Name .....

Quiz 7
PH361

$\vec{p} = \int \vec{r'} \rho(r') d\tau'$
$\vec{F} = (\vec{p} \cdot \vec{\nabla}) \vec{E}$
$E = \frac{1}{4\pi\epsilon_0} \frac{1}{r^3} (3\vec{p} \cdot \hat{r}\, \hat{r} - \vec{p})$
$\vec{\nabla} t = \frac{\partial t}{\partial r} \hat{r} + \frac{1}{r} \frac{\partial t}{\partial \theta} \hat{\theta} + \frac{1}{r \sin\theta} \frac{\partial t}{\partial \phi} \hat{\phi}$
$\hat{r} = \sin\theta \cos\phi\, \hat{x} + \sin\theta \sin\phi\, \hat{y} + \cos\theta\, \hat{z}$
$\hat{\theta} = \cos\theta \cos\phi\, \hat{x} + \cos\theta \sin\phi\, \hat{y} - \sin\theta\, \hat{z}$
$\hat{\phi} = -\sin\phi\, \hat{x} + \cos\phi\, \hat{y}$

1. A dipole $\vec{p}$ is a distance r from a point charge q, and oriented so that $\vec{p}$ makes an angle θ with the vector $\vec{r}$ from q to $\vec{p}$. Write the initial step in obtaining the expression for the force on $\vec{p}$. I don't want to see a calculation beyond this first step. I do want an expression which contains all the terms so that someone in calc II could get the answer from your expression.

$$\vec{F}_{on\,p} = (\vec{p} \cdot \vec{\nabla}) \vec{E}$$

↖ field from pt. charge

$$\vec{E} = \frac{1}{4\pi\epsilon_0} q \frac{(x\hat{x} + y\hat{y} + z\hat{z})}{(x^2 + y^2 + z^2)^{3/2}}$$

$$\vec{p} = p_x \hat{x} + p_y \hat{y} + p_z \hat{z}$$

$$\vec{\nabla} = \hat{x} \frac{\partial}{\partial x} + \hat{y} \frac{\partial}{\partial y} + \hat{z} \frac{\partial}{\partial z}$$

$$\vec{F}_{on\,p} = \left(p_x \frac{\partial}{\partial x} + p_y \frac{\partial}{\partial y} + p_z \frac{\partial}{\partial z} \right) \vec{E}$$