FERMILAB
ENGINEERING NOTE

SECTION	PROJECT	SERIAL-CATEGORY	PAGE

SUBJECT: Reading 3/10

NAME

DATE | REVISION DATE

① (a) $s_1 = 500\,mm$, $s_1' = -97\,mm$ (same as Ex.)
The object distance (for the 2nd lens) is

$$s_2 = 97\,mm + 10\,mm = 107\,mm$$

$$\frac{1}{s_2'} = \frac{1}{f_2} - \frac{1}{s_2} = \frac{1}{42\,mm} - \frac{1}{107\,mm} \Rightarrow s_2' = 69.1\,mm$$

$$m = m_1 m_2 = (0.194)\left(-\frac{69.1\,mm}{107\,mm}\right) = -0.125$$

$$\frac{1}{f_{eff}} = \frac{1}{(500+5)\,mm} + \frac{1}{(69.1+5)\,mm} \Rightarrow \boxed{f_{eff} = 64.6\,mm}$$

(b)
$$\left.\begin{aligned} \frac{1}{f_1} &= \frac{1}{s_1} + \frac{1}{s_1'} \\ \frac{1}{f_2} &= \frac{1}{s_2} + \frac{1}{s_2'} \end{aligned}\right\} \text{ and } s_2 = -s_1' \text{ (note the sign)} \Rightarrow \frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{s_1} + \frac{1}{s_2'} = \frac{1}{f_{eff}}$$ ✓

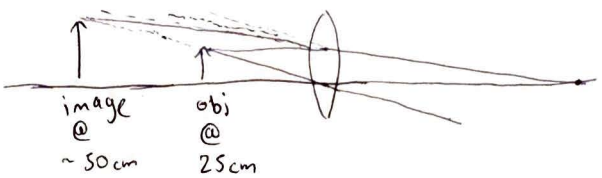
② * Note that $(\text{exposure}) \propto \frac{D^2}{f^2}\Delta t$

(a) We could increase f
(b) We could increase D
(c) We could increase Δt (decrease shutter speed)
(d) m af so magnification would decrease for part (a) ("zoom out"). m wouldn't change for b or c.

③ (a) "presbyopia" (See Pg. 1002)

(b) A person w/ presbyopia needs lenses that will make an object @ 25 cm and create an image @ $s' \approx -50$ cm or so (whatever the person's near point is). This requires converging lenses.

③ (b) continued...



(c) $\frac{1}{f} = +0.75\,D = +0.75\,m^{-1} \Rightarrow \boxed{f = 1.33\,m}$

(d) $\frac{1}{s} + \frac{1}{s'} = \frac{1}{f} \Rightarrow \frac{1}{25cm} + \frac{1}{s'} = 0.75\,D$

$\boxed{s' = -30.8\,cm}$

(her near point is @ 30.8 cm)