

## EM Spring 99A

A sheet of charge occupies the entire  $xy$  plane of three-dimensional free space, and no other charges are present. The potential within this plane is given by

$$V(x, y) = A \sin(kx),$$

where  $A$  and  $k$  are constants.

- Determine the potential  $V(x, y, z)$  throughout the entire space.
- Determine the charge per unit area  $\sigma(x, y)$  of this sheet.
- Replace the sheet of charge described above by a sheet with an electric dipole moment per unit area given by  $p_x = B \cos(kx)$ ,  $p_y = 0$ , and  $p_z = 0$ , where  $B$  and  $k$  are constants.  
Determine the potential  $V(x, y, z)$  throughout the entire space.