UCA Department of Physics and Astronomy

PHYS 3345: OPTICS

Assignment 06: Chapter 05
DUE: February 29, 2008

Spring 2008

Work each problem neatly and completely. Unless otherwise noted, each problem is worth **3 points**. You should solve on green engineering paper or blank unruled paper. You must include sufficient demonstration of your problem solving process. If a problem is to be solved by inspection, state this. If graphs or plots are required, you should use an appropriate tool for their construction (there are several respectable options available on the computers in LSC 114).

1. Hecht, problem 5.5.
2. Hecht, problem 5.32
3. For a diverging lens, construct a derivation of Newton's lens equation: $x_o x_i = f^2$.
4. Hecht, problem 5.24.
5. Hecht, problem 5.38.
6. The images above are taken from the same two-mirror kaleidoscope. What is the angle between the mirrors?
7. You are constructing a kaleidoscope using *three* mirrors instead of two. The three mirrors are to be joined to form a triangle in the barrel of the scope. To achieve a perfectly symmetric set of images (i.e., there are no fractional images, or cut-off portions), what are the allowable mirror geometries? Explain! Sketches work well here.

The following questions are not assigned for grading, but you should be able to work these sorts of problems without difficulty. Chapter 5 problems 8, 12–14, 19–23, 25–28, 52–55, 63, 64, 67, 68. Essentially, you should be able to solve numerically for object distance, image location, focal length, image height, magnification, or some combination thereof regardless of whether it's convex or concave, mirror or lens.

Review Questions

These are not assigned for grading, but they are the sort of conceptual questions that you should be able to address adequately if they were to show up on an exam.

1. Be able to construct accurate ray diagrams for converging, diverging, and systems of lenses.
2. Know the difference between real and virtual images.
3. Hecht, Problem 5.43
4. What is longitudinal (as opposed to transverse) magnification? Why is M_L negative for a thin lens?
5. Distinguish between an aperture stop and a field stop.
6. Why might you choose to increase or decrease the f/# of your camera lens (assuming you have a variable aperture)?
7. Be able to construct accurate ray diagrams for concave and convex mirrors.
8. Why are objects in mirror closer than they appear? You know, in your side-view mirror.
9. What is the difference between a dispersing and a reflecting prism?
10. Briefly describe the accommodation of the human eye.
11. Near point vs far point?
12. Myopia vs hyperopia? What sort of lens to correct which vision defect? Why?