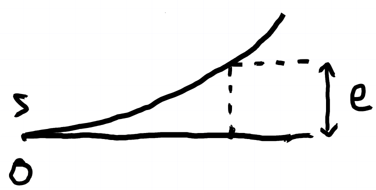
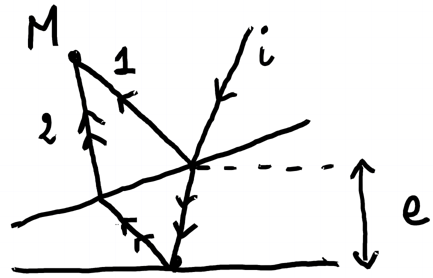
Ex 4 : Anneaux de Newton

1)

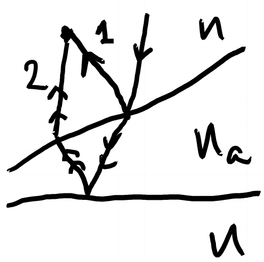


$\Rightarrow$



Les franges sont localisées au voisinage de la surface de la lentille.

2) $\delta = 2e$ ⇝ calcul géométrique.



1er dioptre : n/n_a $\quad n > n_a$

$\Rightarrow$ rayon 1 pas inversé.

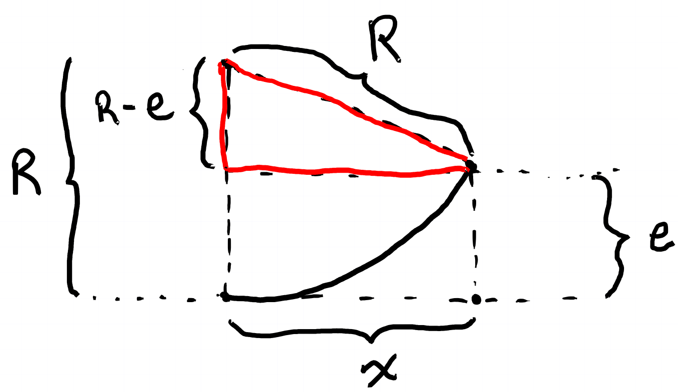
2ème dioptre : n_a/n $\quad n_a < n$

$\Rightarrow$ rayon 2 est inversé

Donc $\delta = 2e + \frac{\lambda}{2}$

3) $\delta' = \delta + 2e_0$

$\delta' = 2e_0 + 2e + \frac{\lambda}{2}$



$(R-e)^2 + x^2 = R^2$

$\cancel{R^2} - 2Re + e^2 + x^2 = \cancel{R^2}$

$x^2 + e^2 - 2Re = 0$ $\qquad e \ll R$

Donc $x^2 = 2Re \Rightarrow e = \frac{x^2}{2R} \Rightarrow 2e = \frac{x^2}{R}$

Alors, $\delta' = 2e_0 + \frac{x^2}{R} + \frac{\lambda}{2}$

4) Anneau noir → interférence destructive

$$\Rightarrow \delta' = \left(K + \frac{1}{2}\right)\lambda = K\lambda + \frac{\lambda}{2}$$

$$\Rightarrow K\lambda + \cancel{\frac{\lambda}{2}} = 2e_0 + \frac{x^2}{R} + \cancel{\frac{\lambda}{2}}$$

$$\boxed{K\lambda = 2e_0 + \frac{x^2}{R}}$$

1er anneau noir → $D_1 = 2{,}5$ mm → K_1

4ème anneau noir → $D_4 = 6{,}2$ mm → $K_4 = K_1 + 3$

1er : $x = \frac{D_1}{2}$ 4ème : $x = \frac{D_4}{2}$

$$\Rightarrow K_1\lambda = 2e_0 + \frac{D_1^2}{4R}$$

$$(K_1 + 3)\lambda = 2e_0 + \frac{D_4^2}{4R}$$

$$R = \frac{D_4^2 - D_1^2}{12\lambda} = 4{,}55 \text{ m}$$