Physics 102 (S15) **Q2D**

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

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

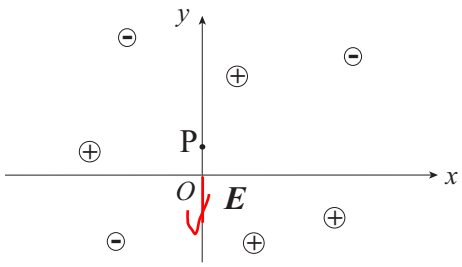

Figure 1:

(a) A charge $q = 8.5$ μC is placed at the origin. What is the magnitude of the force acting on this charge q? [5]

|E| = 3.24 x 10^3 N/C

|F| = q|E| = (8.5 x 10^{-6}) x (3.24 x 10^3) = 27.54 x 10^{-3} = 0.028 N.

(b) Now, the charge q in (a) is moved to location P whose coordinate vector is given by $(0, 0.3)$ m. What is the electric field vector at the origin due to all the charges? [5]

The field created by the charge is in the -y direction, and its magnitude is

kq/r^2 = (9 x 10^9) x (8.5 x 10^{-6})/3^2 = 8.5 x 10^{3}

Therefore, the total force is E = (3.2, -8) x 10^3 N/C.

2. Electric field lines due to more than 8 charges on a plane are depicted in Fig. 2.

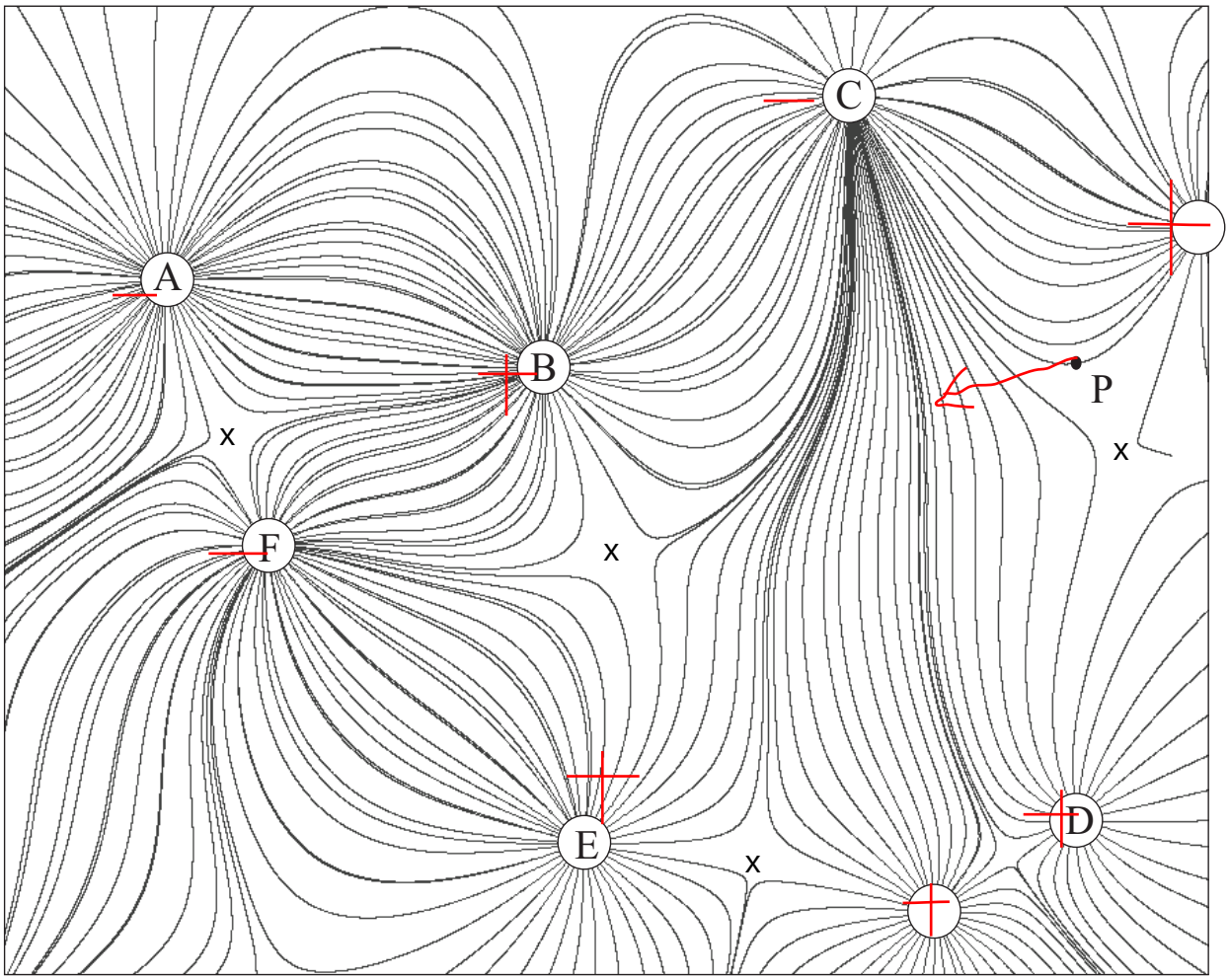

Figure 2:

(a) Suppose charge A is negative. Give all the negative charges among B-F. [4]

C and F

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

(c) Draw the direction of the electric field at P. [3]