1. (15 points) Demonstrate that the difference in optical path between two emerging rays in a Fabry-Perot interferometer is $2d n_f \cos(\theta)$, where $d$ is the distance between the plates, $n_f$ is the index of refraction of the medium between the plates, and $\theta$ is the angle of the incident light with respect to the outside surfaces of the plates. Make sure to draw a figure to explain your answer. *(Hint: Have a look at Chapter 9 in Hecht's Optics)*

2. (25 points) (a) Calculate the signal-to-noise ratio (SNR) per pixel in the case of a 1-hour CCD observation of a galaxy with a photon flux of 1000 photons/second/pixel and a sky background of 10,000 photons/second/pixel. Assume that the detector has a quantum efficiency of 80%, a read-out noise of 5 electrons and negligible dark current. (b) How long would you need to expose if you wish to double this SNR? (c) What happens to the SNR if the quantum efficiency is halved?

*Due: December 12, 2006*