HW 27

① $\frac{1}{o} + \frac{1}{i} = \frac{1}{f}$ where $o = |x_1|$, $i = |x_2|$

$x_1 = -122$ cm
$y_1 = 3.89$ cm
$x_2 = -93.7$ cm

$f = \frac{o \cdot i}{o + i} \doteq 53.0$ cm

② $\frac{y_2}{y_1} = -\frac{i}{o} \Rightarrow y_2 = -\frac{i}{o} \cdot y_1 \doteq -2.99$ cm

③ $\frac{1}{o} + \frac{1}{i} = \frac{1}{f} = \frac{1}{o'} + \frac{1}{i'} = \frac{1}{o'} + \frac{1}{2i}$

$\frac{1}{o'} = \frac{1}{o} + \frac{1}{i} - \frac{1}{2i} = \frac{1}{o} + \frac{1}{2i}$

$\frac{y_2'}{y_1'} = \left(-\frac{i'}{o'}\right) = (-2i) \cdot \left(\frac{1}{o} + \frac{1}{2i}\right) = -\left(1 + 2\frac{i}{o}\right)$

$y_2' = -\left(1 + 2\frac{i}{o}\right) \cdot y_1' = -\left(1 + 2\frac{i}{o}\right) \cdot y_1 \doteq -9.87$ cm

④ $\frac{1}{o''} + \frac{1}{i''} = \frac{1}{f} \Rightarrow 1 + \frac{o''}{i''} = \frac{o''}{f} \Rightarrow 1 - \frac{y_1''}{y_2''} = \frac{o''}{f}$

$\therefore y_2'' = \frac{y_1}{1 - \frac{o''}{f}} \doteq 9.25$ cm $\quad (y_1 = y_1'')$

⑤ (b) The ray is NOT related to a position of focus ⇒ cannot go parallel with the axis!

HW 27-2

(1)

$$\frac{1}{s} + \frac{1}{s'} = \frac{1}{f} \Rightarrow s = \frac{s' \cdot f}{s' - f}$$ (Mirror equation)

where $\left.\begin{array}{l} s' = 28.1 \text{ cm} \\ f = +52 \text{ cm} \end{array}\right\} \Rightarrow s \doteq -61.13 \text{ cm}$

(2) Magnification formula:

$(y_2 = 4.3 \text{ cm})$ $\qquad \frac{y_2}{y_1} = -\frac{X_2}{X_1}$

~~[illegible]~~ $y_1 = \left(\frac{-X_1}{X_2}\right) \cdot y_2 \Rightarrow y_1 \doteq +9.36 \text{ cm}$

(3) Again:

$$s_{new} = \frac{s'_{new} \cdot f}{s'_{new} - f} \doteq -19.25 \text{ cm}$$

(4)

$$y_{2,new} = -\left(\frac{X_{2,new}}{X_{1,new}}\right) \cdot y_1 \doteq 6.82 \text{ cm}$$

(5) The image formed from any real object is always virtual and the magnitude of the image distance can be larger than the focal length of the mirror.