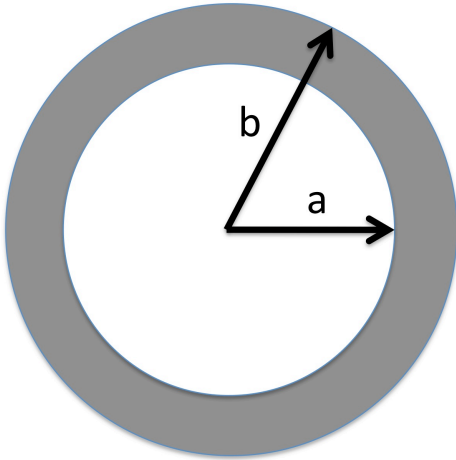2049H Spring 2010 Exam 1

Name:

Grading

Problem 1

Problem 2

Problem 3

Problem 1 [54 points, 9pts each]

Consider an infinite uniformly charged pipe with cross section as depicted below.
The volume charge density is ρ (C/m³).
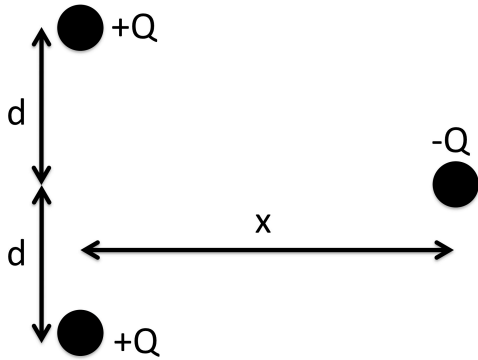

Calculate electric field (as a function of r: radial position with respect to the center of the pipe) for
(a) r > b
(b) a<r<b
(c) r<a

Taking voltage at the center of the pipe to be zero and calculate voltage (as a function of r: radial position with respect to the center of the pipe) for
(a) r > b
(b) a<r<b
(c) r<a

Problem 2 [32 points, equally distributed]

+Q

d

-Q

x

d

+Q

We have equal charges +Q distance 2d away from each other as shown in the figure below. A charge, -Q is brought in from infinite distance away to the position shown.
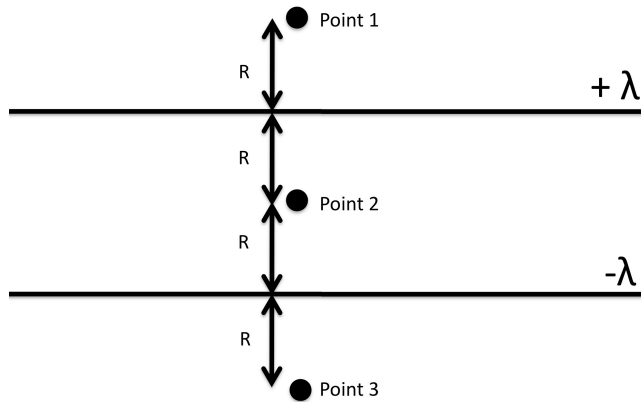
(a) Calculate the force on –Q by the +Q charges

(b) Calculate the electric potential of -Q

(c) Calculate the electric potential energy of -Q

(d) Calculate the work required to move -Q into the position shown in the figure

Problem 3 [14 points]

Consider two infinite line charge distribution as shown below with opposite charges.

Find the direction and the magnitude of electric field at point 1,2, and 3

Point 1

R

$+ \lambda$

R

Point 2

R

$-\lambda$

R

Point 3