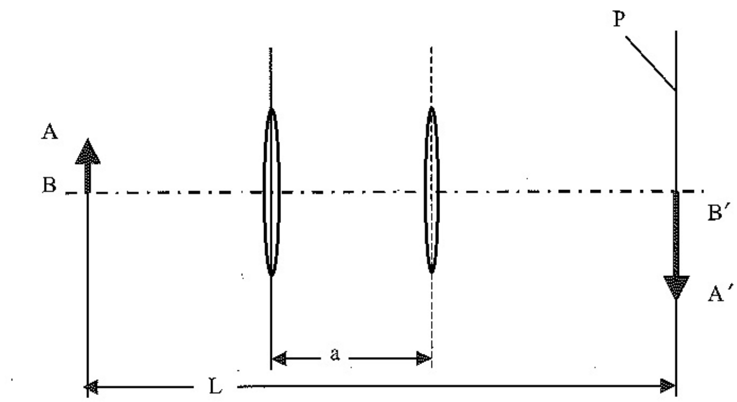
Homework #4 (due Sept. 23)

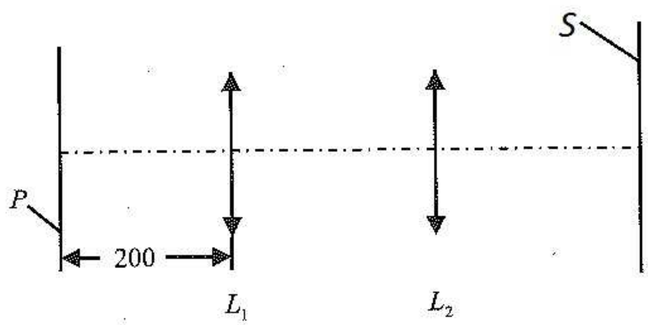
You can use these problems to practice for the first midterm test, although they are somewhat more complicated than what you should expect.

Problem 1 (15 points): *Method of measurement of focal length of a positive lens*. An image of an object AB created by a lens is displayed on a screen P distant from AB at L=135mm. Then the lens is moved from the initial position, 1, where the sharp image is observed at magnification M_1, to the position 2 where again the sharp image is observed on the same screen, but at magnification $M_2=1/M_1$. The distance between positions 1 and 2 is a=45mm. Using this information, find the focal length of the lens.



Problem 2 (10 points): A lens is made from glass of refractive index 1.5. It is meniscus-shaped, meaning that one surface is concave and the other convex. The concave surface has radius of curvature 2.00m, and the convex surface has radius 1.50m. Imagine the lens is placed on the z-axis with its concave surface facing left. Assign values (with signs) to the radii of curvature and use them to calculate the focal length of the lens. Reverse the lens and do it again. Does the focal length come out the same?

Problem 3 (15 points): The system of two thin lenses L_1 (focal length 100mm) and L_2 (focal length 20mm) forms an image of the object plane *P* on a screen *S* at magnification M=3. The distance between P and L_1 is 200mm. Find the location of all elements of the system.



Problem 4 (10 points): As you have seen in class, blocking a part of the lens makes the image dimmer, but does not distort its shape. Explain why this is happening.

Problem 5 (15 points): If a relatively thin glass plate (thickness *d* and refractive index *n*) is inserted between a camera lens and the photographic plate, show that the plate must be moved a distance *((n-1)/n)d* away from the lens for focus to be maintained.