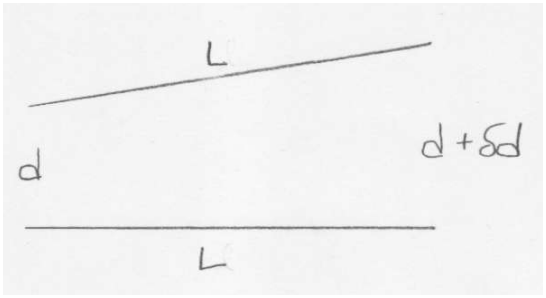
Physics 321, Autumn Quarter 2015
Electrodynamics: Homework Assignment 6

(a) Turn in all problems and clearly note all constants and assumptions you use. (1-point penalty each otherwise)

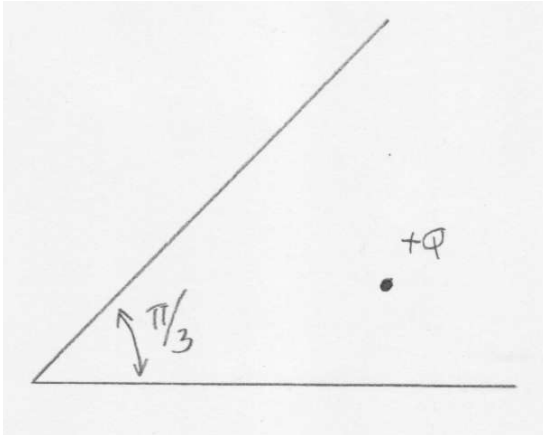
(b) Use 8½ x 11 paper & staple (1-point penalty each otherwise)

Due 9:30 am Thursday November 12

1. Challenge problem. 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. Ignoring fringing fields, find the electrostatic potential between the plates. Hint: this problem has multiple symmetries: how can these symmetries be applied to Laplace's equation?

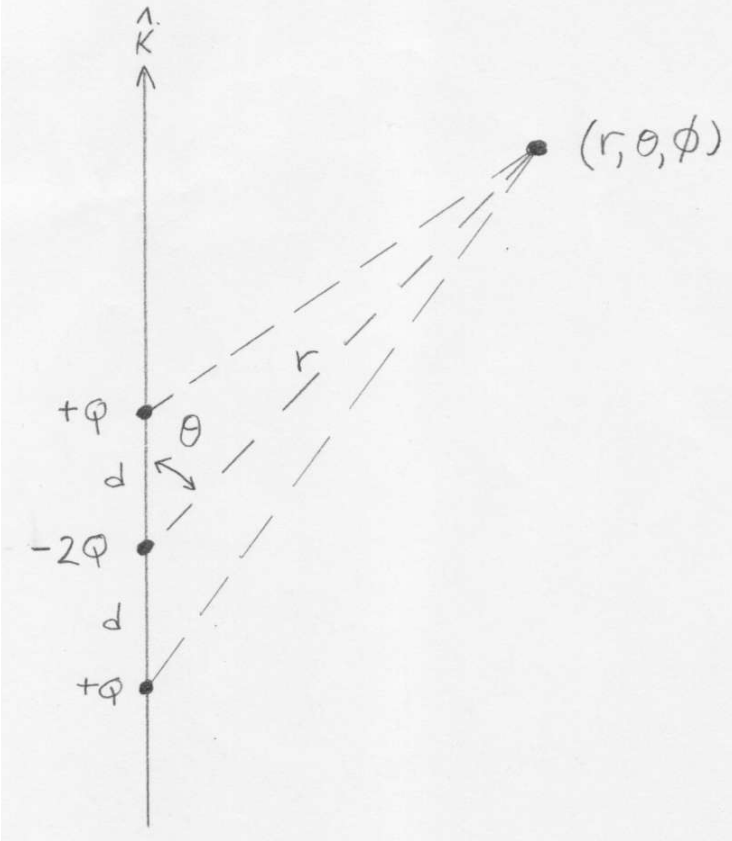


2. Consider two semi-infinite grounded planes joining at an angle $\pi/3$ as shown below. A charge $+Q$ is not necessarily along the mid-plane. Make a careful sketch showing the size and positions of charges for the corresponding image-charge problem.



3. Consider a lightning cloud drifting overhead. At the earth's surface you measure a vertical electric field of magnitude 100 Volts/meter. Suppose the bottom of the cloud is 300 m above the earth surface and the top of the cloud is 600 m above the earth surface. The simplified charge distribution of the cloud is such that its total charge is zero, but it has charge $-Q$ at the very bottom, and charge $+Q$ at the very top. (a) Estimate the magnitude of the charge Q. (b) Estimate the force on the cloud. Hint: the earth surface is a reasonably good ground plane.

4. Consider the linear arrangement of charges as shown below. Assume the separation *d* of the charges is small relative to their distance *r* to the field point located at (r, θ, ϕ) in spherical coordinates. Find to lowest non-trivial order (in r) the electrostatic potential at the field point.



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