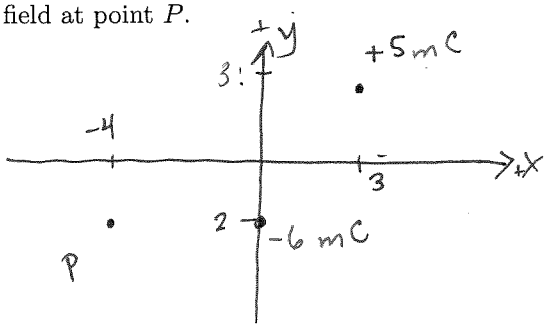
Recap of $\vec{E}$ 2/25/20 1/1

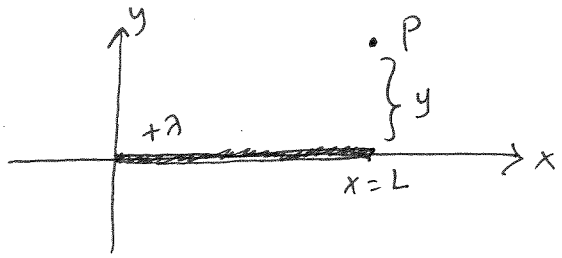
In-class problems, Tue Feb 25, 2020

Electric field: recap and synthesis

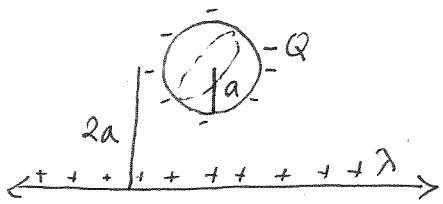
1. Determine the magnitude and direction of the electric field at point P.



2. Determine the magnitude and direction of the electric field at point P. Leave your answer as an integral, but simplify as much as possible.

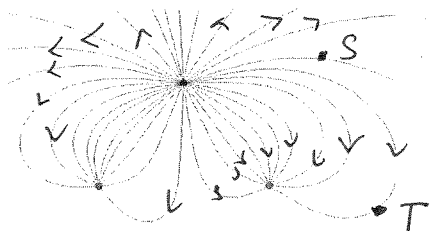


3. A conducting sphere, of radius a and total charge $-Q$, is a distance 2a away from an infinitely charged line with charge density $+\lambda$.



(a) Sketch, on the figure, a possible spot where a charged object would not feel a force.
(b) Determine an expression for this position as a distance away from the infinite line. Use the given variables (a, q, λ). (Use the results for E for an infinite line, and a uniformly charged sphere.

4. The electric field created by 3 charges are shown below.

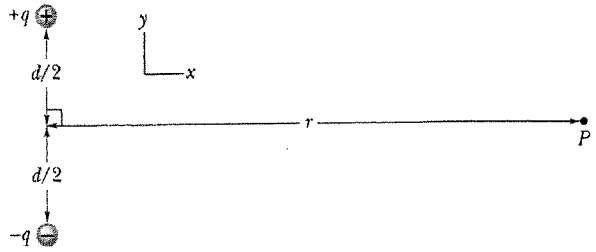


(a) Draw the direction of the electric field at points S and T.
(b) Is the field stronger at S or T?
(c) Identify each of the charges as positive or negative
(d) Which charge has the largest magnitude?

5. Consider the electric dipole below. Determine

(a) the magnitude and direction of the electric field at point P.

(b) an expression for $\vec{E}$ in the limiting case of $r \gg d$.



(HRW 22-19)

Due Wed Feb 26, 2020

23.1 Electric flux

Read 23.1 electric flux

Reminder from last semester: There are two ways to calculate the scalar (or dot) product. The first uses components, while the second uses magnitudes and the angle between the two vectors:

$$\vec{A} \cdot \vec{B} = A_x B_x + A_y B_y + A_z B_z$$
$$\vec{A} \cdot \vec{B} = AB \cos\theta$$

1. (Review) Vector $\vec{A}$ as a magnitude of 6.0 units, vector $\vec{B}$ has a magnitude of 7.00 units, and $\vec{A} \cdot \vec{B}$ has a value of 14.0. What is the angle between the directions of $\vec{A}$ and $\vec{B}$

(HRW 3-39)

2. (Review) The work done by a constant force is given by $W = \vec{F} \cdot \Delta\vec{r}$.

A tugboat pushes a cruise ship with force $\vec{F} = 1.2\hat{i} + 2.3\hat{j}$ MN. The ship moves along a straight path with displacement $\Delta r = 380\hat{i} + 460\hat{j}$ m. Calculate the work done by the tugboat on the cruise ship.

(Wolfson ex6.3)

3. Write down equation 23-3

(a) For every quantity in this equation: give its name and units (some quantities may be unit-less!).

(b) Sketch a diagram that helps explain this equation. Label the quantities. If a quantity is a vector, note its direction (arrowhead).