University of Calgary
Winter semester 2007

PHYS 471: Optics

Homework assignment 1

Due January 22, 2007

Problem 1.1. You are looking at a three-meter-deep swimming pool at an angle 45° to horizontal. How deep will the swimming pool appear?

Problem 1.2. For each of the following systems, make a drawing of the rays that generate the image (do use a pencil and a ruler), characterize the image, determine its distance from the surface of the optical instrument and the magnification.

a) Concave spherical mirror of radius 10 cm, the object 3 cm away from the surface;

b) Concave spherical mirror of radius 10 cm, the object 15 cm away from the surface;

c) Convex spherical mirror of radius 10 cm, the object 3 cm away from the surface;

d) Convex spherical lens of focal length 10 cm, the object 5 cm away from the surface;

e) Convex spherical lens of focal length 10 cm, the object 30 cm away from the surface;

f) Concave spherical lens of focal length 10 cm, the object 5 cm away from the surface.

Problem 1.3. Propose a design (i.e. optical material and curvature radii) for the lenses in Problems 1.2(e) and 1.2(f).

Problem 1.4. A near-sighted, absent minded physics professor went for a walk in the evening and got lost. Because he left his glasses at home, he was unable to read street signs and ended up wandering around the city all night. Will the professor's wife believe this story? Assume the eyeball diameter of $a = 25$ mm, the diameter of the pupil $b = 7$ mm, the refraction index of the vitreous humor close to that of water. The lettering on street signs is $d = 0.1$ m, the viewing distance is $L = 2$ m. The professor normally wears prescription eyeglasses of power $1/f = -7$ diopters. How can the professor argue that in the morning he was able to find his way back home?