OP016 - Focométrie des lentilles par la méthode de Bessel

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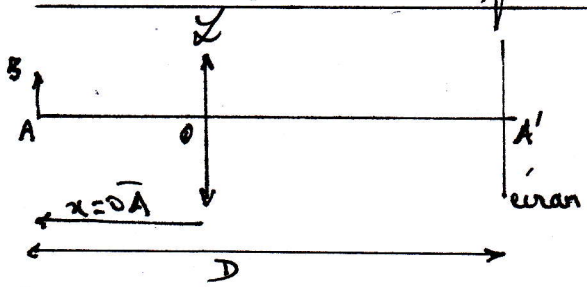
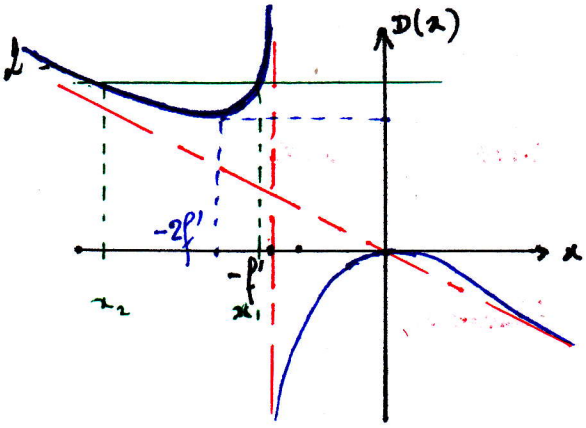


$A \xrightarrow{\mathcal{L}} A'$

Relation de conjugaison de Descartes : $\dfrac{1}{\overline{OA'}} - \dfrac{1}{\overline{OA}} = \dfrac{1}{f'}$

$\overline{OA'} = \overline{OA} + \overline{AA'} = x + D \rightarrow \dfrac{1}{x+D} - \dfrac{1}{x} = \dfrac{1}{f'} \longrightarrow \dfrac{x(x+D)}{-D} = f'$

$\rightarrow x^2 + Dx = -f'D \rightarrow \boxed{D(x) = \dfrac{-x^2}{x+f'}}\ (*)$ $\quad D'(x) = -x\,\dfrac{x+2f'}{(x+f')^2}$



x_1 et x_2 existent si $\begin{cases} D > 0 \\ D > D_{min} \end{cases}$

$\boxed{D_{min} = D(-2f') = 4f'}$

(*) : $D(x+f') = -x^2 \longrightarrow x^2 + Dx + Df' = 0$

admet pour racines $x_{1,2} = \dfrac{1}{2}\left(-D \pm \sqrt{D^2 - 4Df'}\right)$

D'où $\boxed{x_1 + x_2 = -D}$

3- Relation de grandissement de Descartes : $\gamma = \dfrac{\overline{OA'}}{\overline{OA}}$

* $\gamma_1 = \dfrac{\overline{O_1A'}}{\overline{O_1A}} = \dfrac{x_1 + D}{x_1} = \dfrac{-x_2 - D + D}{-x_2 - D} = \dfrac{x_2}{x_2 + D} = \dfrac{1}{\gamma_2}$

* $\gamma_2 = \dfrac{\overline{O_2A'}}{\overline{O_2A}} = \dfrac{x_2 + D}{x_2}$ $\quad$ D'où $\boxed{\gamma_1 = \dfrac{1}{\gamma_2}}$

4- $d = x_1 - x_2 = \dfrac{1}{2}\left(-D + \sqrt{D^2 - 4Df'}\right) - \dfrac{1}{2}\left(-D - \sqrt{D^2 - 4Df'}\right) = \sqrt{D^2 - 4Df'}$

$\rightarrow \boxed{f' = \dfrac{D^2 - d^2}{4D}}$