Physics 2P51 Assignment 2
Due: Wednesday, February 26, 2020 in drop box across from MC B210a by 12:00pm (noon).

1. A glass lens 3.0 cm thick along the axis has one face of radius +5.0 cm and the other of radius +2.0 cm. The former face is on the left in contact with air while the latter is on the right in contact with a liquid of index 1.4. The refractive index of the glass is 1.5.

   (a) Find the first and second equivalent focal lengths, the front- and back-vertex focal lengths, and the positions of the two principal planes, H_1 and H_2 (measured with respect to the first surface and the second surface respectively). Use the matrix approach. Make sure that you have calculated your system matrix correctly by checking that the determinant is equal to one.

   (b) Draw a scale diagram of the lens and mark the locations of the focal points and the principal planes.

2. Show, using graphical ray tracing that:

   (a) when a real object lies between the center of curvature and the focal length of a concave mirror that the image is real, inverted and magnified.

   (b) for a convex mirror, with a real object, the image is virtual, erect and reduced in size.

3. A pinhole is placed 40 cm to the left of a spherical thin lens. A real image is formed 20 cm to the right of the lens. A cylinder is then added to the lens and a horizontal line image is formed 10 cm to the right of the two lenses. What is the power and orientation of the cylinder? (Assume the cylinder is thin, and is placed in contact with the spherical lens).