Physics 102 (S15) **Q2B**

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 $\boldsymbol{E} = (-3.2, 1.2) \times 10^3$ N/C.

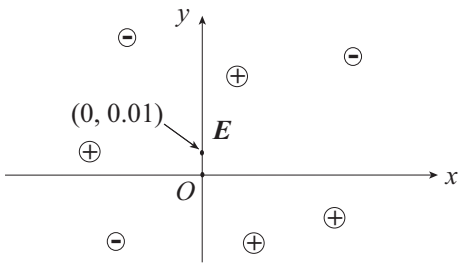

Figure 1:

(a) A charge $q = 1.5$ μC is placed at the origin. What is the magnitude of the force acting on the charge? [5]

|E| = 3.42 x 10^3 N/C.

|F| = q|E| = (1.5 x 10^{-6}) x (3.42 x 10^3) = 5.13 x 10^{-3} N

(b) Another charge whose charge is exactly $-q$ is placed at $(0, 0.01$ m and connected to the $+q$ charge to make a dipole. What is the magnitude of the torque on this dipole? [5]

torque = |p| |E| sin (angle from p to E).

Angle = tan^{-1}(3/¥.2/1.2) = 69.4 deg.

|p| = 1.5 x 10^{-6} x 0.01 = 1.5 x 10^{-8} m.C.

Therefore, torque = (1.5 x 10^{-8}) x (3.42 x 10^3) sin(69.4)

= 4.8 x 10^{-5} m.N.

2. Electric field lines due to more than 10 charges on a plane are depicted in Fig. 2.

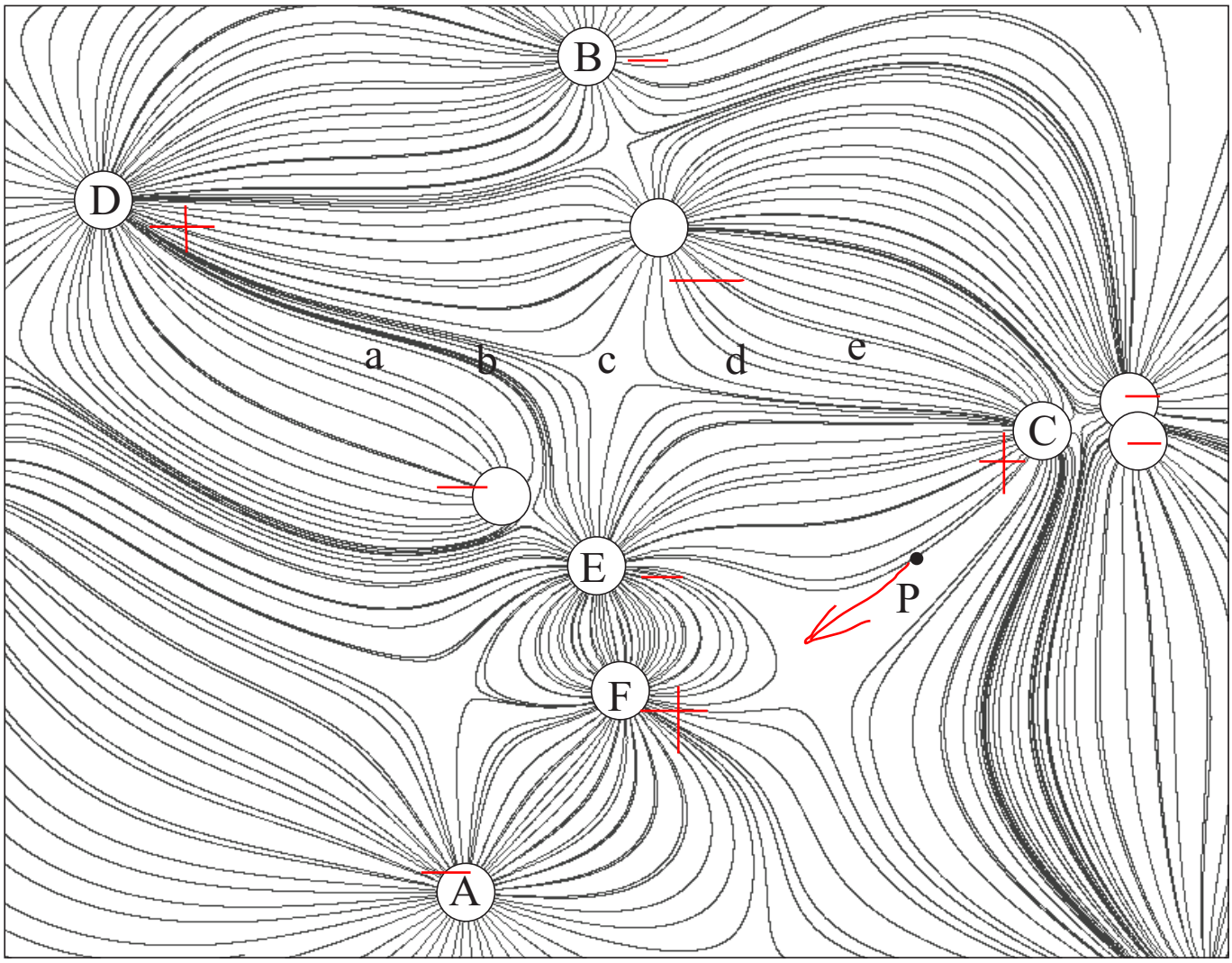

Figure 2:

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

B and E are negative.

(b) Among the points a-e, where is the electric field zero? [2] c

(c) Draw an arrow describing the direction of the electric field vector at P. [4]