

## Symmetries and Idealizations Homework 6

*Due Friday 10/16*

**Problem 6.1 Square loop (practice)** (based on Griffiths 2.4) Consider a square loop with each side a length  $a$  carrying a uniform linear charge density  $\lambda$ .

- a) Find the electric field at the center of the square.
- b) Find the work needed to bring a charge in from infinity to the center of the square. (You may start with the electrostatic potential due to a single finite line of charge.)

**Problem 6.2 Three charges (practice)** (Griffiths 2.32) Three charges are situated at the corners of a square (side  $s$ ). Two have charge  $-q$  and are located on opposite corners. The third has charge  $+q$  and is opposite an empty corner.

- a) How much work does it take to bring in another charge,  $+q$ , from far away and place it at the fourth corner?
- b) How much work does it take to assemble the whole configuration of four charges?

**Problem 6.3 Problem 5.4 (c) and (d)** Remember to turn in parts c and d of problem 5.4 from the previous homework, if you didn't turn them in on Wednesday!

**Problem 6.4 A thin spherical shell (challenge)** Consider a thin spherical shell with radius  $R$  and total charge  $Q$ .

- a) What is the surface charge density of the shell?
- b) Find the electrostatic potential everywhere within the shell.
- c) Compute the gradient of the electrostatic potential to find the electric field *within* the shell.
- d) Find the electrostatic potential everywhere outside the shell.
- e) Compute the gradient of the electrostatic potential to find the electric field *outside* the shell.
- f) Comment on your results.