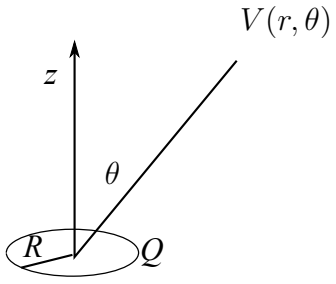
1. **The plane $x = 0$ has a constant surface charge density σ_1 and the plane $x = a$ has a constant charge density σ_2. Find the electric field in the three regions $x < 0$, $0 < x < a$ and $x > a$ by solving the Laplace's equation.**

2. **The points on the xy plane is maintained at potential $V_0 \sin(\alpha x + \beta)$. The potential goes to 0 as $z \to \pm\infty$. Find the potential at all the points above and below the xy plane.**

3. **A conducting sphere of radius R has an amount of charge Q over it. This sphere is placed in an otherwise uniform electric field $\vec{E}_0$. The potential of the sphere is found to be V_0. Find the potential in the region outside the sphere.**

4. **A sphere of radius R has a surface charge given by the surface charge density $\sigma = k \cos 3\theta$ where k is a constant. Find the potential inside and outside the sphere.**

5. **A ring of radius R has a charge Q uniformly spread along it. The ring is placed on the x-y plane with the z-axis coinciding with its axis. Find the potential $V(r, \theta)$ in the region surrounding the ring.**



6. **Solve Laplace's equation by separation of variables in cylindrical co-ordinates, assuming there is no dependence on z.**