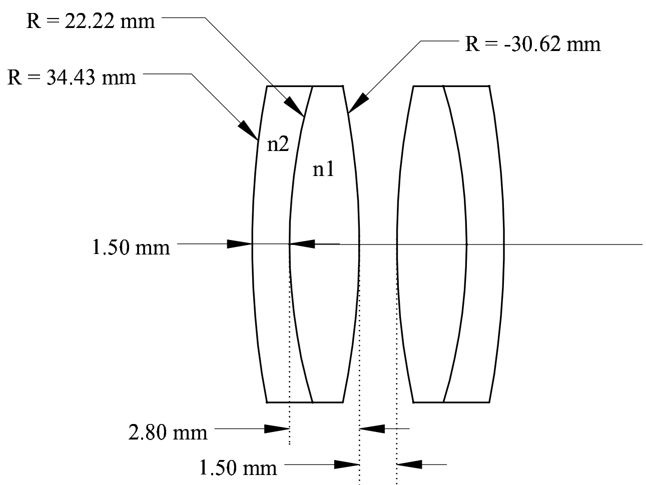
Phys 531 Assignment 2 Due September 12

1. Saleh and Teich Problem 1.4-1, page 40. Along with discussing the imaging properties of the composite lens, find the system focal length, the front and back focal lengths, and the locations of the principal points.

2. Saleh and Teich Problem 1.4-2, page 40. You may assume that $\alpha^2 y^2 \ll 1$, and you can use equations (1.3-9) and (1.3-10) without rederiving them. Don't forget that the system matrix includes the front and back surfaces.

3. The figure below shows the optical layout of a Plössl eyepiece, which is a lens system commonly used in good telescopes and microscopes. Suppose the dimensions and radii of curvature are as given, with the second doublet identical to the first but with reversed orientation. The indices of refraction are $n_1 = 1.5189$ and $n_2 = 1.6771$.
(a) Compute the vertex-to-vertex system matrix. This is most easily done with a computer.
(b) Find the principal planes and the focal length of the system.



4. Determine which of the following functions is a solution of the wave equation. For those that are solutions, find the wave speed c.

(a)
$$u(z,t) = \frac{z}{t}$$

(b)
$$u(z,t) = z^2 + v^2 t^2$$

(c)
$$u(z,t) = e^{-(z^2+v^2t^2)}$$

(d)
$$u(z,t) = \sin kz \cos \omega t$$

(e)
$$u(\mathbf{r},t) = \frac{1}{x+y+2z-vt}$$

(Of these, only (d) is physically interesting; the rest are meant to help you gain familiarity with how the wave equation works.)