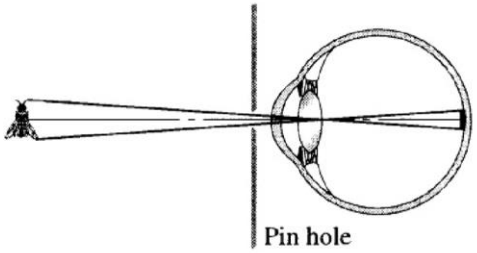
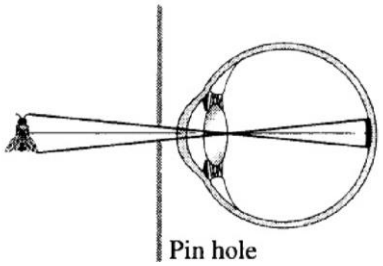
Exercise III

Optics

Problem 1:

The following figures shows a pin hole in an opaque screen being used for something practical. Explain what's happening and why it works. Try it.





Problem 2:

If a photograph of a moving merry-go-round is perfectly exposed, but blurred, at 1/30 s and f/11, what must the diaphragm setting be if the shutter speed is raised to 1/120 s in order to "stop" the motion?

Problem 3:

7 Problem Suppose we wish to make a microscope (that can be used with a relaxed eye) out of two positive lenses, both with a focal length of 25 mm. Assuming the object is positioned 27 mm from the objective, (a) how far apart should the lenses be, and (b) what magnification can we expect?

Problem 4:

Figure bellow shows two identical concave spherical mirrors forming a so-called confocal cavity. Show, without first specifying the value of d, that after traversing the cavity two times the system matrix is

$$\begin{bmatrix} \left(\frac{2d}{r}-1\right)^2-\frac{2d}{r} & \frac{4}{r}\left(\frac{d}{r}-1\right) \\ 2d\left(1-\frac{d}{r}\right) & 1-2\frac{d}{r} \end{bmatrix}$$

Then for the specific case of d = r show that after four reflections the system is back where it started and the light will retrace its original path.