Problem 4: Lens experiment

The apparatus consists of a symmetric biconvex lens, a plane mirror, water, a meter stick, an optical object (pencil), a supporting base and a right angle clamp. Only these parts may be used in the experiment.

a) Determine the focal length of the lens with a maximum error of $\pm$ 1 %.

b) Determine the index of refraction of the glass from which the lens is made.

The index of refraction of water is $n_w = 1.33$. The focal length of a thin lens is given by

$$\frac{1}{f} = (n-1) \cdot \left(\frac{1}{r_1} - \frac{1}{r_2} \right),$$

where n is the index of refraction of the lens material and r_1 and r_2 are the curvature radii of the refracting surfaces. For a symmetric biconvex lens we have $r_1 = -r_2 = r$, for a symmetric biconcave lens $r_1 = -r_2 = -r$.