REVIEW FOR EXAM 1
CH. 20-22

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9/21/2010

Supplementary Material for PHY1308 (General Physics - Electricity and Magnetism)

PROGRAM

- Strategies for the Exam
- A Brief Reminder of the Concepts
- Open forum for questions and discussion

STRATEGIES - 1

- What to prepare
  - an 8.5x11-inch "help sheet" containing formulas, concepts, etc. Front and back is fine
- What to bring
  - A pen or pencil
  - A calculator (you will not be allowed to use your neighbor's calculator)

STRATEGIES - 2

- What to study
  - Chapters 20-22
    - electric charge
    - electric force
    - electric field
    - electric flux
    - Gauss's Law and symmetry
    - matter in electric fields - conductors, etc.
    - electric potential, work, and energy

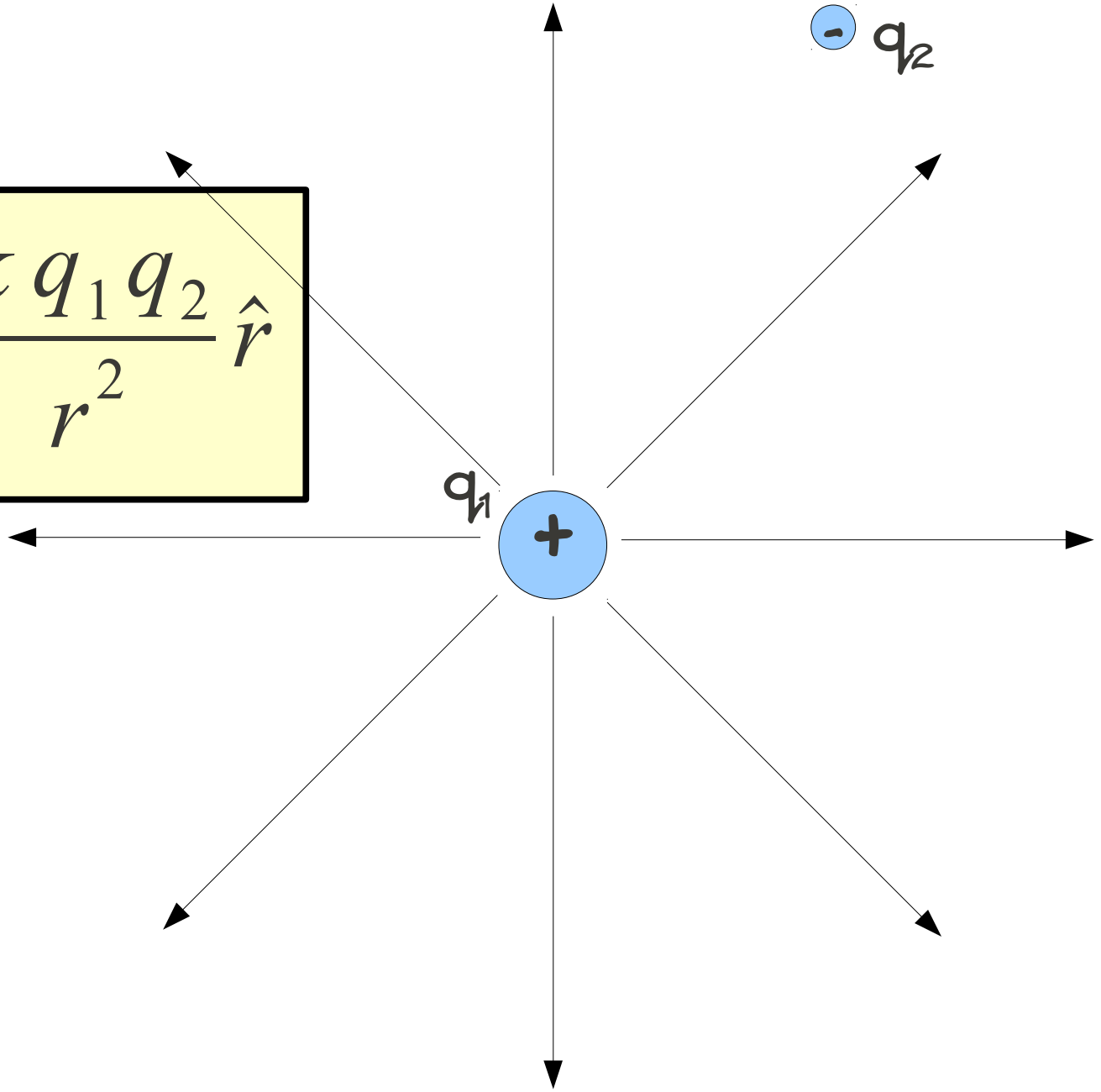
STRATEGIES - 3

- What to study (cont.)
  - homework and quizzes
    - expect the style of the exam to follow that of the quizzes
    - use the homework to remind yourself how to setup problems using physics concepts
  - example problems from chapters
- How to study
  - Work together
  - Ask questions
    - if you're unsure about things, now is the time to ask

(Brief) Reminder of the Class so Far

ELECTRIC POINT CHARGE

$$\vec{F}_{12} = \frac{k\, q_1 q_2}{r^2}\,\hat{r}$$



ELECTRIC POINT CHARGE

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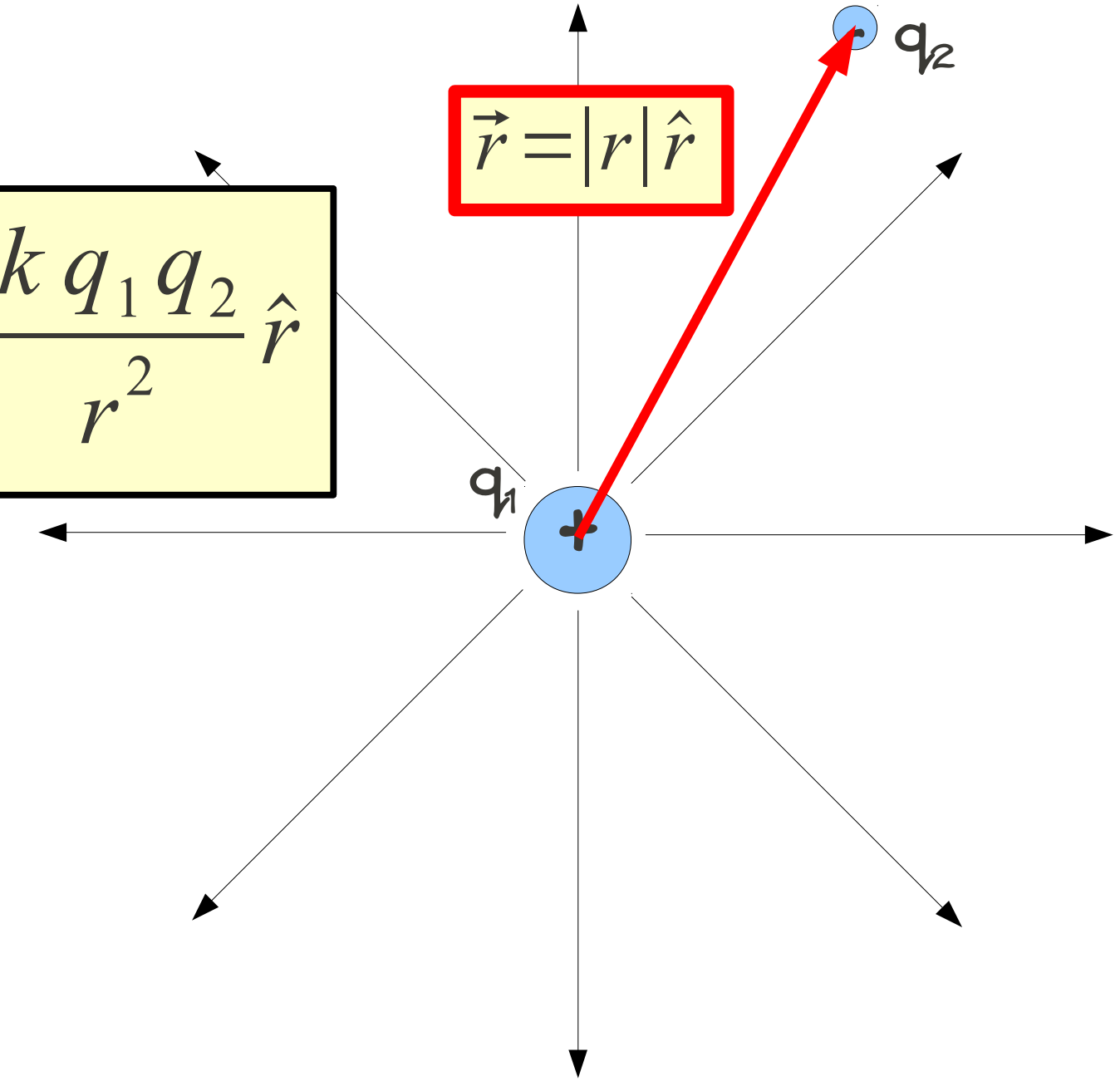
$$\vec{r} = |r|\,\hat{r}$$



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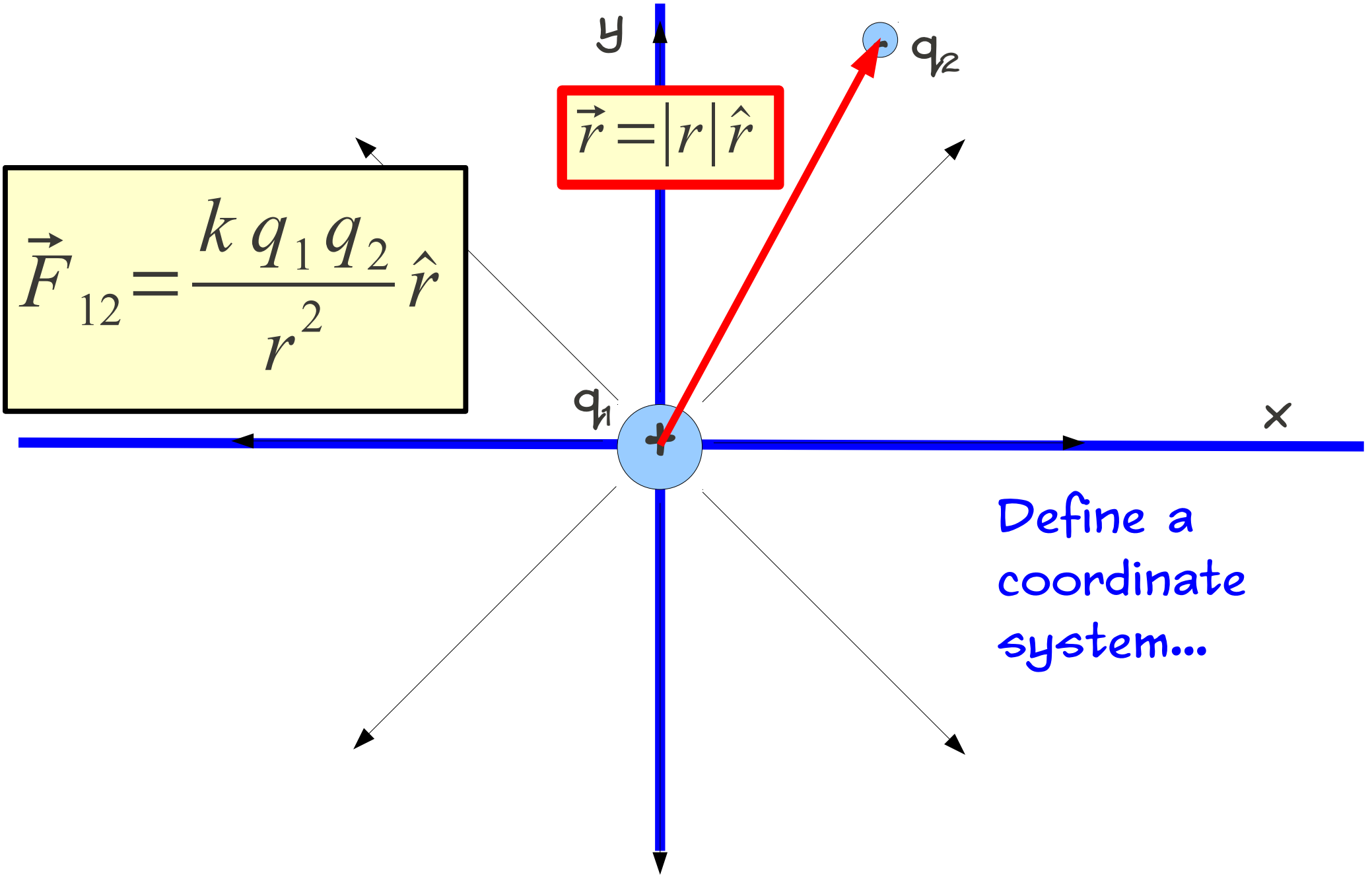
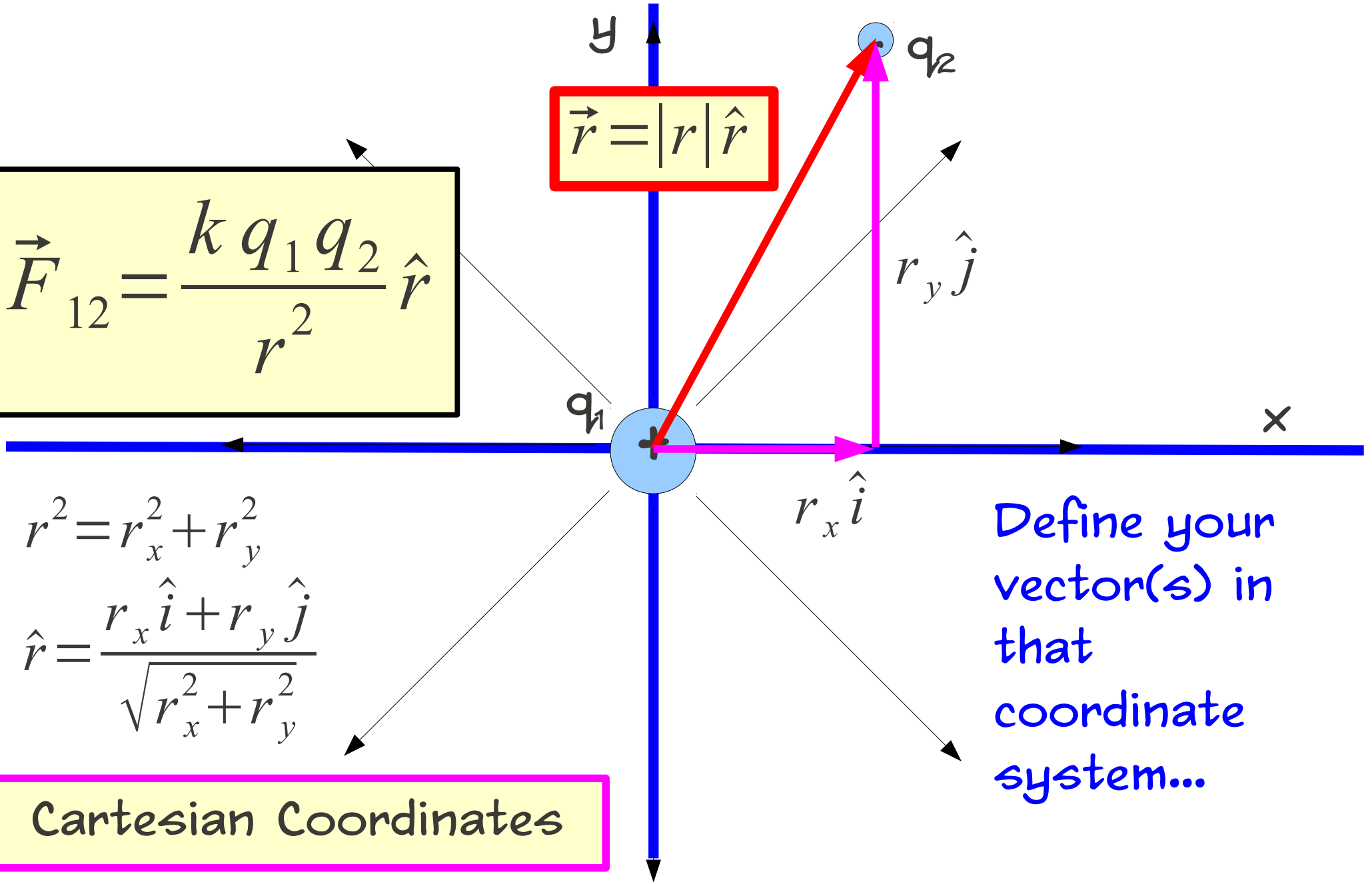


Define a coordinate system...

ELECTRIC POINT CHARGE



$$\vec{F}_{12} = \frac{k\, q_1 q_2}{r^2}\hat{r}$$

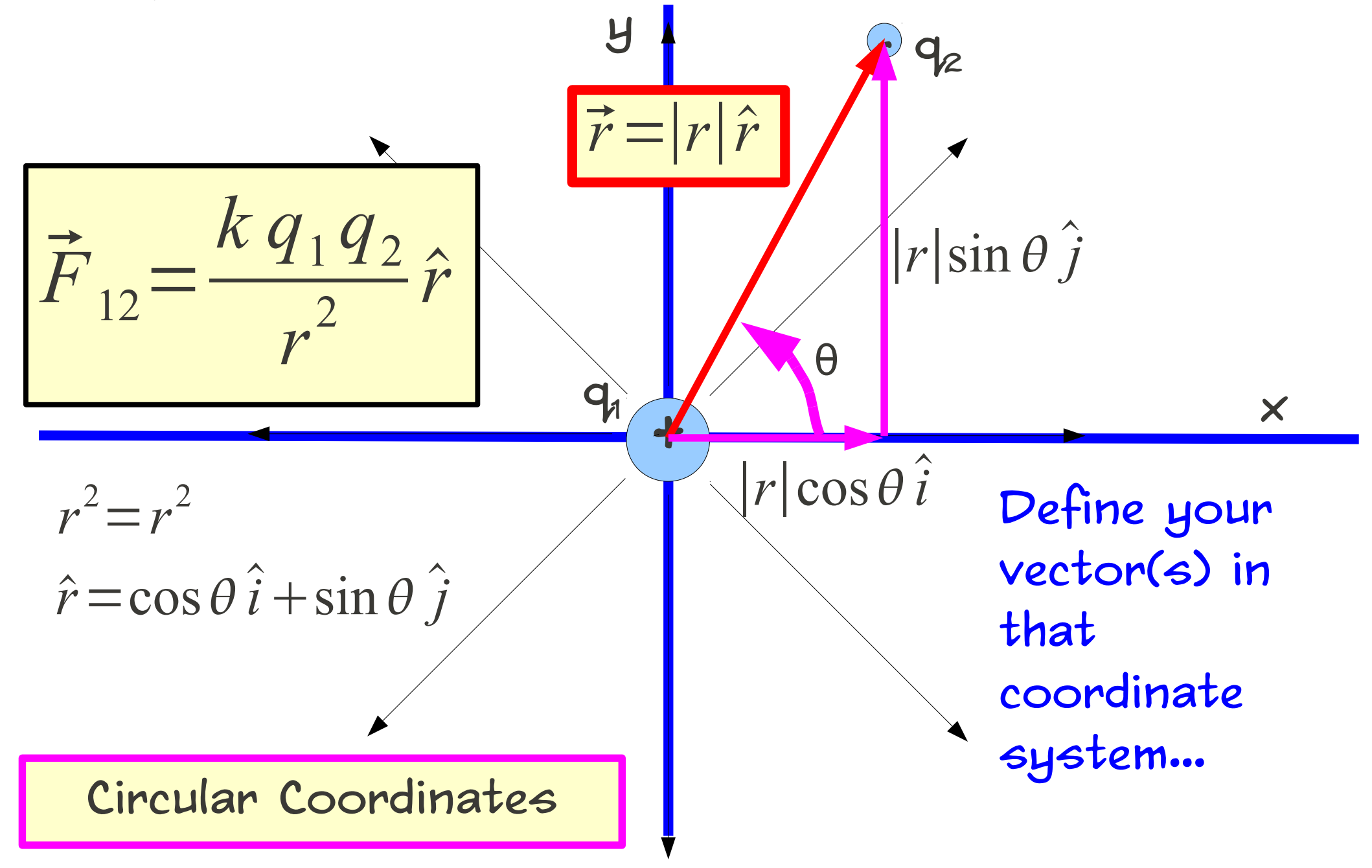
$$r^2 = r_x^2 + r_y^2$$

$$\hat{r} = \frac{r_x \hat{i} + r_y \hat{j}}{\sqrt{r_x^2 + r_y^2}}$$

Cartesian Coordinates

Define your vector(s) in that coordinate system...

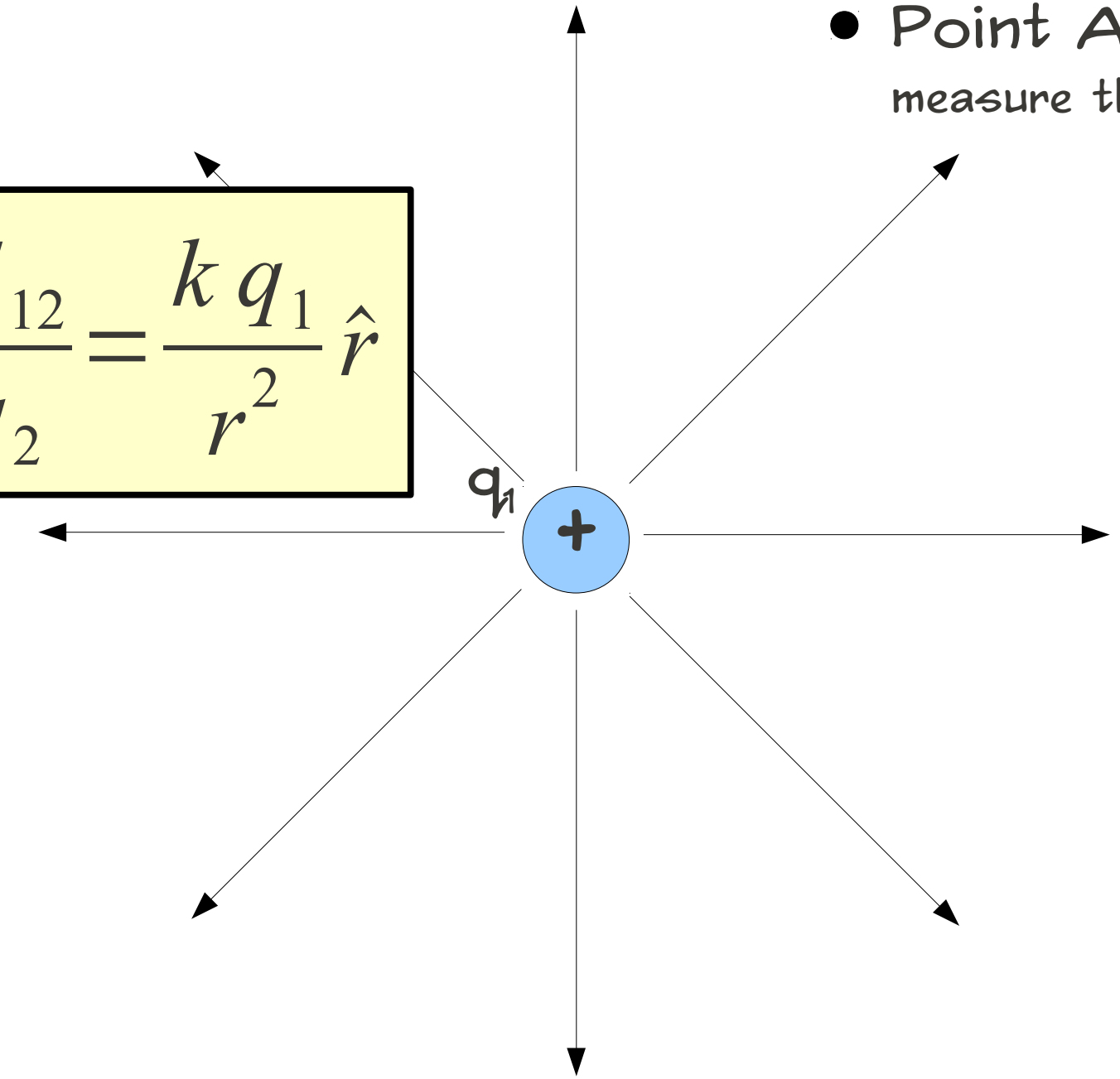
ELECTRIC POINT CHARGE



ELECTRIC POINT CHARGE

- Point A (where we measure the field)

$$\vec{E} \equiv \frac{\vec{F}_{12}}{q_2} = \frac{k\,q_1}{r^2}\,\hat{r}$$



MANY CHARGES

Point A (where we measure the field)

A line of charge carrying charge Q uniformly distributed over its length

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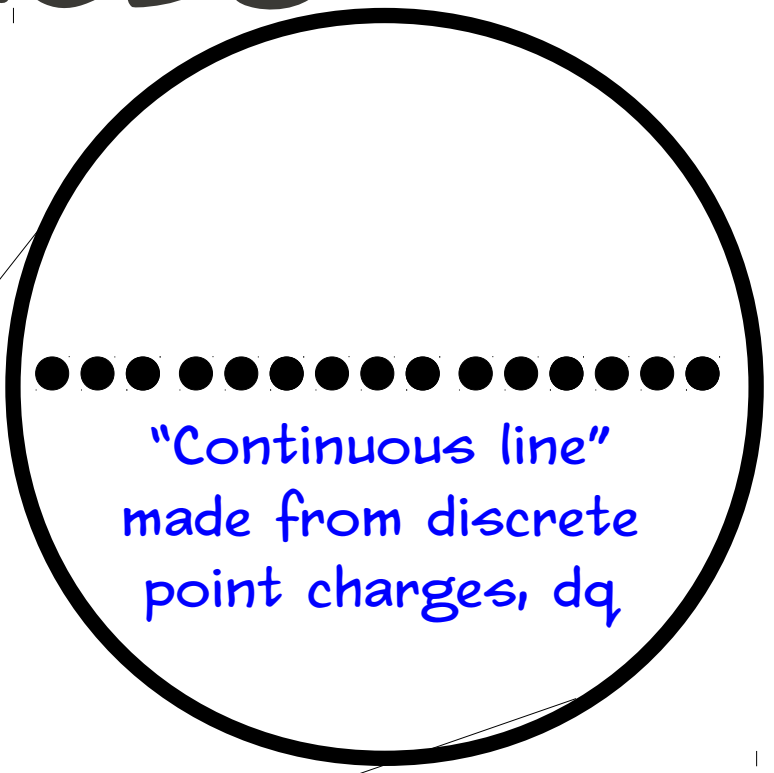


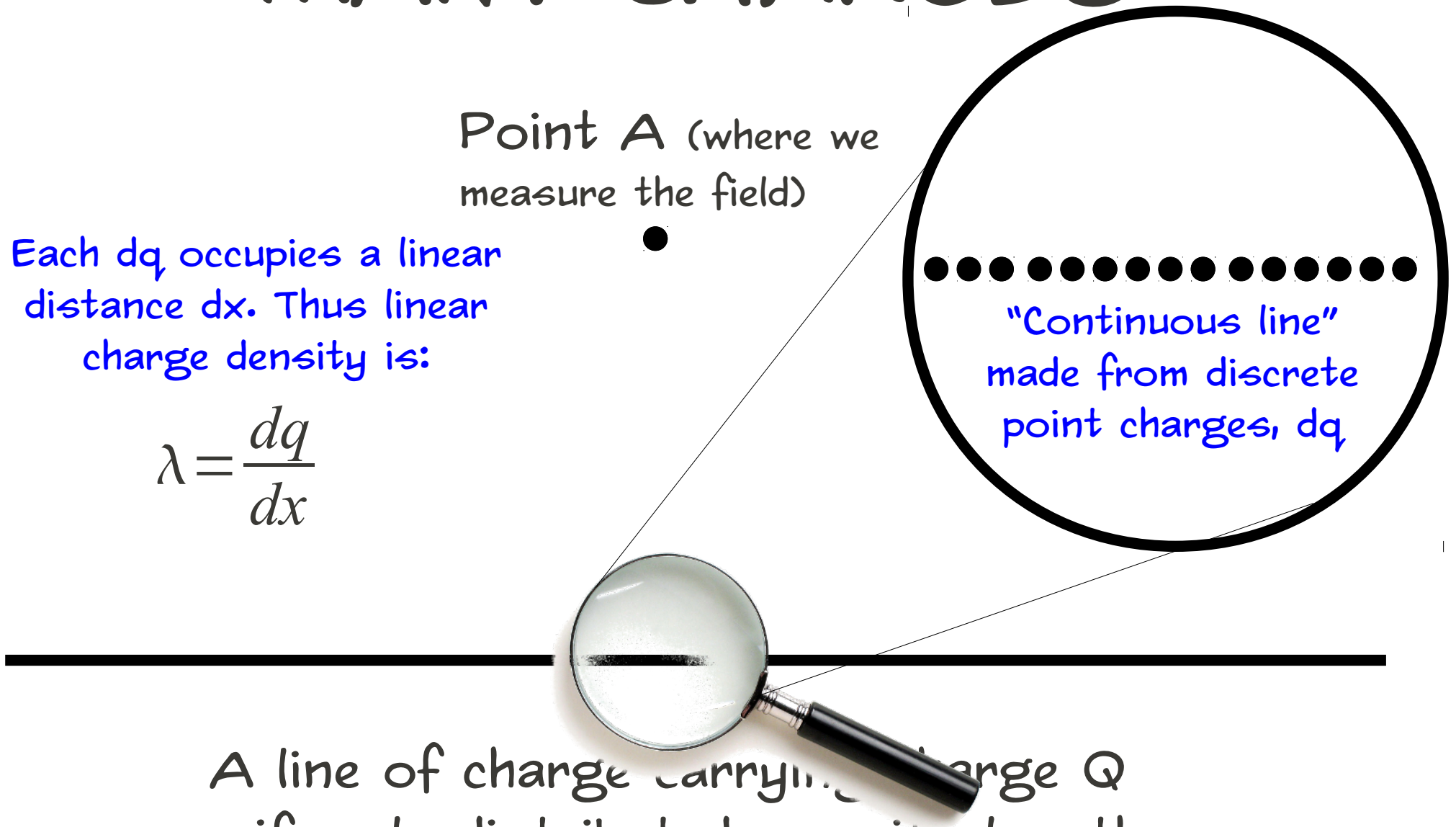
A line of charge carrying charge Q
uniformly distributed over its length

MANY CHARGES

Point A (where we measure the field)

Each dq occupies a linear distance dx. Thus linear charge density is:

$$\lambda = \frac{dq}{dx}$$



A line of charge carrying charge Q uniformly distributed over its length

MANY CHARGES

Point A (where we measure the field)

●

Each dq creates a piece of the total electric field,

$$d\vec{E} = \frac{k\,dq}{r^2}\hat{r}$$

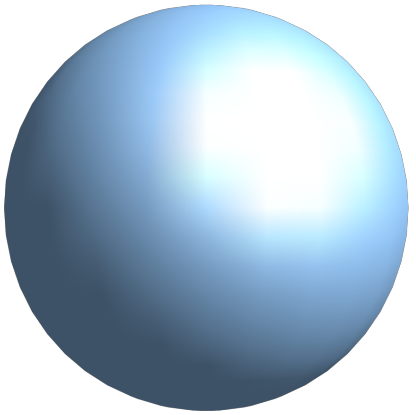
The total electric field is given by summing (integrating) over all the pieces:

$$\vec{E} = \int d\vec{E} = \int \frac{k\,dq}{r^2}\hat{r}$$

A line of charge carrying charge Q uniformly distributed over its length

GAUSS'S LAW

$$\Phi = \int \vec{E} \cdot d\vec{A} = \frac{q_{enclosed}}{\epsilon_0}$$



Complicated continuous charge distribution

GAUSS'S LAW

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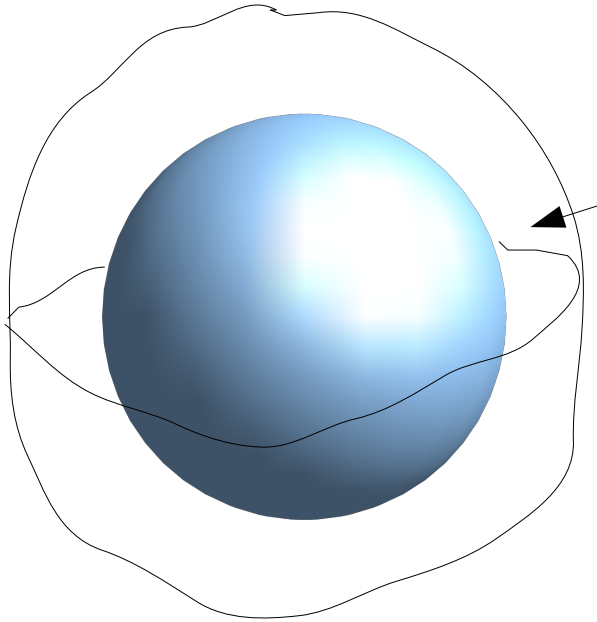

Complicated continuous charge distribution

To find the electric field, enclose the charge distribution in some imaginary surface (a "Gaussian Surface") - the surface let's you setup the integral and enclosed charge more easily.

(I've used a badly drawn sphere here)

ELECTRIC POTENTIAL, WORK, ETC.

WORK DONE BY AN ELECTRIC FORCE (J):

$$W = \int \vec{F} \cdot d\vec{r}$$

DIFFERENCE IN POTENTIAL ENERGY: (J)

$$\Delta U_{AB} = -W_{AB} = -\int_A^B \vec{F} \cdot d\vec{r}$$

DIFFERENCE IN ELECTRIC POTENTIAL: (J/C = VOLTS)

$$\Delta V_{AB} = \Delta U_{AB} / q = -\int_A^B (\vec{F}/q) \cdot d\vec{r} = -\int_A^B \vec{E} \cdot d\vec{r}$$

STRATEGIES - 4

- Problem-solving
  - What is the source of electric field/force?
    - point charge, few charges, or continuous?
  - What is my coordinate system?
    - think about the problem and choose the one that makes life easiest
  - How do I write everything in terms of constants and geometry?
    - if you have a continuous distribution of charge, you have to integrate over something geometric
  - Is the electric field/force constant?
    - If so, life gets a lot easier