Practice Problems Related to Quantum Statistical Mechanics

1. In the notes we claim that

$$v(p) = \frac{p}{m} \left[1 + \left(\frac{p}{mc} \right)^2 \right]^{-1/2} . \tag{1}$$

The Lorentz factor is defined as $\gamma = [1 - v^2(p)/c^2]^{-1/2}$. Derive the relation between γ and p/m. Does your result make sense?

2. For photons, you should be able to write the pressure as a function of the photon number density as $P \propto n^{\Gamma}$. What is Γ? What implications does this have for the stability of stars that are supported by radiation pressure?