Homework is due in class. Do all problems and show your work. Credit is not given for answers only. You are welcome to work together, but be sure your homework is your work.

1. A spherical ball of index $n = 1.6$ is mounted between two media with indices of refraction of 1.33 and 1.5. The radius of the ball is 50 mm. Draw a sketch of your results.
   a) What is the system power?
   b) Where are the principal planes located relative to the respective vertices?
   c) What are the front and back focal distances?
   d) What is the separation between the principal points and the nodal points?

2. A 200 mm focal length optical system is to be constructed out of two thin lenses in air. The separation of the two lenses is 50 mm, and the back focal distance of the optical system is 100 mm. Determine the focal lengths of the two thin lenses.

3. A 10 mm high object is 300 mm to the left of the front vertex of a thick lens in air. The lens specifications are: $R_1 = 100$ mm, $R_2 = -75$ mm, $t = 12$ mm and $n = 1.55$. Draw a sketch of your results.
   a) What is the focal length of the lens?
   b) Where is the image located relative to the back vertex of the lens?
   c) What is the magnification and size of the image?