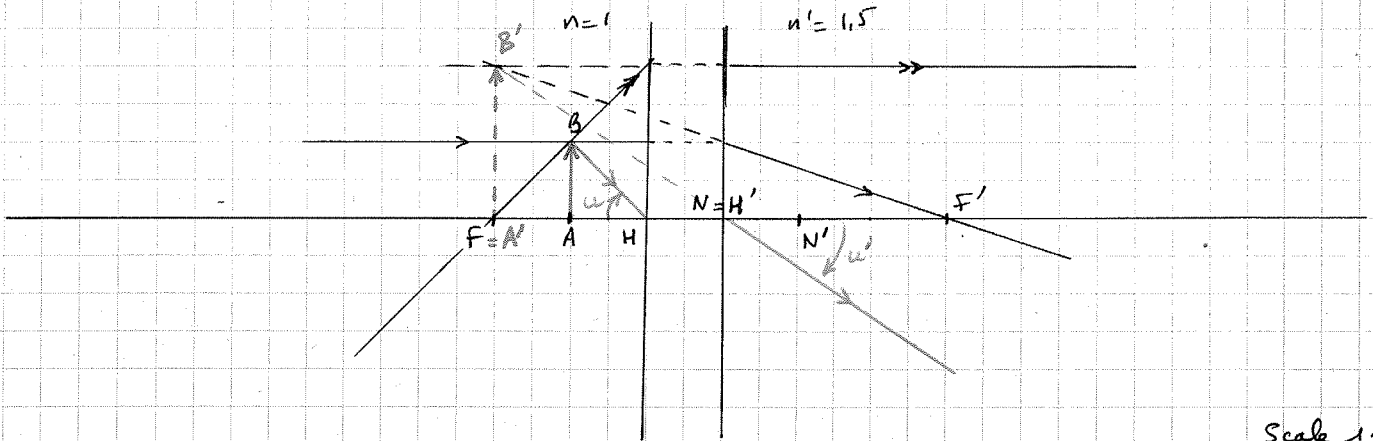


Exercise 1. Homework n°3

①



Scale 1:1

Positions of F and F' ?

$$B = -\frac{n}{f} = \frac{n'}{f'} \Rightarrow f = \overline{HF} = -\frac{1}{50\text{m}^{-1}} = -20\text{mm}$$

$$f' = \overline{H'F'} = \frac{1.5}{50\text{m}^{-1}} = +30\text{mm}$$

Positions of N and N' ?

$$\overline{FN} = f' \Rightarrow \overline{FN} = 30\text{mm} \Rightarrow N = H'$$

$$\overline{F'N'} = f \Rightarrow \overline{F'N'} = -20\text{mm}$$

(we can cross-check that $\overline{HN'} = \overline{NN'}$)

Position of A' ?

$$\overline{FA} \times \overline{F'A'} = f \cdot f' \Rightarrow \overline{F'A'} = \frac{-20 \times 30}{10\text{mm}} = -60\text{mm} \Rightarrow \underline{\underline{A' = F}}$$

Transverse magnification $(g_y)_{A \rightarrow A'}$

Using rays (AH) and (B'H')

$$m u = n' u' \quad (\text{Snell law})$$

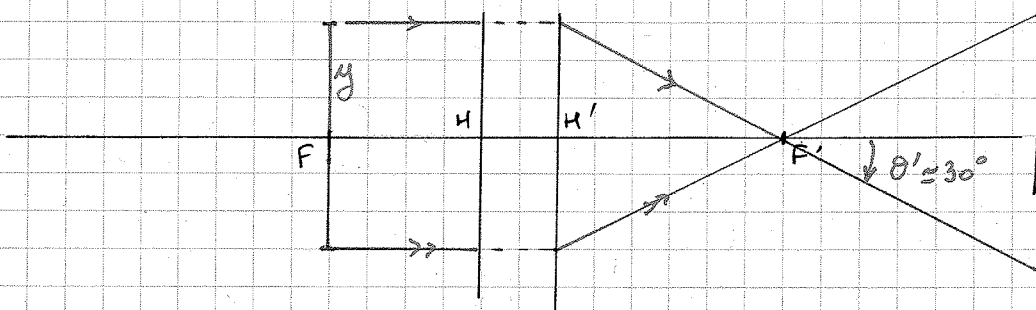
$$n \frac{\overline{AB}}{\overline{HA}} = n' \frac{\overline{A'B'}}{\overline{H'A'}}$$

$$\Rightarrow (g_y)_{A \rightarrow A'} = \frac{\overline{A'B'}}{\overline{AB}} = \frac{n}{n'} \frac{\overline{H'A'}}{\overline{HA}} = \frac{1}{1.5} \frac{-30}{-10}$$

$$(g_y)_{A \rightarrow A'} = \underline{\underline{+2}}$$

Image of a disc with radius $y = 15\text{mm}$ in the object focal plane.

\rightarrow image is at infinity with angular size



$$2\theta' = -\frac{2y}{f'}$$

$$|2\theta'| = 2 \frac{15}{30}$$

$$|2\theta'| = 2 \times 30^\circ$$

