

NAME \_\_\_\_\_

Physics 412: Introduction to Electrodynamics

Test 2

Do 3 out of the 4 following questions. Please mark clearly the 3 questions you wish to have graded.

Problem 1:

A grounded, conducting sphere of radius  $R$  is placed into an otherwise uniform electric field.

- a. Find the potential everywhere.
- b. Find the surface charge density,  $\sigma$ , on the conductor.

Problem 2:

Two infinite, grounded conducting slabs meet at right angles. A charge  $q$  is on the diagonal at distance  $d$  from each slab (see below).

- a. Find the force on charge  $q$ .
- b. Find the work needed to bring the charge  $q$  in from infinity to its present position.

Problem 3:

A circular wire loop of radius  $R$  has charge  $Q$  distributed uniformly around its length.

- a. Find the potential on the axis of the wire loop.
- b. Find the electric field in the plane of the wire loop for  $r < R$ , where  $r$  is the radial coordinate. Find the 3 lowest order, nonzero multipole fields.

Problem 4:

An infinite set of electrodes is as shown below. The strips have width  $w$  and length  $l$ , where  $l \gg w$ , and the strips are held at alternating potentials,  $V_0$  and  $-V_0$ . For this problem, ignore edge effects, that is, assume  $l$  is effectively infinite.

- a. What is the potential on the vertical planes at  $x = \pm nw$ , where  $n$  is an integer?
- b. Find the potential everywhere.