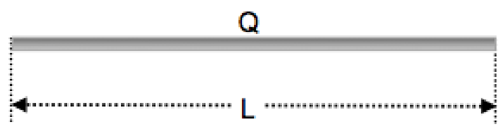
Name: ______________________ **Problems Solved __/ 7**

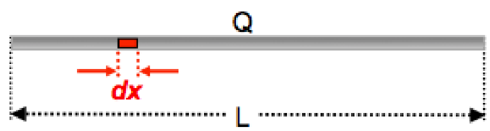
A total charge Q is uniformly distributed over the length L of a line charge distribution. The charge density λ is given by

a) Q/L
b) $(Q/L)dx$
c) L/Q
d) Qdx



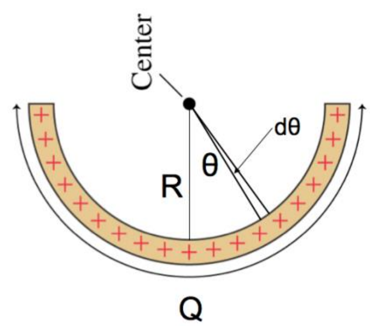
A total charge Q is uniformly distributed over the length L of a line charge distribution. The total charge inside a short element dx is given by

a) Q/L
b) $(Q/L)dx$
c) L/Q
d) Qdx



A total charge Q is uniformly distributed over a half ring with radius R. The charge density λ is given by

a) $Q/2\pi R$
b) $Q/\pi R$
c) R/Q
d) $\pi R/Q$

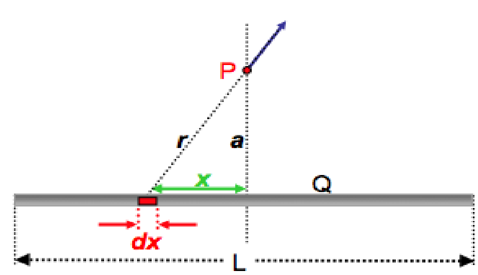


A total charge Q is uniformly distributed over a half ring with radius R, as above. The total charge inside a small element dθ is given by:

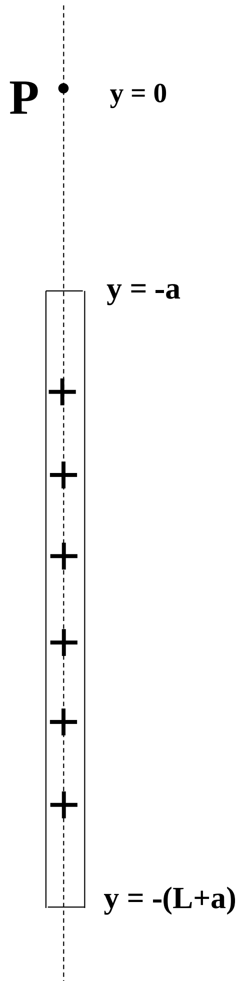
a) $(Q/2\pi)d\theta$
b) $(Q/\pi)d\theta$
c) $(Q/2\pi R)dR$
d) $(Q/\pi R)dR$

A total charge Q is uniformly distributed over the length L of a line charge distribution. The $\hat{j}$ (vertical) component of electric field at point P created by a short element dx is given by:

a) $\dfrac{kQa}{Lr^3}dx$ b) $\dfrac{kQx}{Lr^3}dx$ c) $\dfrac{kQa}{Lr^2x}dx$ d) $\dfrac{kQx}{Lr^2a}dx$

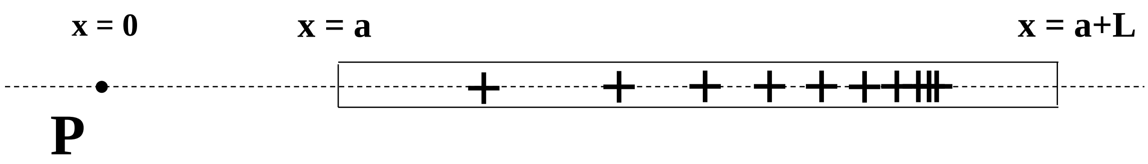


Find the net electric field vector at point *P* due to a uniformly charged rod of total charge *Q* and length *L*. Point *P* is at the origin, a distance *a* from one end of the line.

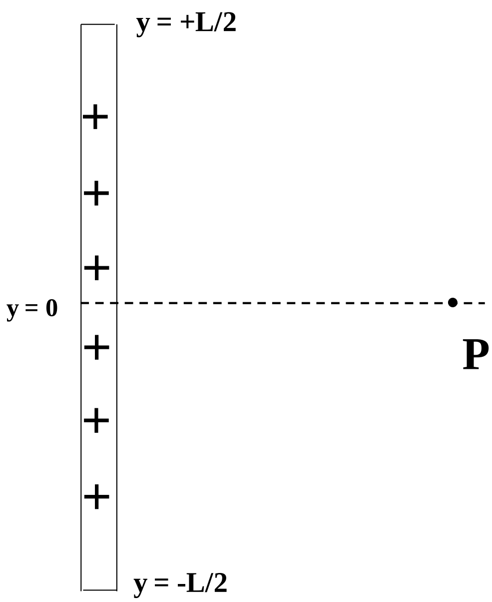


A charged rod of length L has a non-uniform linear charge density $\lambda = \lambda_0 \frac{x^3}{L^3}$ C/m.

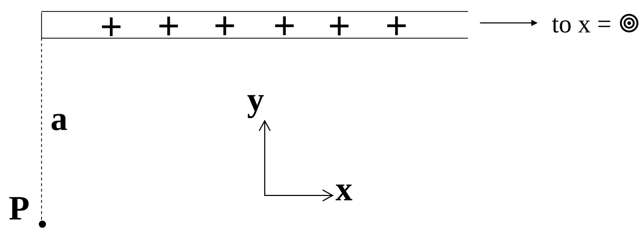
a) Calculate the Total Charge, Q, of the rod.
b) Calculate the net electric field vector at the point P shown in the figure.



Find the net electric field vector at point P due to a uniformly charged rod of total charge Q and length L. Point P is a distance a from the rod, and it lies along a line that perpendicularly bisects the rod.



A **semi-infinite** (i.e., infinite in one direction) plastic charged rod has uniform charge density λ. Starting from scratch, find the net electric field vector at point P, a distance a beneath one end of the rod. Show all work. Write your answer in terms of λ, a, and other constants.



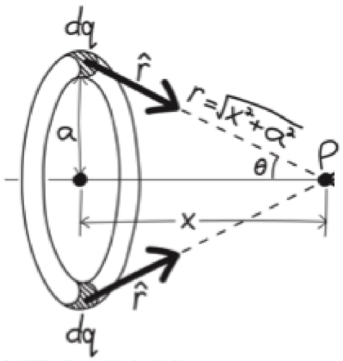
Hint: E_{tot} has both x and y components here because there's no symmetry. Calculate E_x and E_y separately and then combine the vectors. Also,

$$\int \frac{x\,dx}{\left(x^2+a^2\right)^{3/2}} = \frac{-1}{\sqrt{x^2+a^2}}$$

$$\int \frac{dx}{\left(x^2+a^2\right)^{3/2}} = \frac{1}{a^2}\frac{x}{\sqrt{x^2+a^2}}$$

$$\lim_{x\to\pm\infty} \frac{x}{\sqrt{x^2+a^2}} = \pm 1 \text{ (think of a} \to 0\text{)}$$

A ring of radius *a* carries a charge *Q* distributed evenly over the ring. Find an expression for the electric field at any point on the axis of the ring.



A semicircular loop of radius a carries a positive charge Q distributed uniformly over its length. Find the electric field at the center of the loop (point P in the figure). *Hint:* Divide the loop into charge elements dq as shown, and write dq in terms of the angle $d\theta$. Then integrate over θ.