# Homework Assignment #18

**(due Fr, Oct.14, at the beginning of class)**

1. In the next sections we will be working a lot with dipoles. This problem provides us with the expressions we will use.

   **(a)** Show that $V_{\rm dip}(\vec{r})$ which is defined as

   $$V_{\rm dip}(\vec{r}) := \frac{1}{4\pi\epsilon_0}\frac{1}{r^2}\int r' \cos\alpha' \rho(\vec{r}')\mathrm{d}\tau'$$

   is equal to Eq.(3.99) (with Eq.(3.98) as definition of $\vec{p}$)
   Hint: The derivation is in the book.

   **(b)** Show that for the special case of $\vec{p} = p\,\hat{\mathbf{z}}$ one obtains Eq.(3.103).
   Hint: The derivation is in the book.

   **(c)** Griffith's problem 3.36.
   Hint: Start with Eq.(3.99) and use the gradient in cartesian coordinates, and use also that $\vec{p}$ is independent of $\vec{r}$.

2. Griffiths 3.29

3. Griffiths 3.33 a,b