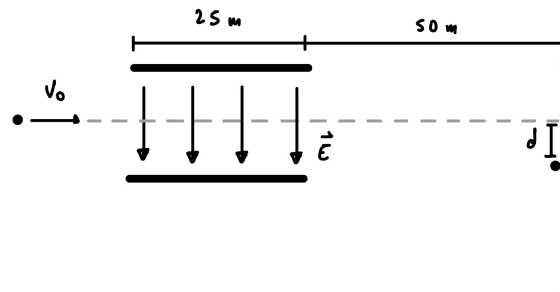
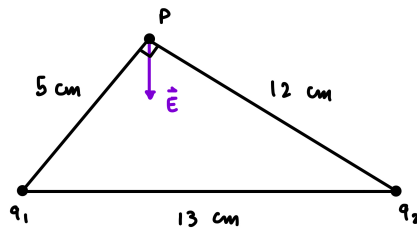


Problem set 8 (due April 15)

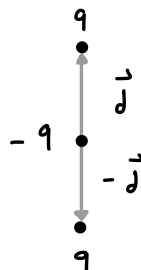
- Consider a uniform (constant) electric field \vec{E} .
 - (1pt) Find the potential energy of a particle with charge q on this electric field
 - (1pt) Using the expression above, find the potential energy of a dipole with moment \vec{p}
- (2pts) Consider a particle of mass m , charge q , and initial speed $v_0 = 5 \times 10^3 \text{ m/s}$ projected into a uniform electric field between two parallel plates of length 25 m . The electric field is directed downward between the plates with magnitude $|\vec{E}| = 800 \text{ N/C}$ and vanishes outside of the plates. After passing through the field, the object reaches a wall at a distance of 50 m , where it is found to have been deflected downward a distance $d = 1.25 \text{ m}$. Ignoring gravity and air resistance, compute the object's charge-to-mass ratio q/m .



- Two charges are placed as shown in the diagram below.



- (1pt) Considering the different possible signs of q_1 and q_2 , sketch the four possible electric field configurations \vec{E}_1 and \vec{E}_2 produced by q_1 and q_2 at point P
 - (1pt) Assuming that the net electric field \vec{E} at P is entirely in the negative y direction, deduce the signs of q_1 and q_2
 - (1pt) Determine the magnitude of \vec{E} if the magnitude of q_1 is $2 \times 10^{-6} \text{ C}$
- Consider the configuration of charges shown in the diagram below.



(a) (1pt) Sketch the electric field lines

(b) (1pt) The electric field \vec{E} at a distance $r \gg |\vec{d}|$ can be expanded in powers of $1/r$. The leading term in the expansion falls off as $1/r^n$ for some integer n . Compute the leading term. Does this result fit your expectation? Explain why.

(c) (1pt) Compute the next term in the expansion of the electric field at a distance $r \gg |\vec{d}|$ (that is, the term that goes like $1/r^{n+1}$). Explain why we should expect this result.