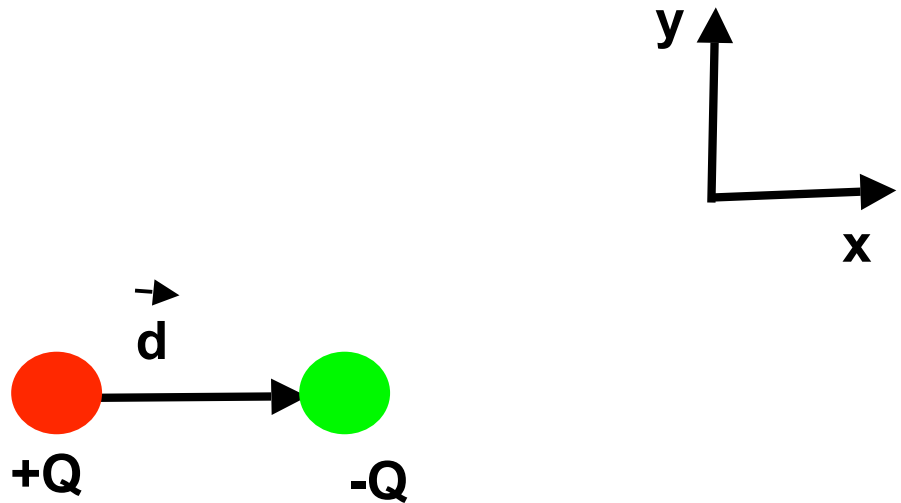


**Problem 3 (25 points)**

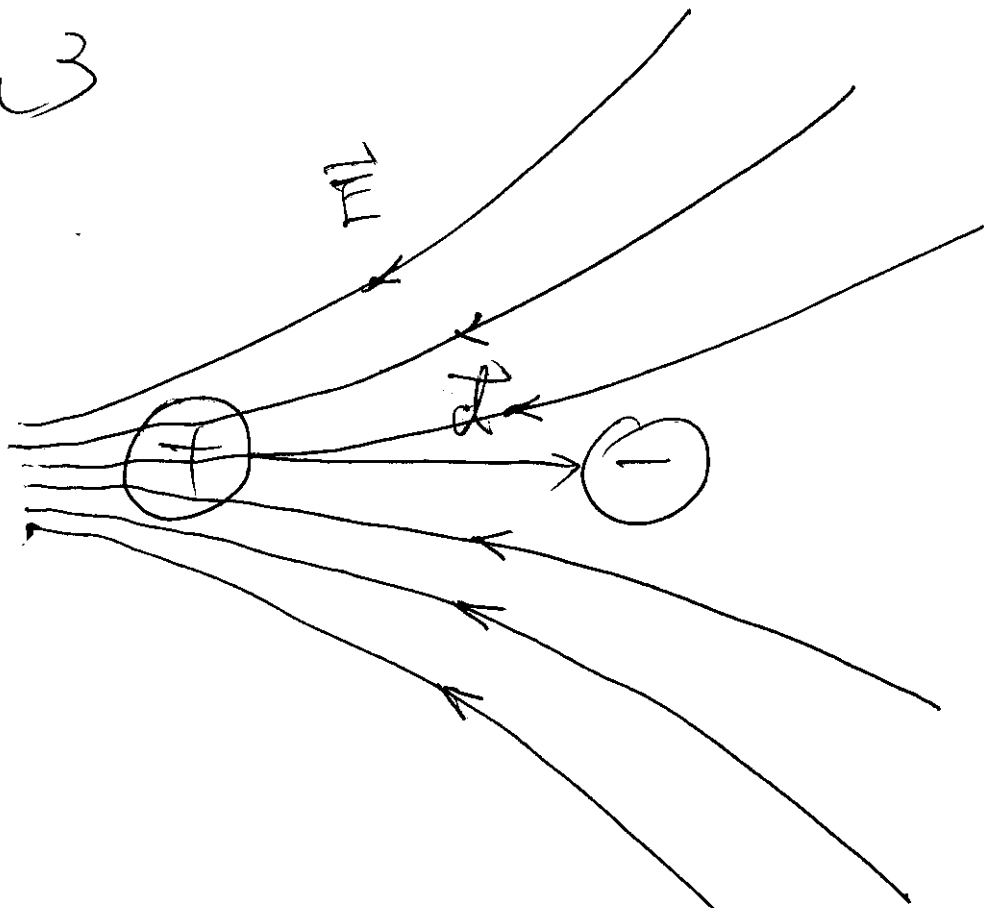
Shown below is an electric dipole with equal charges  $+Q$  and  $-Q$  separated by a distance  $d$ . The dipole is free to rotate or move. Consider the following information: The dipole sits inside an external electric field with  $|E| > 0$ . The dipole does not feel a net torque. The dipole feels a net force in the  $-x$  direction. When rotated from its original orientation and released, the dipole moves back towards the original orientation.

- (a) On the picture below, sketch field lines corresponding to an external electric field that is compatible with this description. Do not include the field due to the dipole charges.
- (b) How would the force and torque on the dipole change if the magnitude of the negative charge was increased, i.e. if the charge  $-Q$  was made more negative? (two sentences max.)?



# Problem 3

(a)



(b) ~~Q~~ If  $-Q$  was made more negative, the net force may be ~~Q~~ inversed. Then, if you rotate it again, it will move away from the original orientation.