Phys 375 – Monday/Wednesday sections – Prof. Fuhrer
Homework #3, due in class week of October 1-3, 2007

1) The normal human eye can focus on objects at distances ranging from 25 cm to infinity. The distance from lens to retina is about 1.7 cm. What is the range of focal lengths of the lens of the eye?

2) Use a ruler and pencil and paper to find the image distances and magnifications for the following two situations. You must draw these by hand, and use the measured distances to find the image distances and magnifications! You may check your results with the thin-lens equation.

A) An object of height 2 cm at a distance 8 cm from a converging lens of focal length 5 cm.

B) An object of height 2 cm at a distance 8 cm from a diverging lens of focal length 5 cm.

3) A lightbulb is placed at x = 0 cm on an optical bench. A diverging lens of unknown focal length is placed at x = 15 cm. A converging lens of focal length 10 cm is placed at x = 25 cm. A screen is placed at x = 55 cm and shows a well-focused image of the light bulb filament.

A) What is the focal length of the diverging lens?

B) What is the *lateral* magnification of the image?

C) Is the image upright or inverted?

4) You construct an astronomical telescope with using a converging lens of focal length 20 cm to form an image of an object at infinity, and a second converging lens (eyepiece) of focal length 5 cm placed beyond the image to magnify that image. You wish to place the second lens such that the image is at the near point of the eye (25 cm) when the eye is close to the lens.

A) Where should you place the second lens?

B) What is the *angular* magnification of the telescope?

C) Is the image upright or inverted?

5) A converging lens is used to form an image at s' of an object at s. Suppose the object has finite thickness; i.e. it extends from s to $s + ds$. Show that the *longitudinal* magnification of the object $ds'/ds = -M^2$, where $M = -s'/s$ is the *lateral* magnification.