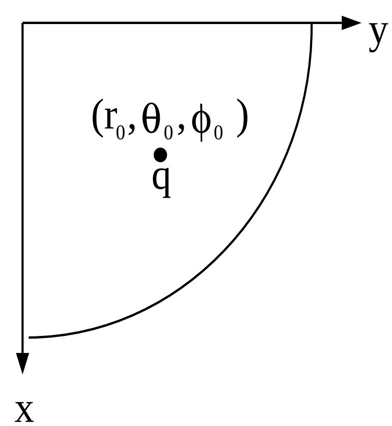
Problem set 2

1. In the two-dimensional box with Neumann boundaries, discussed in class, solve for Φ when $f(x) = E_o(1 - 2x/a)$ (basically done in class).

2. Jackson problem 2.6 Hint, for parts a and b we already solved a problem in class with the identical potential. Explain why the solution is identical (uniqueness), and use it.

3. A cavity in a conductor has the shape of a wedge in the form of a quarter sphere, being bounded by the surfaces $\phi = 0$, $\phi = \pi/2$, and $r = a$. A point charge q is located at $r = r_o$ $\theta = \theta_o$ and $\phi = \phi_o$, where $r_o < a$ and $0 < \phi_o < \pi/2$.

- Give the coordinates and magnitudes of the image charges necessary to maintain the boundaries of the cavity $\Phi = 0$.
- Calculate the force on the charge and the charge density on the different surfaces of the cavity.



4. Jackson problem 2.8 (do by any means).

5. Jackson problem 2.9 (use the result of 2.8).

6. Jackson problem 2.13. We set up this problem in class. The important part of this problem is determining the number of terms which must be kept in the series to obtain an answer of a certain accuracy.

7. Jackson problem 2.16 (consider the superposition arguments used in class for the rectangular box with Dirichlet B.C.

8. Using spherical coordinates, consider the two *very large* (neglect edge effects) conducting concentric cones centered about the polar axis. The inner cone is maintained at a potential V_1 and the outer at potential V_2.

- This problem is clearly azimuthally symmetric (no ϕ dependence); however, one may also neglect the radial dependence. Why? (give a *short* answer).
- Starting from Laplace's equation, solve for the potential Φ between the cones.

- Find the charge density on the conical surfaces.

9. Consider the example presented in Sec. IV.B of the notes. Read the instructions and solve this problem numerically using the Fortran code laplace.for on the anonymous ftp site (Q1) on a square with sides of length one when $V_1 = V_2 = V_3 = 1$, $V_4 = 4$ and , when $N_x = N_y = 9$. Also, solve the problem with a series solution, and compare the two results along the horizontal dividing line down the center, $y = 0.5$, of the square (be careful to take enough terms in the series!).