Discussion Session 4

1) Consider the example of the ring of charge of radius R and linear charge density λ done in lecture. Recall the electrical field for a point on the z-axis at $\vec{r} = \begin{pmatrix} 0 & 0 & z \end{pmatrix}$ is given by $\vec{E} = \frac{\lambda R\ z\ \hat{z}}{2\varepsilon_0 \sqrt{R^2 + z^2}^3}$.

A) Calculate $V(z)$ relative to infinity using $V(\vec{r}_b) - V(\vec{r}_a) = -\int_{\vec{r}_a}^{\vec{r}_b} \vec{E} \bullet d\vec{\ell}$. Hint the integral is easy to do using a variable substitution.

B) Calculate $V(z)$ relative to infinity using the appropriate version of the Coulomb potential: $V(\vec{r}) = \int \frac{\rho(\vec{r}\,')\ d\tau}{4\pi\varepsilon_0 \boldsymbol{r}}$.

2) Griffiths Problem 2.36