

Modern Optics: Homework 12

Due: 30 September 2015

1 Spherical mirror: image production

A point source is located on the optical axis at 1.2m from a mirror whose radius is 1.0m. Rays leave the source at various angles, θ_1 measured from the optical axis, are reflected and pass back through the optical axis. Use the set up in class (calculating $\theta_i, x, \theta_2, \dots$) to answer the following, performing the calculations to three significant figures.

- a) Without using any approximations, determine where the reflected ray passes through the optical axis if $\theta_1 = 3.00^\circ$.
- b) Without using any approximations, determine where the reflected ray passes through the optical axis if $\theta_1 = 10.00^\circ$.
- c) Without using any approximations, determine where the reflected ray passes through the optical axis if $\theta_1 = 25.00^\circ$.
- d) Compare the results. Over what distance is the image spread?

2 Bennett, *Principles of Physical Optics*, 4.4, page 135.

3 Bennett, *Principles of Physical Optics*, 4.61, page 196.

4 Lens construction

Suppose that lenses are constructed from glass with index of refraction 1.50. The lenses must be constructed so that the focal length is 10 cm

- a) If the lens has two convex surfaces of with the same radius of curvature, determine the radius needed to produce this focal length.
- b) Suppose that the lens has one convex surface and another flat surface; this is a planoconvex lens. Determine the radius of curvature needed to produce this focal length.