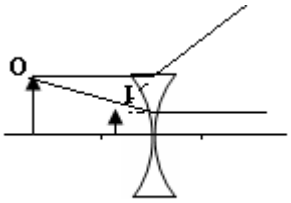
Physics 6C – 1st Midterm (Spring 2017)

Dr. Nassar (1 ½ hour exam -- 3x5 card allowed)

NAME:_____

1. (10 pts) An object of height 8 cm is placed 45 cm to the left of a concave lens of radius of curvature equals to 30 cm.
(a) Calculate the position and size of the image formed by the lens. Is the image real or virtual? Explain.

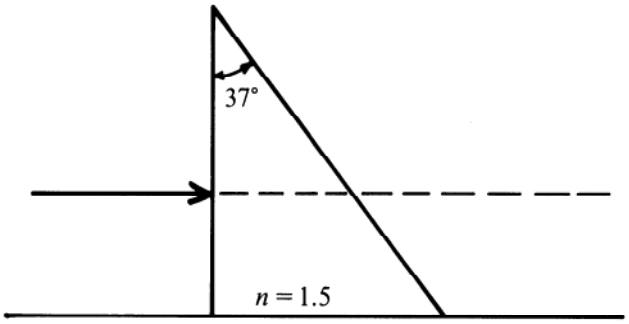


$\frac{1}{-15}=\frac{1}{45}+\frac{1}{d_i}\therefore d_i=-11.25cm$ Virtual ($d_i < 0$)

(b) Draw a ray diagram to show the formation of the image by the lens. Clearly show principle rays.

Virtual (rays do not intersect)

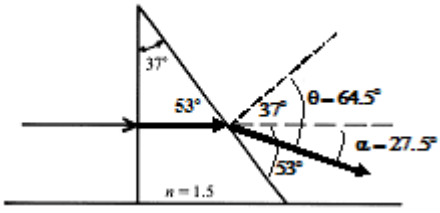
2. (10 pts) The triangular prism shown in the figure below has an index of refraction 1.5 and angles 37°, 53°, and 90°. The shortest side of the prism is set on a horizontal table. A beam of light, initially horizontal, is incident on the prism from the left.



(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.

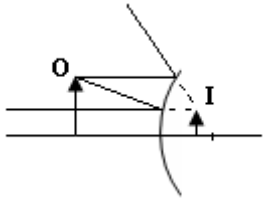
You may use for the index of refraction of air (around the prism) $n_{air} = 1$.



(1) $\sin\theta=(1.5)\sin 37^o\ \therefore\theta=64.5^o$

From the diagram above, $\alpha=64.5^o-37^o=27.5^o$

3. (10 pts) An object is placed 7.5 cm from a convex mirror of focal length 18 cm.
a) Draw a ray diagram for this situation.



b) Is the image real or virtual?

Virtual

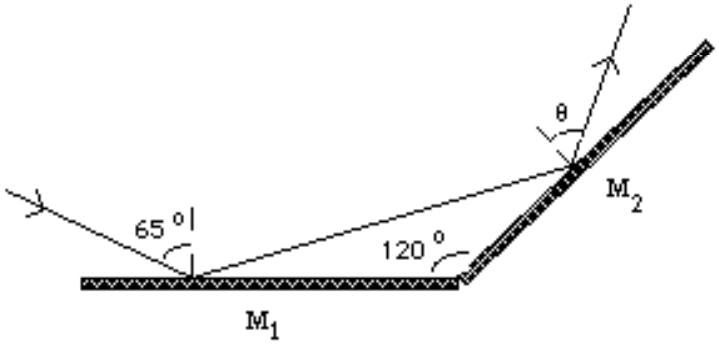
c) How far is the image <u>from the nearest focal point</u>?

$\frac{1}{-18} = \frac{1}{7.5} + \frac{1}{d_i} \therefore d_i = -5.3cm$ which implies that the image is (18 – 5.3)cm = 12.7 cm from the focal point.

d) By what factor is the image enlarged or reduced?

$M = -\frac{d_i}{d_o} = -\frac{(-5.3)}{7.5} = 0.71$ (image is reduced)

4. (5 pts) Two plane mirrors are separated by 120°, as the drawing illustrates. If a ray strikes mirror M_1, at a 65° angle of incidence, at what angle θ does it leave mirror M_2?



Angle = 55°