Homework #2 (due Sept. 9)

Each problem is 10 points

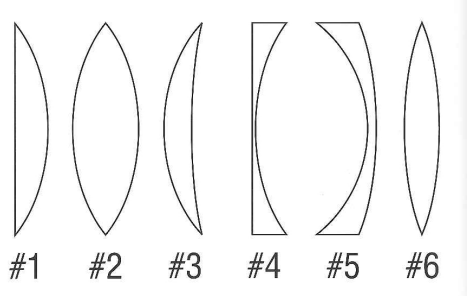
Textbook problems (modified): 2.7, 3.4, 3.9

Problem 2.7: A light ray travels through a pile of clear accurately parallel faced glass sheets, each in contact with its neighbors above and below. The glass sheets can have different refractive indices. If the angle of incidence of the ray is 45^o , what can you say about the direction of the ray when it emerges from the final sheet? Will it ever be the case that total internal reflection will prevent the ray traversing all the sheet? If yes, under what conditions?

Problem 3.4: An object is located 25cm from a converging lens whose focal length is 20cm. The object is 0.1cm in length lies *along* the optical axis. Where is the image is located and how long is it? Use ray tracing to check the image location.

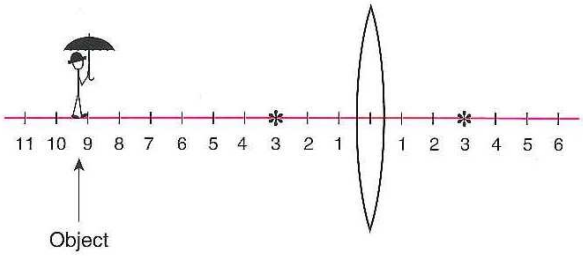
Problem 3.9: A biconcave lens made from glass of refractive index 1.65 has surface with radii of curvature 25cm and 45cm. What is the focal length of the lens?

A1. Identify which lenses are converging and which are diverging. Which converging lens has the *shortest* focal length?

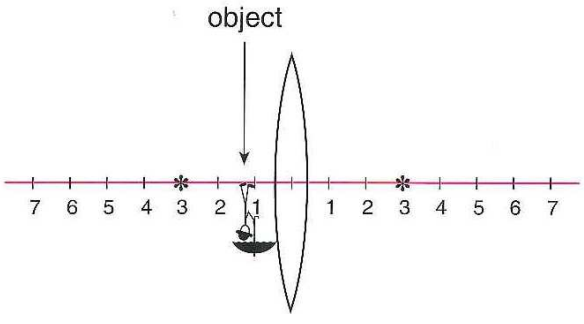


A2.The following lens has a focal length f=3cm (Foci are marked *) Draw the "magic rays" and find the position of the image graphically, and then use the lens formula to verify your results for the two object distances below. What is the magnification in each case?

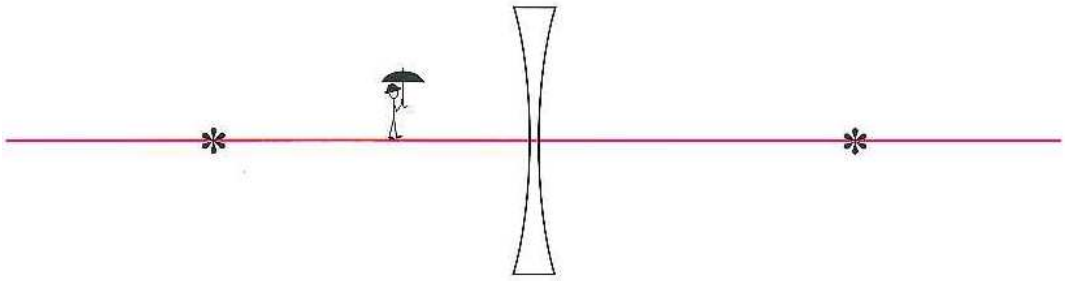
(a)



(b)



A3. Show the three “magic rays” from the top of the object through the lens. The symbol * marks the focal length on either side of the lens. Describe the image (real vs virtual, erect vs inverted).



Bonus question (extra credit): I took this image of my daughters in Norfolk art museum with a regular phone camera, and no photoshop has been used. Considering that I have only two children (no tweens!), try to guess how this image could be obtained.