Physics 102 (F16) Q2C

Name: _____ **Section:** _____ **Score:** _____/20

1. As shown in Figure 1 multiple point charges are fixed in space, making an electric field $\boldsymbol{E}$. At the origin O the electric field is given by $\boldsymbol{E} = (3.2, 0.5) \times 10^3$ N/C.

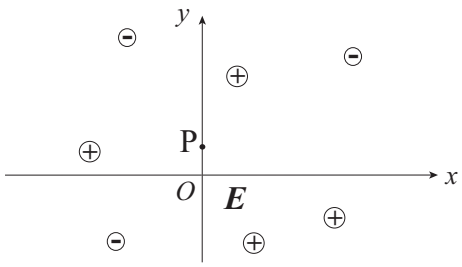

Figure 1:

(a) A charge $q = -4.3$ μC is placed at the origin. What is the force vector (its x and y components) acting on this charge q? [5]

F = qE

F = -4.3x10^{-6} x (3.2, 0.5)x10^{3} = -(13.76, 2.15)x10^[-3} N

(b) Now, the charge q in (a) is moved to location P whose coordinate vector is given by $(0, 3)$ m. What is the electric field vector at the origin due to all the charges? [5]

superposition

E due to a single charge, E = KQ/R^2

E at the origin due to q at P is +y direction and with magnitude
kq/r^2 = 9x10^9 x 4.3x10^{-6}/3^2 = 4.3x10^{3} N/C. That is, (0, 4.3)x10^3 N/C.

Therefore, the total field is
(3.2, 0.5)x10^{3} + (0, 4.3)x10^3 = (3.2, 4.8)x10^3 N/C

2. Electric field lines due to more than 7 charges on a plane are depicted in Fig. 2.

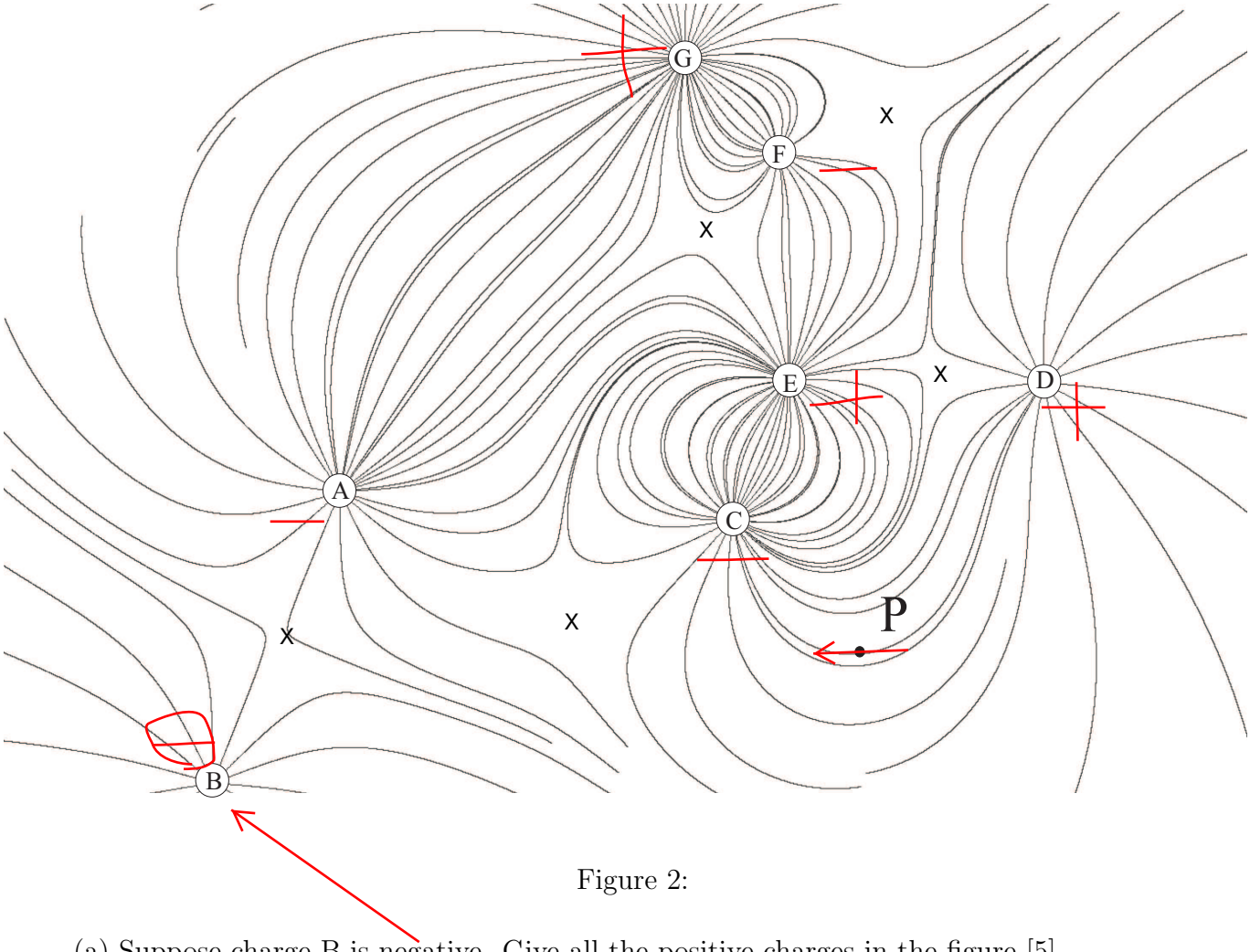

Figure 2:

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

D, E, G.

(b) There are locations where the electric field is zero. Mark at least four of them with X in the figure. [3]

(c) Draw the direction of the electric field at P. You must give a brief justification of your arrow, [2]

+ to - tangent to the force line