6.1) Calculate the torque exerted on the square loop shown in Fig. 6.6 due to the circular loop (assume r is much larger then a or b). If the square loop is free to rotate, what will its quilibrium orientation be?

6.5) A uniform current density $\vec{\mathbf{J}} = J_0\hat{\boldsymbol{z}}$ fills a slab straddling the yz plane, from $x = -a$ to $x = +a$. A magnetic dipole $\vec{\mathbf{m}} = m_0\hat{\boldsymbol{x}}$ is situated at the origin.

a) Find the force on the dipole, using Eq. 6.3.

b) Do the same for a dipole pointing in the y direction: $\vec{\mathbf{m}} = m_0$
haty.

c) In the *electrostatic* case, the expressions $\vec{\mathbf{F}} = \vec{\boldsymbol{\nabla}}\left(\vec{\mathbf{p}} \cdot \vec{\mathbf{E}}\right)$ and $\vec{\mathbf{F}} = \left(\vec{\mathbf{p}} \cdot \vec{\boldsymbol{\nabla}}\right)\vec{\mathbf{E}}$ are equivalent (prove it), but this is *not* the case for the magnetic analogs (explain why). As an example, calculate $\left(\vec{\mathbf{m}} \cdot \vec{\boldsymbol{\nabla}}\right)\vec{\mathbf{B}}$ for the configurations in (a) and (b).