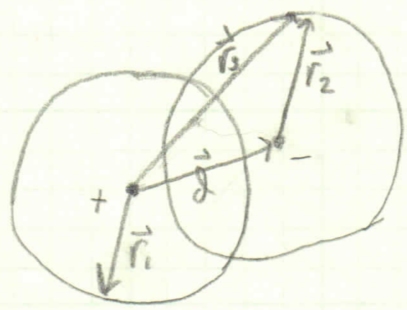
2.18



$$\vec{r}_3 = \vec{d} + \vec{r}_2$$

$$\hat{r}_3 = \frac{\vec{d} + \vec{r}_2}{|\vec{d}+\vec{r}_2|} = \frac{\vec{d} + |\vec{r}_2|\hat{r}_2}{|\vec{d}+\vec{r}_2|}$$

$$\hat{r}_2 = \frac{\vec{r}_2}{|\vec{r}_2|}$$

$$\Rightarrow \frac{|\vec{d}+\vec{r}_2|\hat{r}_3 - \vec{d}}{|\vec{r}_2|} = \hat{r}_2$$

for just $\vec{r}_1$, $\vec{E}_1 = \frac{|\vec{r}_3|\rho}{3\varepsilon_0}\hat{r}_3$

for $\vec{r}_2$, $\vec{E}_2 = -\frac{|\vec{r}_3 - \vec{d}|\rho}{3\varepsilon_0}\hat{r}_2$

$$\hat{r}_2 = \frac{|\vec{r}_3|\hat{r}_3 - \vec{d}}{|\vec{r}_2|}$$

then for the region of overlap, w/ $\vec{r}_1 = \vec{r}_3$

$$\vec{E}_{overlap} = \vec{E}_1 + \vec{E}_2 = \frac{|\vec{r}_3|\rho}{3\varepsilon_0}\hat{r}_3 - \frac{|\vec{r}_2|\rho}{3\varepsilon_0}\hat{r}_2$$

$$= \frac{|\vec{r}_3|\rho}{3\varepsilon_0}\hat{r}_3 - \frac{\rho}{3\varepsilon_0}|\vec{r}_2|\frac{|\vec{r}_3|\hat{r}_3 - \vec{d}}{|\vec{r}_2|} = \frac{\rho}{3\varepsilon_0}\vec{d}$$