BI-B1) A plane wave traveling along the z axis interferes with a point source at the origin. At some position $z_0 >> \lambda$ and over a small region near the axis, derive:

a.) The expression for the radius of the fringes in the xy plane.

b.) The area of each fringe in the xy plane, where area is defined between lines of maximum irradiance.

BI-B2) You are given five mutually coherent point sources of equal amplitude, each separated a distance d as shown in the drawing. Assume $z >> x$, y, and d. Also assume that the initial phases of the five spherical wavefronts are equal.

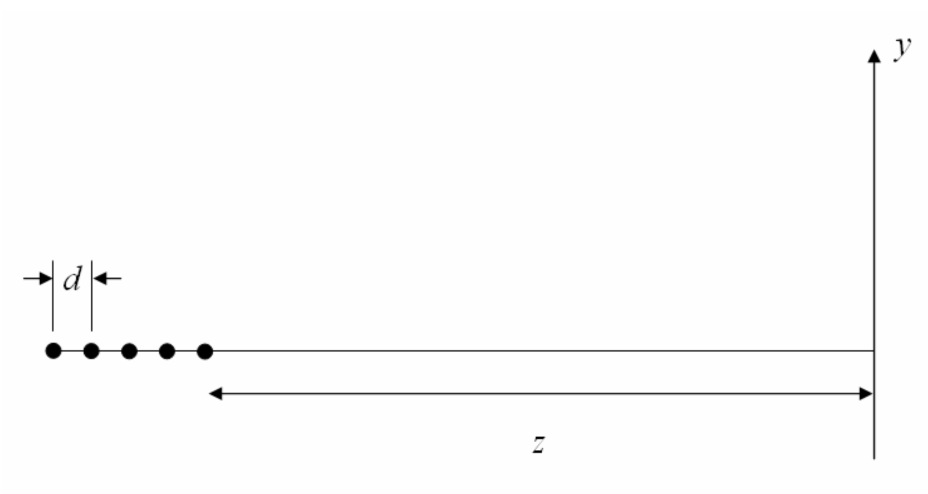
a.) Show that the irradiance in the xy plane goes as

$$\frac{\sin^2\left(2.5k\mathrm{OPD}_0\right)}{\sin^2\left(0.5k\mathrm{OPD}_0\right)}$$

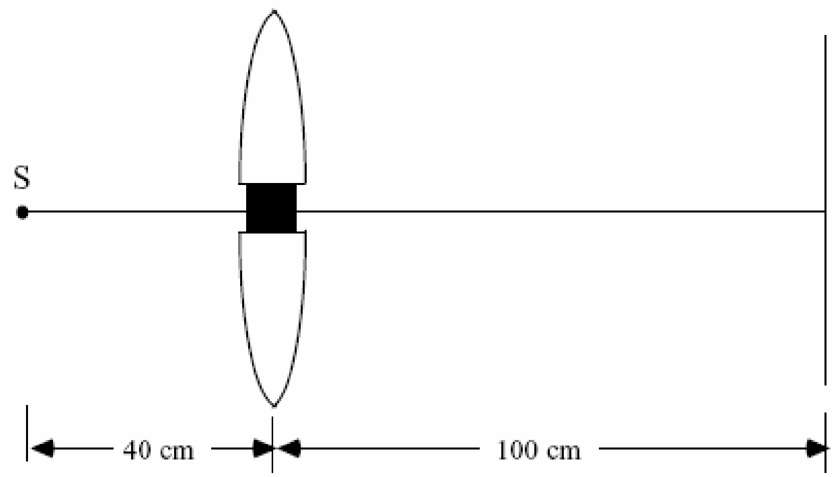
where $k = 2\pi/\lambda$ and OPD_0 is the optical path difference measured at the xy plane between fields emitted from adjacent points.

b.) Determine OPD_0

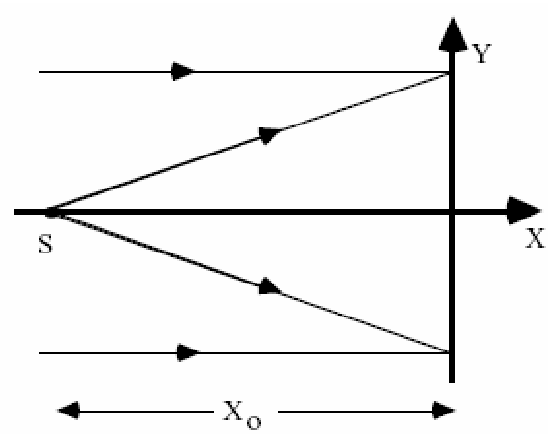
c.) Determine the shape of the fringes in the x-y plane.



BI-B3) Billet's split lens. A converging lens of 20 cm focal length is cut in two by means of a plane passing through its optic axis. A source S of monochromatic light lies in this plane 40 cm from the lens, as shown in the figure. As the half-lenses are gradually moved apart, the image of the source splits into two images, acting as coherent sources. The region between the two half-lenses is blocked. Determine the width of the interference fringes observed on the screen at a distance of 100 cm when the lenses are 0.5 mm apart. Assume $\lambda = 500$ nm.

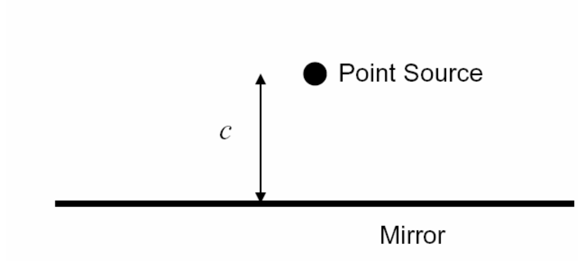


BI-B4) A spherical wave coming from a source a distance xo from an observation screen is interfered with a plane wave propagating normal to the observation screen. Show that the areas of the annular regions between consecutive bright fringes are equal if |Xo| >>|Y| or |Z|.



BI-B5) A point source is placed distance *c* above a mirror surface. Light reflected from the mirror exhibits a π phase change.

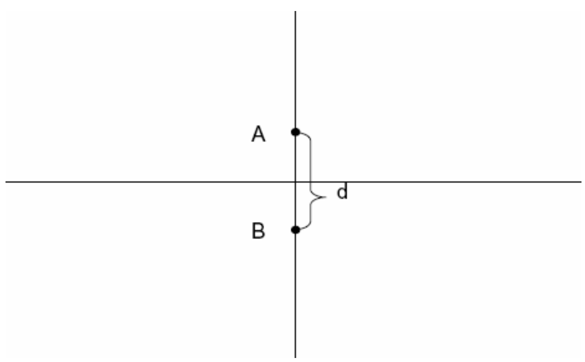
a.) If λ= 500 nm and *c* = 1 μm, plot the fringe field (plots of maximum irradiance) in the plane of the drawing.
b.) Indicate the direction of power flow on the diagram in (a).
c.) If the separation between the mirror and the point source increases, do the number of fringes increase or decrease? Justify your answer.



BI-B6) A linearly polarized source is used with a Young's two-pinhole interferometer. The same amount of light is transmitted through each pinhole. A half-wave plate is placed over one pinhole. The fast axis of the half-wave plate makes an angle θ with respect to the direction of polarization of the light incident upon the half-wave plate. A perfect polarizer is placed just before the observation plane. The transmission axis of the polarizer is in the direction of polarization of the light coming from the pinhole without the half-wave plate. What is the fringe visibility as a function of θ?

BI-B7) Two point sources A and B emit perfect spherical waves. The sources are in phase.

a.) Sketch the resulting fringe pattern over the pane of the paper if the distance d is two wavelengths.
b.) How would your diagram change if source A is out of phase with source B by 180^0?



BI-B8)