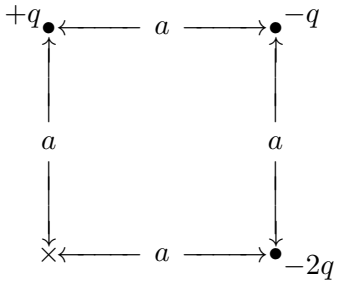
Problems

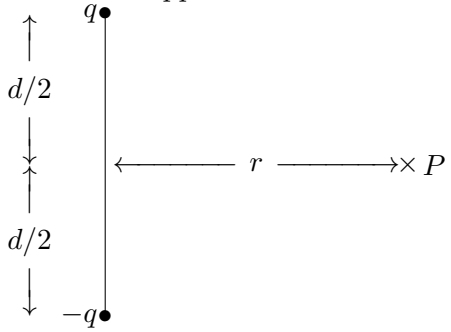
Chapter 2

1. Find the distance from a point charge of 5.0 μC at which the electric field due to it has a magnitude of 2.0 N/C.

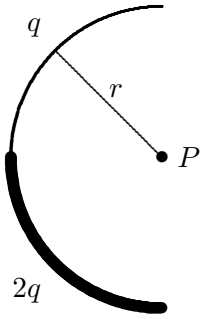
2. For the following arrangement of point charges, use an appropriate coordinate system and find the electric field at the bottom left hand corner of the square. Here $q = 2.0 \times 10^{-6}$ C and $a = 0.040$ m.



3. Find the magnitude and direction of the electric field at the point P produced by the dipole shown below. The point P is at a distance r from the midpoint of the dipole along the perpendicular bisector as shown. Find an approximate form for this field for $r \gg d$.

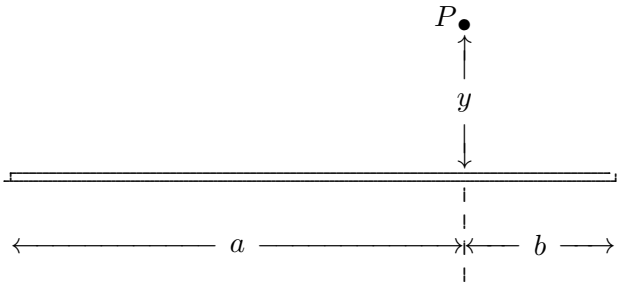


4. A thin rod is bent in the shape of a semicircle of radius r as shown in the figure below. The upper half has a charge q spread uniformly on it and the lower half has a charge $2q$ spread uniformly on it. Find the components of the electric field produced at the center (marked P).



5. The figure below shows a thin rod of length $a + b$. It has a uniform charge per unit length of λ. Find the electric field above the rod at the point marked P at a vertical distance y from

the rod as shown.



6. An electric field is used to give an electron an acceleration of 2.0×10^9 m/s^2 in the positive x direction. What is the magnitude and direction of the electric field?

7. A particle accelerator produces a uniform electric field of 4.0×10^4N/C. A proton is placed in this field.

   (a) Find the acceleration of the proton.

   (b) If the proton starts at rest, find its speed after moving a distance of 0.50cm.

8. The figure below shows a uniform electric field $\vec{\mathbf{E}}$ produced by a pair of oppositely charged plates. The magnitude of the field is 2.00×10^3N/C. An electron is shot between the plates starting at the left edge of the lower plate at a velocity $\vec{\mathbf{v}}_0$. The magnitude of this velocity is 5.00×10^6m/s and its direction is given by the angle θ as shown. The distance d between the plates is 2.00cm.

   (a) Find the maximum value of θ (less than 90 degrees) for which the electron will not hit the upper plate.

   (b) For this maximum θ, what must be the minimum length L of the lower plate such that the electron *does* hit it.