

[lex124] Conducting sphere between point charges

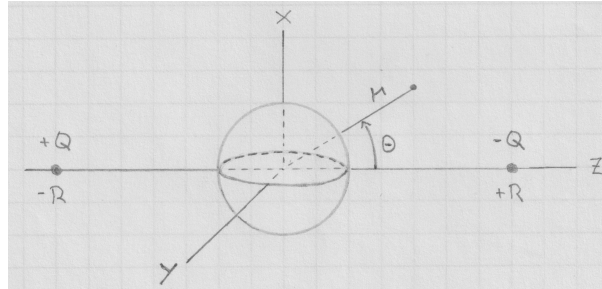
Two point charges $\pm Q$ are placed at $z = \mp R$ and a grounded conducting sphere of radius a is centered at $z = 0$.

(a) Use the result developed in [lam10] for one point charge near a grounded conducting sphere in combination with the superposition principle to construct an expression $\Phi(r, \theta)$ for the electric potential

(b) Expand the function $\Phi(r, \theta)$ in inverse powers of R keeping only the dominant term.

(c) Show that the combined limit $Q \rightarrow \infty, R \rightarrow \infty$, fixed Q/R^2 recovers the familiar result of a conducting sphere in a uniform electric field.

(d) Calculate from the asymptotic potential obtained in part (b) the surface charge density $\sigma(\theta)$ on the conducting sphere and the electric dipole moment $\mathbf{p} = p_0 \hat{\mathbf{z}}$.



Solution: