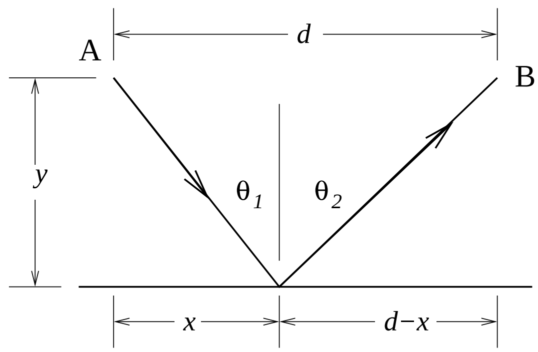
Physics 422 - Spring 2015 - Assignment #5
Due Wednesday, April 1st

1. Use Fermat's principle to derive the law of reflection,

$$\sin\theta_1 = \sin\theta_2,$$

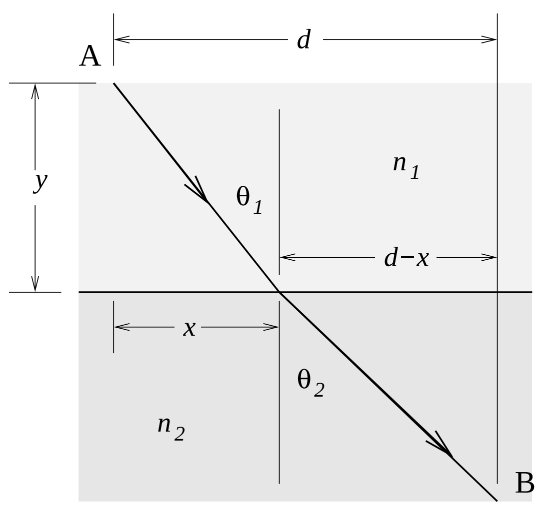
using the geometry shown below and the requirement that the optical path length between points A and B be stationary with respect to x.



2. Use Fermat's principle to derive the law of refraction,

$$n_1\sin\theta_1 = n_2\sin\theta_2,$$

using the geometry shown below and the requirement that the optical path length between points A and B be stationary with respect to x.



3. **(a)** Calculate the distance to the object focal point, f_o, and the image focal point f_i for a single spherical concave refracting surface with radius of curvature $R = -10$ cm, made of a material with index of refraction $n_2 = 1.5$, and with air ($n_1 = 1$) on the object side.

(b) Calculate f_o and f_i for the case where the air is replaced with water ($n_1 = 1.33$).

4. Two positive thin lenses with focal lenghts f_1 and f_2 are placed a distance $d = f_1 + f_2$ apart. If light of intensity I_0 is incident on the system along the optical axis from very far away, *ie.*, $s_o \rightarrow \infty$, what is the intensity of the light emerging from the second lens?