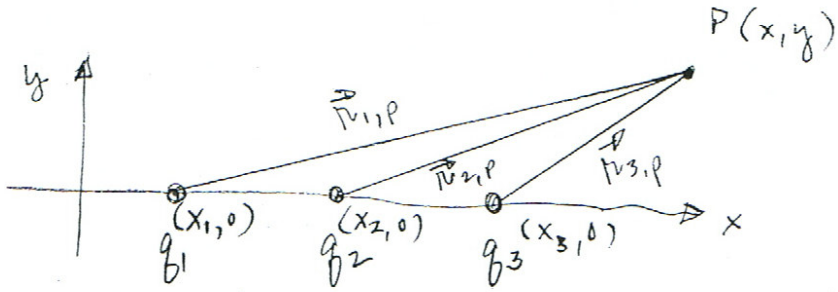
LEAD IN TO #5 (#11)

DIRECTION UNIT VECTORS



The arguments apply to $\vec{E}$ and $\vec{F}$. Below we are just discussing $\vec{E}$ but replace $\vec{E}$ with $\vec{F}$ and the arguments are the same

Usually we will be considering only positions on line with the other charges, ie. $y=0$

If $x > x_3$ all the direction vectors point to the right

$$\hat{r}_{1,P} = \hat{r}_{2,P} = \hat{r}_{3,P} = +\hat{i}$$

If $x < x_1$ all the direction vectors point to the left

$$\hat{r}_{1,P} = \hat{r}_{2,P} = \hat{r}_{3,P} = -\hat{i}$$

$$\vec{E}_P = \vec{E}_{1,P} + \vec{E}_{2,P} + \vec{E}_{3,P}$$

$$= \frac{KQ_1}{r_{1,P}^2}\hat{r}_{1,P} + \frac{KQ_2}{r_{2,P}^2}\hat{r}_{2,P} + \frac{KQ_3}{r_{3,P}^2}\hat{r}_{3,P}$$

If $x > x_3$ or $x < x_1$ AND $E_P = 0$ then you can ignore the direction unit vector.

If $x > x_3$ or $x < x_1$ AND $E_P \neq 0$ then the direction unit vectors need to be taken into consideration

If $x_1 < x \leq x_3$ then the direction unit vectors will not all be the same. The $\hat{i}$ vectors can only be used if the coord. of point P stays between a given pair of charges.

If x can be anywhere on the x-axis the full direction vectors are needed ie. $\hat{r}_{i,P} = \vec{r}_{i,P} / |\vec{r}_{i,P}|$.
This will take care of any sign changes.