

Exo 4 TD SP5 Doublet de lentilles non afocal (suite)

Calculs avec Newton

$$1) \boxed{F_1' \xrightarrow{L_1} F_1} \quad \overline{F_2 F_1'} \cdot \overline{F_2' F_1} = -f_2'^2$$

$$\overline{F_2 F_1'} = \overline{F_2 O_2} + \overline{O_2 F_1'} = 2f_2' \quad \text{car } F_1' = F_2'$$

$$\Rightarrow \overline{F_2' F_1} = -\frac{f_2'^2}{2f_2'} \quad \overline{F_2' F_1} = -\frac{f_2'}{2} = -\frac{a}{2}$$

$$\boxed{F \xrightarrow{L_1} F_2} \quad \overline{F_1 F} \cdot \overline{F_1' F_2} = -f_1'^2$$

$$\overline{F_1' F_2} = -2f_2' \Rightarrow \overline{F_1 F} = \frac{f_1'^2}{2f_2'} = \frac{9a^2}{2a} \quad \overline{F_1 F} = \frac{9}{2}a$$

$$\overline{F_1 F} = \overline{F_1 O_1} + \overline{O_1 F} \Rightarrow \overline{O_1 F} = \frac{9}{2}a - f_1' = \frac{9}{2}a - 3a$$

$$\overline{O_1 F} = \frac{9}{2}a - \frac{6a}{2} \quad \boxed{\overline{O_1 F} = \frac{3}{2}a}$$

$$2) A \xrightarrow{L_1} A_1 \quad \overline{F_1 A} \cdot \overline{F_1' A_1} = -f_1'^2 \quad \textcircled{1}$$

$$A_1 \xrightarrow{L_2} A' \quad \overline{F_2 A_1} \cdot \overline{F_2' A'} = -f_2'^2 \quad \textcircled{2}$$

$$\textcircled{1} \quad \overline{F_1' A_1} = -\frac{f_1'^2}{\overline{F_1 A}} \quad \overline{F_1 A} = \overline{F_1 O_1} + \overline{O_1 A} = 3a - a = 2a$$

$$\overline{F_1' A_1} = -\frac{(3a)^2}{2a} = -\frac{9a^2}{2a} = -\frac{9}{2}a$$

$$\textcircled{2} \quad \overline{F_2' A'} = -\frac{f_2'^2}{\overline{F_2 A_1}} \quad \overline{F_2 A_1} = \overline{F_2 F_1'} + \overline{F_1' A_1} = \overline{F_2 F_2'} + \overline{F_1' A_1}$$

$$\overline{F_2 A_1} = 2a - \frac{9}{2}a = \frac{4-9}{2}a = -\frac{5}{2}a$$

$$\overline{F_2' A'} = -\frac{a^2}{-\frac{5}{2}a} \times 2 = \frac{2}{5}a$$

$$\overline{O_2 A'} = \overline{O_2 F_2'} + \overline{F_2' A'}$$

$$\overline{O_2 A'} = a + \frac{2}{5}a = \frac{7}{5}a$$

Avec Descartes pour le grandissement

$$\gamma_1 = \frac{\overline{O_1 A_1}}{\overline{O_1 A}}$$

$$\gamma_2 = \frac{\overline{O_2 A'}}{\overline{O_2 A_1}}$$

$$\overline{O_2 A_1} = \overline{O_2 O_1} + \overline{O_1 A_1}$$

$$= -2a - \frac{3a}{2}$$

$$= -\frac{4a-3a}{2}$$

$$= -\frac{a}{2}$$

$$\gamma_1 = -\frac{3a}{2} \times \frac{1}{(-a)} \quad \gamma_1 = \frac{3}{2}$$

$$\gamma_2 = \frac{7a}{5} \times \frac{2}{-7a} = -\frac{2}{5}$$

$$\gamma = \gamma_1 \gamma_2 = \frac{3}{2} \left(-\frac{2}{5}\right) \quad \gamma = -\frac{3}{5}$$