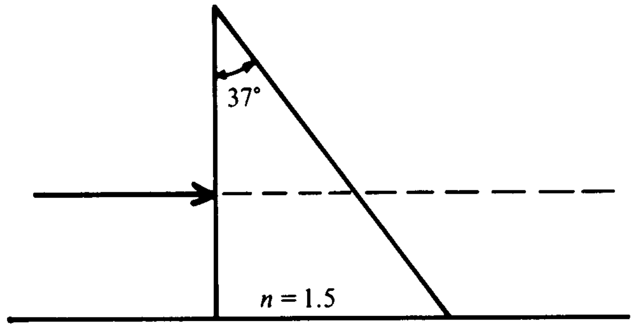


Figure I

1988B5. The triangular prism shown in Figure I above has index of refraction 1.5 and angles of 37°, 53°, and 90°. The shortest side of the prism is set on a horizontal table. A beam of light, initially horizontal, is incident on the prism from the left.

a. On Figure I above, sketch the path of the beam as it passes through and emerges from the prism.
b. Determine the angle with respect to the horizontal (angle of deviation) of the beam as it emerges from the prism.
c. The prism is replaced by a new prism of the same shape, which is set in the same position. The beam experiences total internal reflection at the right surface of this prism. What is the minimum possible index of refraction of this prism?

The new prism having the index of refraction found in part (c) is then completely submerged in water (index of refraction = 1.33) as shown in Figure II below. A horizontal beam of light is again incident from the left.

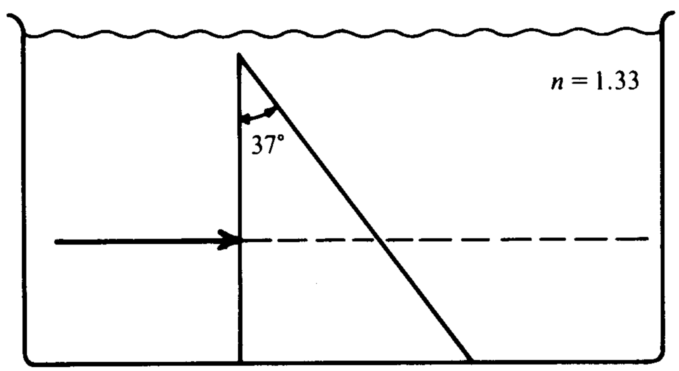
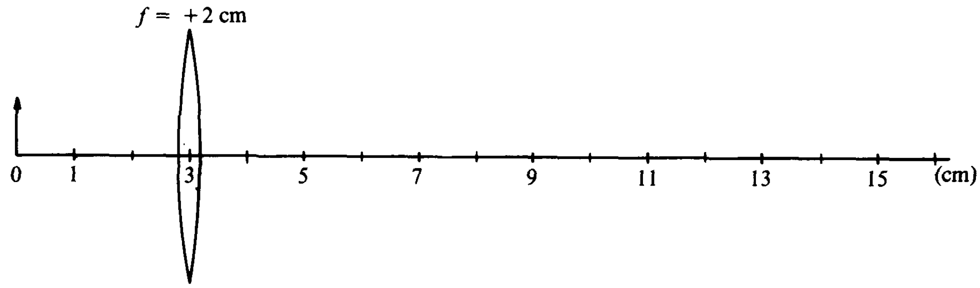


Figure II

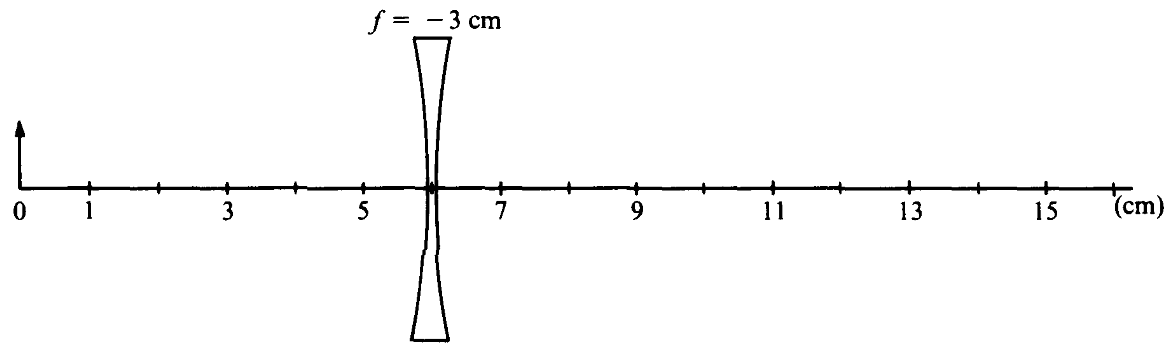
d. On Figure II, sketch the path of the beam as it passes through and emerges from the prism.
e. Determine the angle with respect to the horizontal (angle of deviation) of the beam as it emerges from the prism.

1986B6. An object is placed 3 centimeters to the left of a convex (converging) lens of focal length f = 2 cm, as shown below.



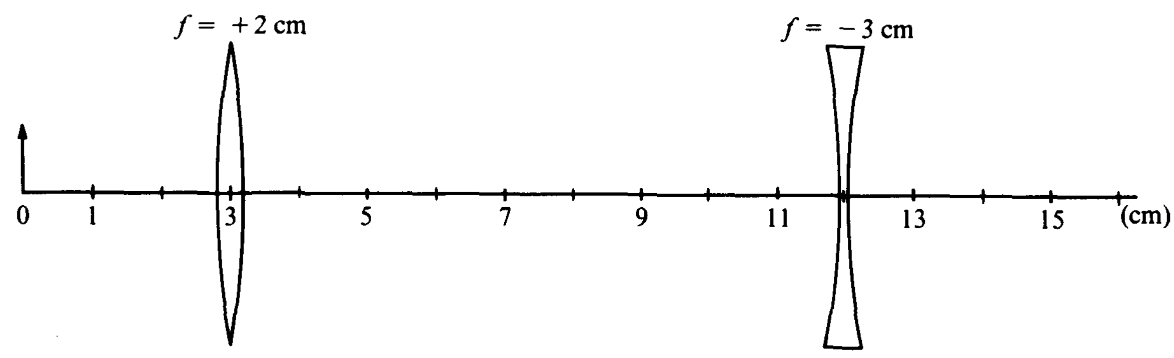
a. Sketch a ray diagram on the figure above to construct the image. It may be helpful to use a straightedge.
b. Determine the ratio of image size to object size.

The converging lens is removed and a concave (diverging) lens of focal length f = –3 centimeters is placed as shown below.



c. Sketch a ray diagram on the figure above to construct the image.
d. Calculate the distance of this image from the lens.
e. State whether the image is real or virtual.

The two lenses and the object are then placed as shown below.

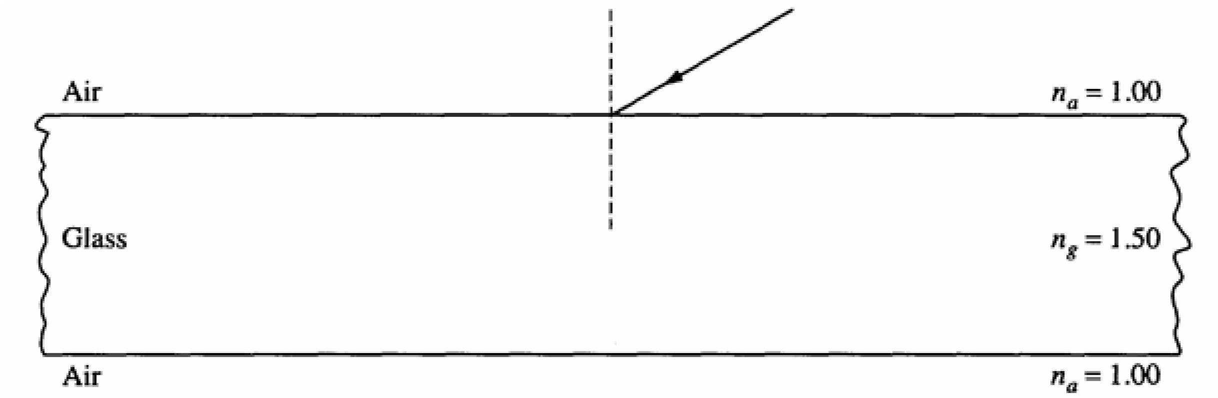


f. Construct a complete ray diagram to show the final position of the image produced by the two-lens system.

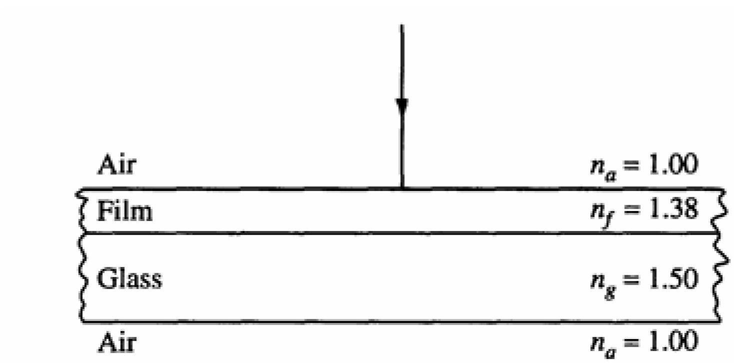
2000B4.

A sheet of glass has an index of refraction n_g = 1.50. Assume that the index of refraction for air is n_a = *1.00.*

a. Monochromatic light is incident on the glass sheet, as shown in the figure below, at an angle of incidence of 60°. On the figure, sketch the path the light takes the first time it strikes each of the two parallel surfaces. Calculate and label the size of each angle (in degrees) on the figure, including angles of incidence, reflection, and refraction at each of the two parallel surfaces shown.



b. Next a thin film of material is to be tested on the glass sheet for use in making reflective coatings. The film has an index of refraction n_f = 1.38. White light is incident normal to the surface of the film as shown below. It is observed that at a point where the light is incident on the film, light reflected from the surface appears green (λ = 525 nm).



i. What is the frequency of the green light in air?
ii. What is the frequency of the green light in the film?
iii. What is the wavelength of the green light in the film?
iv. Calculate the minimum thickness of film that would produce this green reflection.