Problem Set 3

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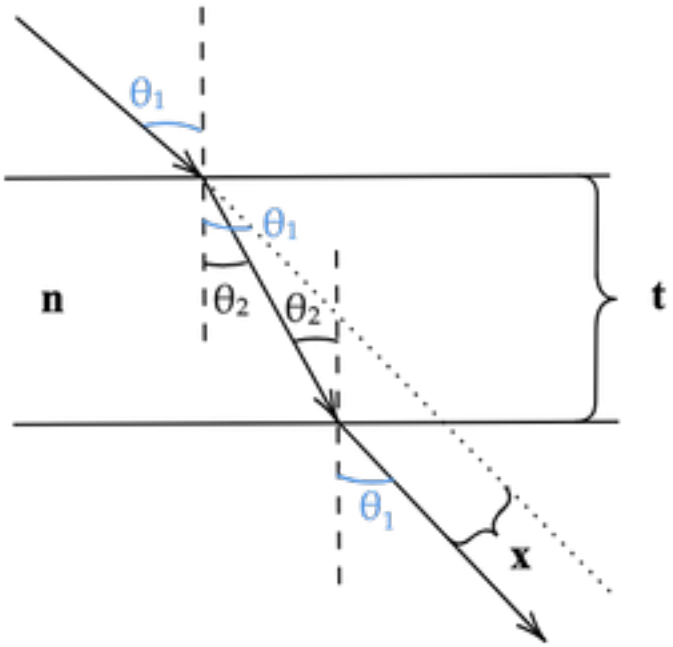

Show that the displacement x of an emerging light ray $x = \frac{t \sin \theta_1 - \theta_2}{\cos \theta_2}$ can be approximated as $\frac{t\theta(n-1)}{n}$ assuming that the incident ray is paraxial.

$$\frac{t \sin \theta_1 - \theta_2}{\cos \theta_2}$$

$$\frac{t(\sin \theta_1 \cos \theta_2 - \cos \theta_1 \sin \theta_2)}{\cos \theta_2}$$

$$\frac{t(\theta_1 \cos \theta_2 - \theta_2 \cos \theta_1)}{\cos \theta_2} \text{ by paraxial ray approximation}$$

$$\frac{t\theta(\cos \theta_2 - \cos \theta_1)}{\cos \theta_2}$$

$$t\theta(\frac{\cos \theta_2}{\cos \theta_2} - \frac{\cos \theta_1}{\cos \theta_2})$$

$$t\theta(\frac{n}{n} - \frac{1}{n}) \text{ by Snell's law}$$

$$\frac{t\theta(n-1)}{n}$$