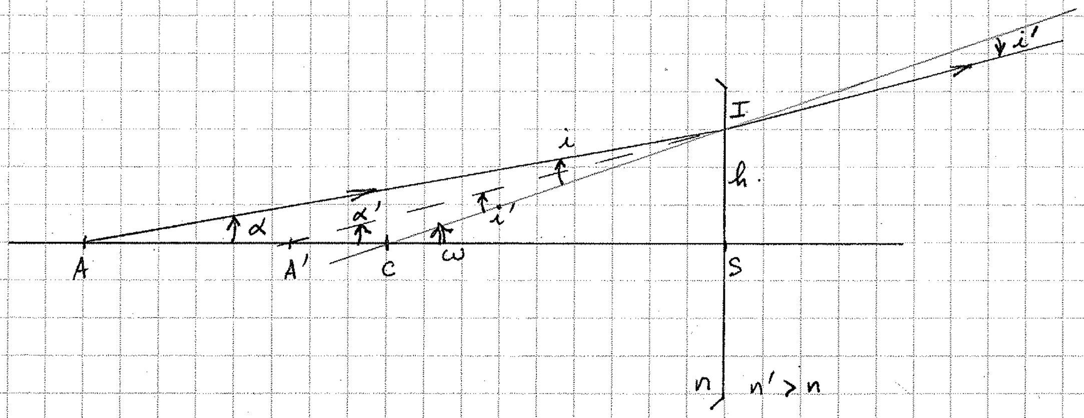
Exercise 1 - Homework 2.




In the paraxial regime, $n i = n' i'$

so $n(\alpha - \omega) = n'(\alpha' - \omega)$

Using
$$\left.\begin{aligned} \alpha &= -\frac{h}{x} \\ \alpha' &= -\frac{h}{x'} \\ \omega &= -\frac{h}{R} \end{aligned}\right\} \quad \text{with } x = \overline{SA}, \quad x' = \overline{SA'}, \quad R = \overline{SC}$$

we obtain: $n\left(\frac{1}{x} - \frac{1}{R}\right) = n'\left(\frac{1}{x'} - \frac{1}{R}\right)$

Thus: $\boxed{\frac{n}{x} - \frac{n'}{x'} = \frac{n - n'}{R}}$ ①

Exercise 2. Homework 2

Apply ① with $x = -\infty$ : $\frac{n'}{\overline{SF'}} = \frac{n' - n}{R} \Rightarrow \overline{SF'} = \frac{n'}{n'-n} R$.

$x' = \infty$ : $\frac{n}{\overline{SF}} = \frac{n - n'}{R} \Rightarrow \overline{SF} = \frac{n}{n-n'} R$

$$\frac{\overline{SF'}}{\overline{SF}} = -\frac{n'}{n} < 0$$

Calculate $\overline{CF}$ : $\overline{CF} = \overline{SF} - \overline{SC} = \frac{n}{n-n'} R - R = \frac{n'}{n-n'} R$

so $\overline{CF} = -\overline{SF'}$

Call $O$ = middle of $S$ and $C$ $\Rightarrow$ $\overline{OF} = \overline{OC} + \overline{CF} = -\overline{CO} - \overline{SF'}$
$= -(\overline{OS} + \overline{SF'})$

$\overline{OF} = -\overline{OF'}$

so $O$ is also middle of $F$ and $F'$

Furthermore, $F$ and $F'$ cannot be between $S$ and $C$ otherwise $\overline{SF}$ and $\overline{SF'}$ would have the same sign