OPTI 435/535 Homework #4 Due: November 23, 2021

Undergrads do problems 1 through 3
Grads do all four problems

1. Show that a biconic surface can be written as:

$$(sag)\ f(r) = \frac{r^2/R_{eff}}{1 + \left[1 - \left(K_{eff} + 1\right) r^2/R_{eff}^2\right]^{1/2}}$$

   where R_{eff} and K_{eff} are the effective Radius of Curvature and effective Conic Constant, respectively along a given meridian. What are the expressions for R_{eff} and K_{eff}?

2. An astigmatic cornea can be approximated as a biconic surface. Suppose the radius of curvature is 7.8 mm along the vertical meridian and 8.0 mm along the horizontal meridian, and the conic constant is –0.25 in all directions. Create color maps of the axial and instantaneous powers (in diopters) of this surface (NOTE: You can use the results of question 1 and just determine the radial derivatives here). In addition, plot the difference in elevation (or sag) in mm between this surface and a sphere with a radius of curvature of 7.899 mm.

3. Suppose a myopic person with a prescription of -3.00D wants to get LASIK. When they are evaluated, their anterior corneal radius is measured to be 8.00 mm. What does the radius of the cornea need to be after surgery to correct their refractive error? Based on the Munnerlyn formula, how deep is the ablation for a treated area 6 mm in diameter?

**********Grads Only**********

4. Design a doublet corrects the longitudinal chromatic aberration of the eye. The doublet should have zero power so that an object at infinity still focuses on the retina. However, the dispersions of the glasses in the doublet should be chosen to help cancel the chromatic aberration of the eye. Plot the residual chromatic aberration of the eye/doublet system.