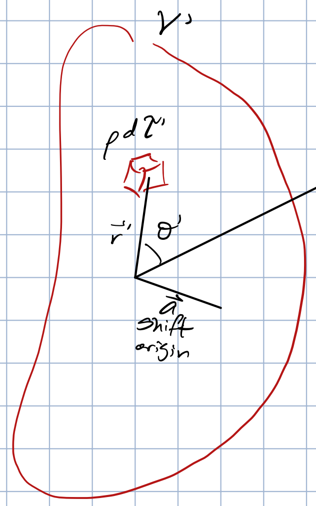


$$V(\vec{r}) = \frac{1}{4\pi\epsilon_0} \int_{V'} \frac{\rho(\vec{r}')}{R} \, d\tau'$$

$$= V_{mono}(\vec{r}) + V_{dipole}(\vec{r}) + \dots$$

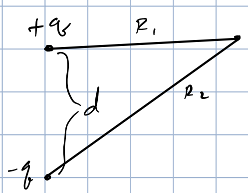
$\vec{r}$ depends on origing

potential @ P doesn't depend on origin, but each term does

Total charge Q doesn't depend on origin

Dipole moment: origin dependent if $Q \neq 0$ else isn't dependent

$$\int_{V'} (\vec{r}' + \vec{a}) \rho \, d\tau = \int_{V'} \vec{r}' \rho \, d\tau + \vec{a} \int_{V} \rho \, d\tau$$



Exact: $V = \frac{1}{4\pi\epsilon_0} q \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$

$V = V_{dipole,2} + V_{quad,2}$

approximate: $V = V_{dipole,2} \approx \frac{1}{4\pi\epsilon_0} \frac{1}{r_2^2} \vec{p}_2 \cdot \vec{r}_2'$ [?]

perfect dipole when $d \to 0$

polarization: dipole moment/area