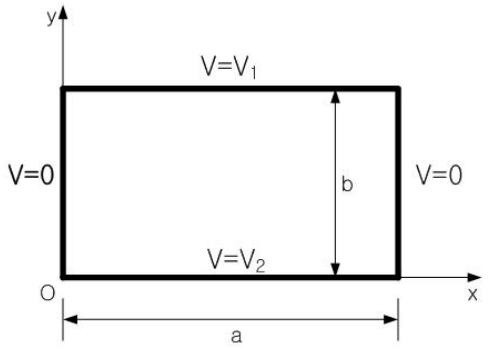
Electromagnetics 1 2nd exam. (Prof. Seong-cheol, Kim)

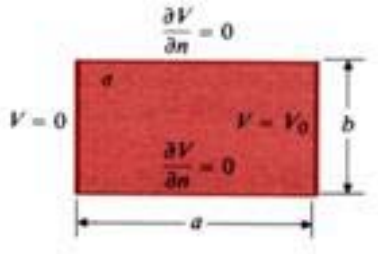
10th Mar 2008, AM 10:00 ~ 12:00

1. **(25pt) Consider the rectangular region shown in Fig.1 as the cross section of an enclosure formed by four conducting plates. The left and right plates are grounded, and the top and bottom plates are maintained at constant potentials V_1 and V_2, respectively. Determine the potential distribution inside the enclosure.**



[Fig. 1]

2. **(25pt) Assume a rectangular conducting sheet of conductivity σ, width a, and height b. A potential difference V_0 is applied to the side edges, as shown in Fig.2. Find**
   - **(a) The potential distribution**
   - **(b) The current density everywhere within the sheet. (Hint: solve Laplace's equation in Cartesian coordinates subject to appropriate boundary conditions.)**



[Fig. 2]

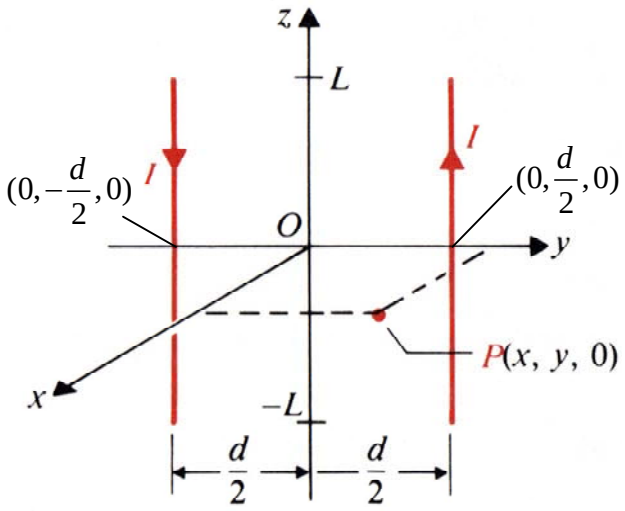
3. **(25pt) Consider the two parallel wires each of length $2L$, located at $y=\pm d/2$ and carrying equal and opposite currents, as shown in Fig.3**

   (a) Consider the only right-side wire ($y=d/2$). Find the vector magnetic potential $\vec{A}$ at point $P(x,y,0)$ in the bisecting plane of the wire.

   (b) Consider both the wires. Find $\vec{A}$ at point $P(x,y,0)$.

   (c) Find $\vec{A}$ due to equal and opposite currents in a very long two-wire transmission line.

   (d) Find $\vec{B}$ from $\vec{A}$ in part (b).



[Fig. 3]

4. **(25pt) A ferromagnetic sphere of radius b is magnetized uniformly with a magnetization $\vec{M}=\hat{a}_z M_0$.**

   (a) Determine the equivalent magnetization current densities $\vec{J}_m$ and $\vec{J}_{ms}$.

   (b) Determine the magnetic flux density at the center of the sphere.