

Exercise 5 - Homework 3

The dentist's mirror

$$\frac{1}{\overline{SA}} + \frac{1}{\overline{SA}'} = \frac{2}{R}$$

with $\overline{SA} = -15 \text{ mm}$
(The tooth is real! i.e. to the left of the mirror)

so
$$\frac{1}{\overline{SA}} \left(1 + \frac{\overline{SA}}{\overline{SA}'} \right) = \frac{2}{R}$$

Besides,
$$(g_y)_{A \rightarrow A'} = - \frac{\overline{SA}'}{\overline{SA}} \quad (\text{Descartes' formula})$$

so
$$\frac{1}{\overline{SA}} \left(1 - \frac{1}{(g_y)_{A \rightarrow A'}} \right) = \frac{2}{R}$$

This yields
$$R = \frac{2 \overline{SA}}{1 - \frac{1}{(g_y)_{A \rightarrow A'}}$$

For $\overline{SA} = -15 \text{ mm}$ and $(g_y)_{A \rightarrow A'} = +1.5$, we get $R = -90 \text{ mm}$

So, the mirror is concave

and
$$\overline{FA} = - \frac{f}{(g_y)_{A \rightarrow A'}} \quad (\text{Newton's formula})$$

so
$$\overline{FA} = \frac{R/2}{(g_y)} = \frac{-45}{+1.5}$$

$\overline{FA} = +30 \text{ mm} \rightarrow$ A is between F and S.

Let us cross-check with a figure to scale 1:1

