Reading assignment
Paul, Whites, and Nasar, 3.10, 3.11, 3.14
Connor and Salon, p. V-27-V-33 (available on library reserve)

Problem 1 (option 1) - analytical solution to Poisson's equation
A charged region of a semiconductor is sandwiched between two grounded conductors as shown below.

a. Solve for V(z) by directly integrating Poisson's equation, \( \nabla^2 V = -\rho/\varepsilon \), and applying the appropriate boundary conditions.
b. Find \( E(z) \) and \( D(z) \).
c. What is \( \rho_s \) on the two conductors?

Problem 1 (option 2) - analytical solution to Laplace's equation
A coaxial cable has an inner conductor (at \( r = a \)) held at voltage \( V_0 \) and an outer conductor (at \( r = b \)) that is grounded. There is no charge other than the surface charge on the conductors.

a. Solve for \( V(r) \) by directly integrating Laplace's equation, \( \nabla^2 V = 0 \), and applying the appropriate boundary conditions.
b. Find \( E(r) \) and \( D(r) \).
c. What is \( \rho_s \) on the two conductors?
d. What is the capacitance per unit length of the cable?

Problem 2 - finite difference solution to Laplace's equation
Find the voltage at the 4 points below.
Problem 3 - Use of spreadsheet to solve Laplace's equation
a. Use a finite difference calculation on a spreadsheet to solve for the voltage everywhere in the configuration on the left below. The drawing illustrates the cross-section. Assume this figure extends out of the page for a long distance.
b. Sketch or plot the equipotentials and electric field lines.
c. Find the charge density on the conductor at point P (0,1.5).
d. Find the total charge per unit length on the outer and inner conductors.
e. Determine the capacitance per unit length between the 2 conductors.