

16. From the figure below it is clear that the net electric field at point P points in the $-\hat{j}$ direction. Its magnitude is

$$\begin{aligned} \left| \vec{E}_{\text{net}} \right| &= 2E_1 \sin \theta = 2 \left[k \frac{q}{(d/2)^2 + r^2} \right] \frac{d/2}{\sqrt{(d/2)^2 + r^2}} \\ &= k \frac{qd}{[(d/2)^2 + r^2]^{3/2}} \end{aligned}$$

where we use k for $1/4\pi\epsilon_0$ for brevity. For $r \gg d$, we write $[(d/2)^2 + r^2]^{3/2} \approx r^3$ so the expression above reduces to

$$\left| \vec{E}_{\text{net}} \right| \approx k \frac{qd}{r^3} .$$

Since $\vec{p} = (qd)\hat{j}$,

$$\vec{E}_{\text{net}} \approx -k \frac{\vec{p}}{r^3} .$$

