CONCEPT: COULOMB'S LAW WITH CALCULUS

- Coulomb's Law for POINT charges can be given in VECTOR form: $\rightarrow \vec{F} = k\frac{q_1 q_2}{r^2}\hat{r}$
  - Unit vector $\hat{r}$ simply gives *direction* between charges
- To simplify, we will use $\vec{r} = r\,\hat{r}$ $\rightarrow \vec{F} =$ _____
  - Vector $\vec{r}$ points along line of charges, like $\hat{r}$

Point Charges

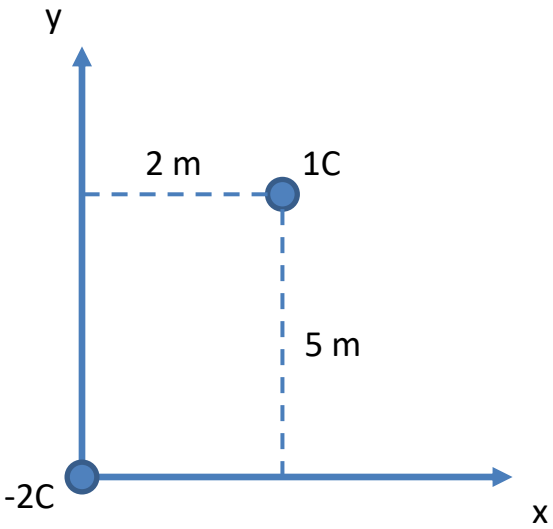
$\vec{F} = k\frac{q_1 q_2}{r^3}\vec{r}$

Charge Distribution

- Must _____ tiny pieces of Electric Force

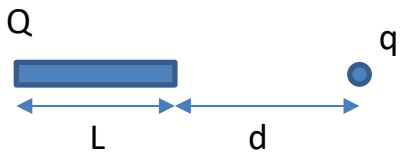
$\vec{F} =$ _____ = _____

EXAMPLE: What is the electric force on the 1C charge in vector form?



EXAMPLE: FORCE BETWEEN LINE OF CHARGE AND POINT CHARGE

What is the force between the line of charge, with a charge Q and a length L, and a point charge q, separated by a distance *d* as indicated in the following figure? (The linear charge density is $\lambda = {}^{Q}/_{L}$)



STEPS FOR COULOMB'S LAW W/ CALC
1) Use geometry to figure out **dF** and **r**
2) Relate dQ to integration variable using **charge density** ($\boldsymbol{\lambda, \sigma, \rho}$)
3) Determine limits of integration
4) Use integration techniques to solve $\int \mathbf{dF}$