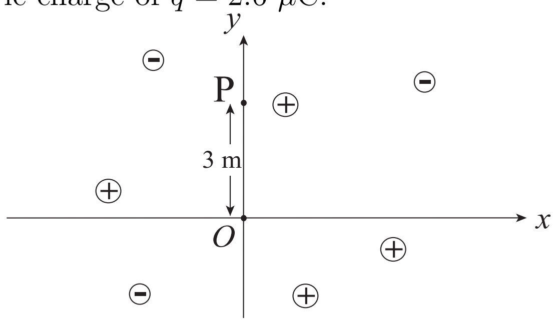
Physics 102 (F16) Q2B

Name: ________________ **Section:** __________ **Score:** __________/**20**

1. As shown in the figure below multiple point charges are fixed in space, making an electric field $\boldsymbol{E}$. At P is an electric charge of $q = 2.6\ \mu$C.



(a) The electric field at the origin is now $\boldsymbol{E} = (1.0, 1.0) \times 10^3$ N/C. What was the electric field (vector) at the origin before putting charge q at P ? [5]

superposition

E by a single charge

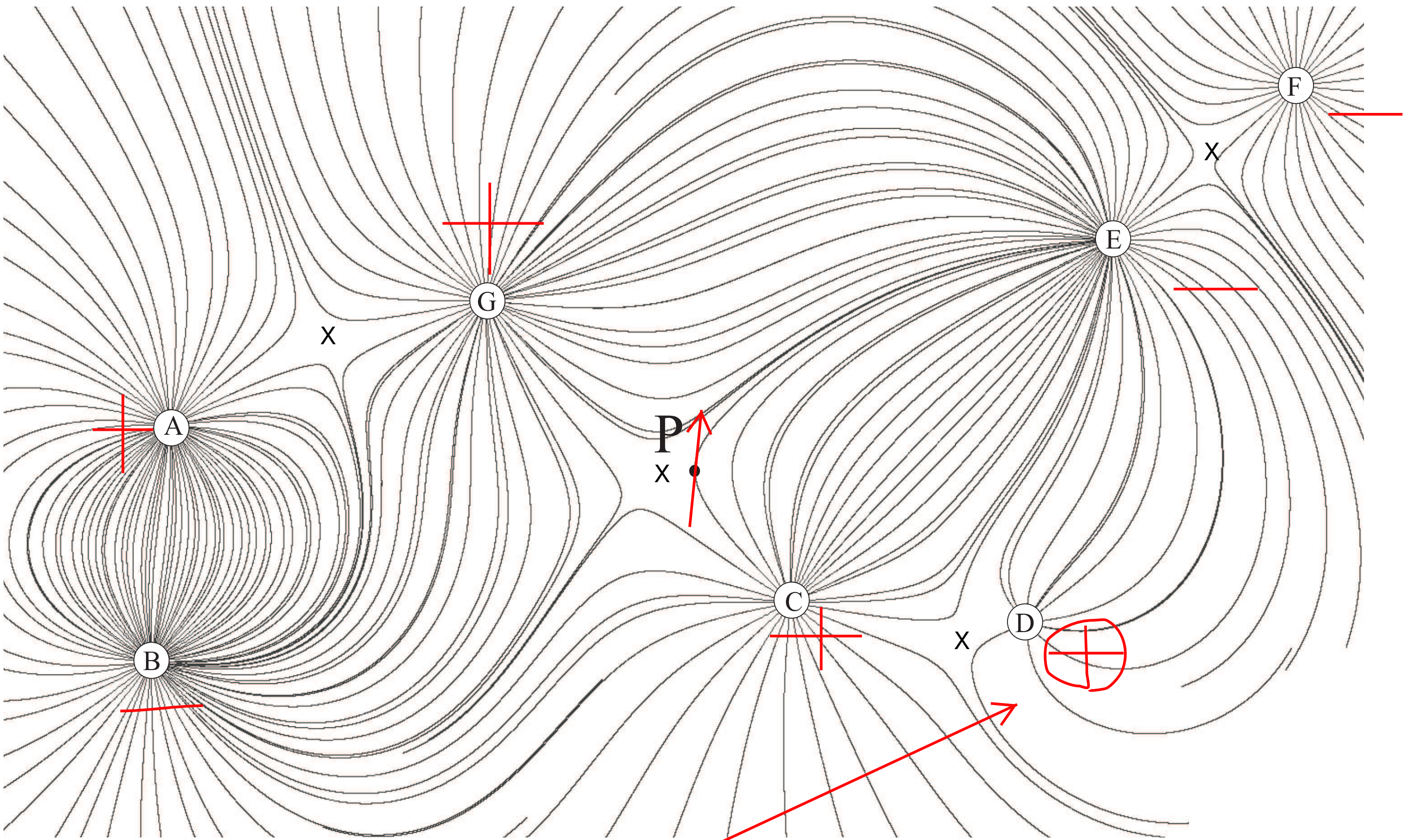
E at the origin due to q at P is in the -y direction with magnitude
kq/r^2 = 9x10^9 x 2.6x10^{-6}/3^2 = 2.6x10^3 N/C. That is, the field due to q at the origin is (0, -2.6)x10^3 N/C.
This + the original E is (1.0,1.0)x10^{3} N/c, so the original E must be
(1.0,1.0)x10^{-3} - (0, -2.6)x10{-3}
= (1.0, 3.6)x10^{3} N/C.

(b) Now, the charge q is moved from P to the origin. What is the force (vector) on charge q? [5]

Now, q interact with the original field E = (1.0, 3.6)x10^{3}N/C, so
F = 2.6x10^{-6} x (1.0,3.6)x10^{3}= (2.6, 9.36)x10^{-3}N.

Therefore, the magnitude is sqrt(9.36^2+2.6^2) x 10^{-3} = 9.74x10^{-3}N.

2. Electric field lines due to multiple charges on a plane are depicted in the figure below.



(a) Suppose charge D is positive. Tell all the negative charges in the figure [5]

B, E, F.

(b) Mark at least three (3) points with × where the electric field vanishes [3]

(c) Draw an arrow describing the direction of the electric field vector at P. You must briefly justify your choice. [2]

+ to - tangent to the force line.