Homework 3

Problem 1. Consider a Compton scattering event ($\gamma + e^- \to \gamma + e^-$) taking place at a time in which the electrons are non-relativistic and share the same temperature as the photons. Let $\vec{p}$, $\vec{q}$ be the initial momenta of the incoming photon and electron, and $\vec{p'}$, $\vec{q'}$ be the final momenta of the outgoing photon and electron. Show that energy exchange between the electron and photon can be approximated as

$$E_e(q) - E_e(q') \simeq \frac{(\vec{p'} - \vec{p}) \cdot \vec{q}}{m_e}. \tag{1}$$

Hints: i) use the conservation of momentum; ii) show that $q \gg p, p'$.