

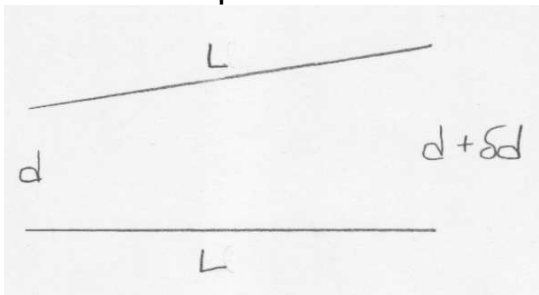
# Physics 513, Autumn Quarter 2017

## Electrodynamics: Homework Assignment 7

Due November 16 either 11:00am in class or 10:45am in the instructor's mailbox.

1. 4. We forgot to do this in class: Show that the electrostatic energy  $U$  of a single electric dipole  $\mathbf{p}$  in an electric field is  $U = -\mathbf{p} \cdot \mathbf{E}$ .

2. Consider the capacitor shown below. Each plate has length  $L$  and width  $W$ . The capacitor plates are not quite parallel. The gap is  $d$  on one side and  $d + \delta d$  on the other. One plate is grounded, the other at potential  $\Phi_0$ . Ignoring fringing fields, find the electrostatic potential between the plates.



3. Show that the quadrupole moment is independent of origin under certain assumptions. What are those assumptions?

4. A parallel-plate capacitor consists of two plates of area  $A$  separated by a distance  $d$ . The capacitor is filled with an anisotropic dielectric having constitutive relation  $D_\alpha = \varepsilon_{\alpha\beta} E_\beta$ . Unfortunately, the dielectric is oriented so its principal axes are not in the ideal directions: the first makes an angle  $\theta$  to the normal to the plate, the second makes an angle  $\pi/2 - \theta$  to the normal to the plate, and third is tangential to the plates. Find the capacitance. You can ignore fringe fields. Hint: In coordinates based on the principal axes, the tensor is diagonal.