
Contemporary Microscopy and Biophotonics

BioEn 498/599, Phys 427B

Problem Set #3

Due 4/27/2016

- Magnifying Glass.** In class we experimented with a magnifying glass. Please explain (and calculate) the phenomena we observed. Fix the distance between your eye and the object to 1 m. Starting with a 100-mm-focal-length lens close to the object and moving the lens towards your eye, you first observe the object right-way-up and growing in magnification. A little past a focal length, the object magnification diverges. As you continue to move the glass, the image reappears, flipped and blurry and shrinks in size. Eventually the image can be focussed again and continues to shrink as you move the glass towards your eye. (Please stop before you get a headache.) A schematic picture of the optical system representing your eye is shown in figure 1. To represent the scenario described, let $s_{oA} + s_{iA} + s_{oB} = 1$ m. The focal length of the lens in your eye can be adjusted to bring objects between infinity and the near point (25 cm) into focus (unaided by the lens). In your eye, the distance between the lens and the retina is roughly 2 cm.
 - Plot the intermediate real or virtual image position $s_{oA} + s_{iA}$ as a function of the magnifying glass position s_{oA} .
 - What is the observed range of focal lengths that the lens of the eye can take as a consequence of accommodation?
 - Plot the focal length of the lens in your eye (as a function of the magnifying glass position s_{oA}) necessary to bring the image into focus (regardless of whether this is physiological).
 - At what magnifying glass positions does the image become blurry?
 - What focal length does the lens take when the image cannot be brought into focus?
 - Define the magnification as the ratio of the size of the image on your retina with and without the magnifying glass (aided and unaided). Plot the magnification as a function of the magnifying glass position s_{oA} (making the unphysiological assumption that the image is always in focus.)

