1. A line charge of uniform density ρ_l in free space forms a semicircle of radius b. Determine the magnitude and direction of the electric field intensity at the center of the semicircle.

2. Three uniform line charges——ρ_{l1}, ρ_{l2}, and ρ_{l3}, each of length L——form an equilateral triangle. Assuming that $\rho_{l1} = 2\rho_{l2} = 2\rho_{l3}$, determine the electric field intensity at the center of the triangle.

3. Two infinitely long coaxial cylindrical surfaces, $r = a$ and $r = b$ $(b > a)$, carry surface charge densities ρ_{sa} and ρ_{sb}, respectively.

   a) Determine $\mathbf{E}$ everywhere.

   b) What must be the relation between a and b in order that $\mathbf{E}$ vanishes for $r > b$?

4. Determine the work done in carrying a $-2(\mu C)$ charge from $P_1(2, 1, -1)$ to $P_2(8, 2, -1)$ in the field $\mathbf{E} = \mathbf{a_x}y + \mathbf{a_y}x$

   a) along the parabola $x = 2y^2$.

   b) along the straight line joining P_1 and P_2.

5. A finite line charge of length L carrying uniform line charge density ρ_l is coincident with the x-axis.

   a) Determine V in the plane bisecting the line charge.

   b) Determine $\mathbf{E}$ from ρ_l directly by applying Coulomb's law.

   c) Check the answer in part (b) with $-\nabla V$.

6. A charge Q is distributed uniformly over the wall of a circular tube of radius b and height h. Determine V and $\mathbf{E}$ on its axis

   a) at a point outside the tube, then

   b) at a point inside the tube.