Undergrads: Do HW problem 2 and the design problem. As always, you can do the extra HW for extra credit.

Remember you can work in groups if you prefer, but state clearly who else was in your group on the front page.

HW 1) Telephoto lens system (again)
Consider the lens system below, consisting of a positive and a negative lens with an intermediate stop. Using your yu program or any of our other paraxial ray-tracing methods, find the effective focal length of this system. Now, find the image distance, locations and sizes of the stop, pupils, windows, and angular field of view if the object is at 400 mm (to the left of lens 1). Make a reasonably accurate sketch of the system including at least the primary marginal and chief rays and several rays. Now find the principal planes and make a second sketch of the Gaussian equivalent system (just principal planes and EFL). Trace rays on this second system showing it is equivalent to the first.
2) Design an afocal Keplerian telescope with magnification -2 to image a 5 mm object with 2 micron resolution in green light (0.5 micron). Locate the aperture stop appropriately to give a telecentric imaging condition. Where are the entrance and exit pupils? You wish to build the shortest system possible with lenses no faster than F/1. Size the lenses appropriately to put the field stop at the object. Where are the entrance and exit windows? Show the complete system prescription including the marginal and chief rays.

Design problem: Your boss comes to you with problem 2 above and tells you a big customer wants to order a zillion of this product, BUT the marketing department has determined that you can’t afford the F/1 lenses originally designed and you must instead back off to no faster than F/2. The wavelength is non-negotiable, but some relaxation of technical specs (size, resolution, etc) might be acceptable. Unfortunately, marketing doesn’t know exactly which specs you can relax or by how much (that’s why they get the big offices, after all).

Prepare for a meeting with the customer by calculating some design trade-offs that will help them guide you to the best compromise solution. Computer plots of specifications are likely to be useful. What system would you recommend (give its specs and prescription).