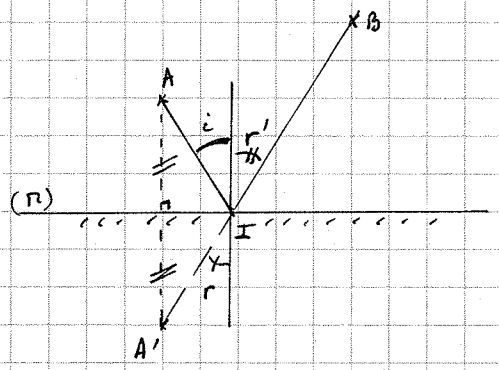
Exercise 1 - Homework 1

1) Reflection



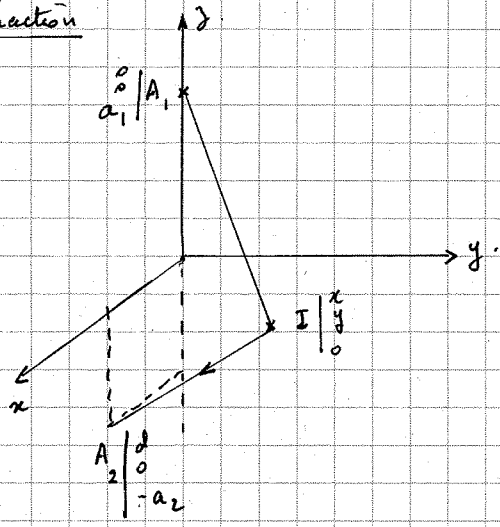
$L_{AB} = n(AI + IB)$

$= n(A'I + IB)$ where $A' = S_\Pi(A)$

L_{AB} minimal $\Leftrightarrow$ $I \in (A'B)$, so $r' = r$

$A' = S_\Pi(A) \Rightarrow r = i$

2) Refraction



$\vec{A_1I} \begin{vmatrix} x \\ y \\ -a_1 \end{vmatrix}$ $\vec{IA_2} \begin{vmatrix} d-x \\ -y \\ -a_2 \end{vmatrix}$

$$G = \frac{A_1I}{v_1} + \frac{IA_2}{v_2}$$

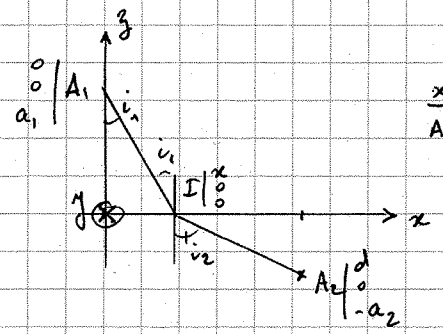
$$G = \frac{1}{v_1}\sqrt{x^2+y^2+a_1^2} + \frac{\sqrt{(d-x)^2+y^2+a_2^2}}{v_2}$$

$$\frac{\partial G}{\partial x} = \frac{x}{v_1}\frac{1}{\sqrt{x^2+y^2+a_1^2}} + \frac{x-d}{v_2}\frac{1}{\sqrt{(d-x)^2+y^2+a_2^2}}$$

$$\frac{\partial G}{\partial y} = \frac{y}{v_1}\frac{1}{\sqrt{x^2+y^2+a_1^2}} + \frac{y}{v_2}\frac{1}{\sqrt{(d-x)^2+y^2+a_2^2}}$$

$$\begin{cases} \frac{\partial G}{\partial x} = 0 \Leftrightarrow \frac{x}{v_1 A_1I} + \frac{x-d}{v_2 A_2I} = 0 \\ \frac{\partial G}{\partial y} = 0 \Leftrightarrow y = 0 \end{cases}$$

$\frac{\partial G}{\partial x} = \frac{\partial G}{\partial y} = 0 \Leftrightarrow I \in (x,0,z)$ and $n_1 \sin i_1 = n_2 \sin i_2$.



$\frac{x}{A_1I} = \sin i_1$

$\frac{d-x}{A_2I} = \sin i_2$