1. **An infinitely long cylindrical cavity of radius b is bored into a bigger cylinder of radius a. The axes of the two cylinders are parallel but the cylinders are not concentric. The remaining part of the cylinder has a cosnstant volume charge density ρ. Show that the electric field inside the cavity is uniform and directed along the line joining the center of the two cylinders.**

2. **A hollow spherical shell carries a uniform charge density ρ_0 in the region $a \leq r \leq b$. Find the electric potential as a function of r.**

3. **The electric field in a region is cylindrically symmetric, given as follows:**

$$\begin{aligned} \vec{\mathbf{E}}(\vec{\mathbf{r}}) &= \frac{c\hat{\mathbf{s}}}{s}; \qquad \textbf{when} \quad s \geq a \\ &= 0; \qquad \textbf{when} \quad s < a \end{aligned}$$

   Find the charge distribution in the region using the differential form of Gauss' law $\vec{\nabla} \cdot \vec{E} = \frac{\rho}{\epsilon_0}$.

4. **Prove the mean value theorem in electrostatics which states that in a chargeless region, the average of the potential over the surface of any sphere is equal to the potential at the center of the sphere.**
   This is true for any regular polyhedron. If the faces of a regular polyhedron having n faces are maintained at potentials $V_1, V_2, ..., V_n$ then the potential at the center of the polyhedron is $(V_1 + V_2 + ... + V_n)/n$. How many such regular polyhedron do you think are possible? Look for platonic solids. Tetrahedron, cube, octahedron, dodecahedron and icosahedron.

5. **Prove that in a chargeless region electrostatic potential cannot have a maxima or a minima.**