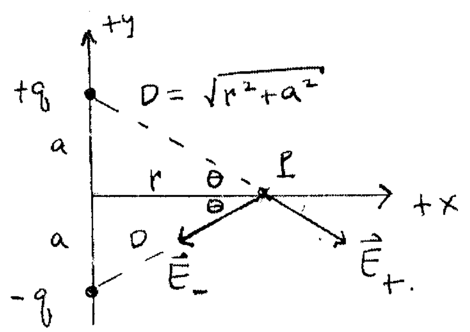
TURN OFF KEYPADS!!!

4. EXAMPLE: Consider an electric dipole made up of two charges with equal magnitudes q but opposite signs. Let $+q$ be at $(0,a)$ while let $-q$ be at $(0,-a)$.



$$\vec{E}=\vec{E}_+ +\vec{E}_- = E_+\cos\theta\,\hat{i}-E_+\sin\theta\,\hat{j}-E_-\cos\theta\,\hat{i}-E_-\sin\theta\,\hat{j}$$

Equation 2: $\vec{E}=\hat{i}(E_+ - E_-)\cos\theta-\hat{j}(E_+ + E_-)\sin\theta$

Equation 3: $E_+ = k_e q/D^2 = E_-$

From Equation 3, Equation 2 becomes

$$\vec{E}=-\hat{j}(E_+ + E_-)\sin\theta=-\hat{j}(2E_+)a/D=\left(-\hat{j}\right)\frac{2k_e q}{D^2}\frac{a}{D}$$

$$\vec{E}=\left(-\hat{j}\right)2a\frac{k_e q}{D^3}=\left(-\hat{j}\right)\frac{k_e(2a)q}{\left(r^2+a^2\right)^{3/2}}$$

For very large r ($r>>a$),

$$\vec{E}\approx-\hat{j}k_e\frac{2aq}{\left(r^2\right)^{3/2}}=\left(-\hat{j}\right)k_e\frac{p}{r^3}$$ where p = electric dipole moment $\equiv(2a)q$

=(distance between the charges)×(charge)

II. Electric field due to a continuous distribution