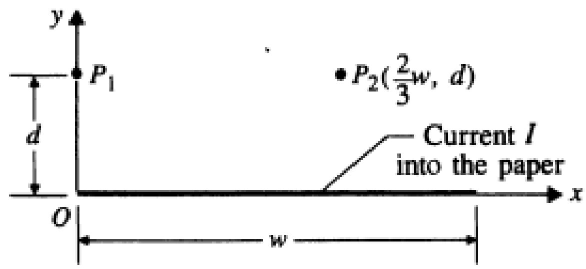

Figure 1: Figure for **P.6-4**

P.6-23 The scalar magnetic potential, V_m, dur to a current loop can be obtained by first dividing the loop area into many small loops and then summing up the contribution of these small loops (magnetic dipoles); that is,

$$V_m = \int dV_m = \int \frac{d\boldsymbol{m} \cdot \boldsymbol{a_R}}{4\pi R^2},$$

where

$$d\boldsymbol{m} = \boldsymbol{a_n} I ds.$$

Prove that

$$V_m = -\frac{I}{4\pi}\Omega,$$

where Ω is the solid angle subtended by the loop surface at the field point P.(See Fig 2)

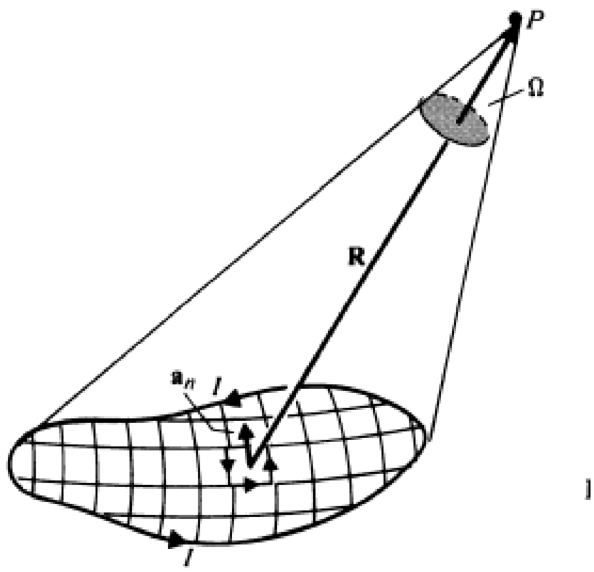

Figure 2: Figure for **P.6-23**

P.6-30 Prove that the relation $\nabla \times \boldsymbol{H} = \boldsymbol{J}$ leads to

$$\boldsymbol{a_{n2}} \times (\boldsymbol{H_1} - \boldsymbol{H_2}) = \boldsymbol{J_s} \quad (A/m)$$

at an interface between two media.

P.6-31 What boundary conditions must the scalar magnetic potential V_m satisfy at an interface between two different magnetic media?