1. A small object faces the convex spherical glass window of a small water tank. The radius of curvature of the window is 5 cm. The inner back side of the tank is a plane mirror, 25 cm from the window. If the object is 30 cm outside the window, determine the nature of it's final image, ignoring any refraction due the thin glass window itself.

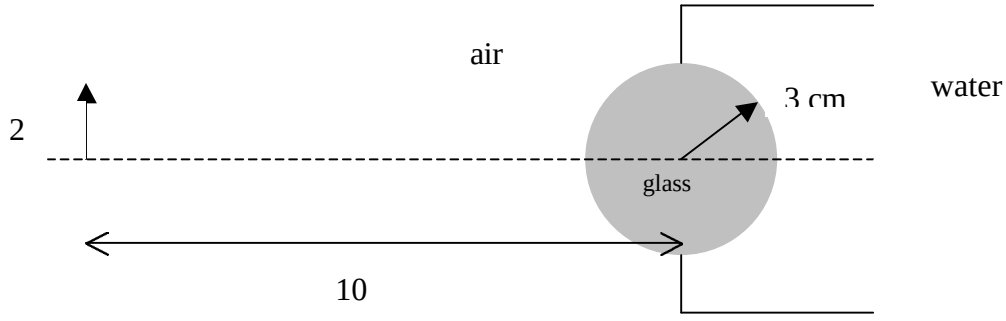
2. One side of a fish tank is built using a large-aperture thin lens made of glass (n=1.50). The lens is equiconvex with $|r_1| = |r_2| = 30cm$. A small fish in the tank is 20 cm from the lens when viewed from the side. Where does it appear when viewed through the lens? What is its magnification?

3. An object 10 cm tall is located 50 cm left of a lens of focal length +10cm. A second lens of focal length –10 cm is located 20 cm right of the first lens. A convex mirror of radius 20 cm is located 20 cm right of the second lens. Describe the final image produced by this system.

4. Consider the two lens system shown below. The first lens is of focal length +10 cm. The second lens is of focal length +20 cm. The distance between the lenses is 50 cm. The distance between the first lens and the final image (between the two lenses) is 31 cm. What is the original object distance? What is the overall magnification of the system? Is the orientation of the final image as shown below correct?

5. A glass sphere (n = 1.50) with a radius of 15 cm has a tiny air bubble 5 cm above its center. When the sphere is viewed along the axis containing the bubble what is the apparent depth of the bubble below the surface of the sphere?

6. A glass (n_g = 3/2) marble, having a radius of 3 centimeters, is used as a window in an otherwise opaque wall, which separates air (n_a = 1) and water (n_w = 4/3) as shown below. A 2 centimeter tall object is located 10 centimeters to the *left of the wall*. Describe the final image.



7. A compound lens such as that shown below is immersed in water. An object is placed in the water 100 cm left of this lens. Where is the final image produced by this lens?