

Solution
 THIRD MIDTERM

av. score

20.46
25

3

Name (print) _____ Name (signed) _____

Discussion Instructor (circle): Basko Chakibazian DiCarlo Romer Wei Zhukov

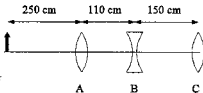
Discussion Section # _____

SHOW ALL WORK!!!!
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
 Use the conversion constants and data given on the front page.

grader: Max Shkurou

For the lens system shown in air the original object is 250 cm to the left of lens A. Focal lengths are given as a magnitude only, you supply the sign.

- A: $|f| = 100$ cm
 B: $|f| = 50.0$ cm
 C: $|f| = 150$ cm



- (a) Calculate the position of the final image as a distance left (-) or right (+) of lens C.
 (b) Is the final image real or virtual. Give your reason.
 (c) Is the final image erect or inverted?
 (d) Calculate the magnification of this system.

$$\frac{1}{e_1} + \frac{1}{e_2} = \frac{1}{f} \quad (f < 0; B; f > 0; A, C)$$

(i) $e_1 = 250$ cm $f = 100$ cm
 $e_2 = ?$ $\frac{1}{250} + \frac{1}{e_2} = \frac{1}{100}$

$$\frac{1}{e_2} = \frac{1}{100} - \frac{1}{250} = 6 \cdot 10^{-3} \text{ cm}^{-1}$$

$$M_i = \frac{e_2}{e_1} = 6,67 \cdot 10^{-1}$$

$$e_2 = 166,67 \text{ cm} \quad (166,67 \text{ cm on the right of A})$$

(ii) $e_1' = 110 - 166,67 = -56,67$ cm (56,67 cm on the right of B)
 $f = -50.0$ cm

$$\frac{1}{-56,66} + \frac{1}{e_2'} = -\frac{1}{50} \Rightarrow \frac{1}{e_2'} = -2,35 \cdot 10^{-3} \text{ cm}^{-1}$$

$$M_{ii} = \frac{e_2'}{e_1'} = 7,5$$

$$e_2' = -425 \text{ cm} \quad (425 \text{ cm on the left of B})$$

(iii) $e_1'' = 150 - (-425) = 575$ cm
 $f = 150$ cm

$$\frac{1}{e_2''} + \frac{1}{575} = \frac{1}{150} \Rightarrow \frac{1}{e_2''} = 4,93 \cdot 10^{-3} \text{ cm}^{-1}$$

$$M_{iii} = \frac{e_2''}{e_1''} = 3,53 \cdot 10^{-1}$$

$$e_2'' = 203 \text{ cm} \quad (\text{Real image, } 203 \text{ cm on the right of C})$$

(a) **203 cm** on the right of lens C

(b) **Real** image (can see it on a screen)

(c) **Inverted** (see picture)

$$M = M_i \cdot M_{ii} \cdot M_{iii}$$

$$d) \quad M = 1,76$$

picture for #3

