

THIRD EXAM

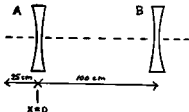
Name (Print) Markus Luty Name (Signed) Average = 20.9

Discussion Instructor (Circle One): Brown Cook Luty

Discussion Section #: _____ Pollard Schweizer Vaseghi

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

A and B are both diverging lenses. The magnitude of their focal lengths are for A, 50.0 cm and for B, 125.0 cm. An object is placed 25.0 cm to the left of A.



- +13(a) Find the position of the final image, measured from A, positive to the right, negative to the left.
 ++(b) If the object is 2.00 cm high, find the size of the final image.
 +4(c) Is the final image real or virtual? Why?
 ++(d) Is the final image erect or inverted? Why?

(a) The object is inside the focal point of lens A.

$$\frac{1}{f_A} = \frac{1}{p_A} + \frac{1}{q_A}$$

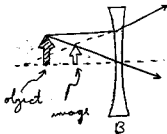
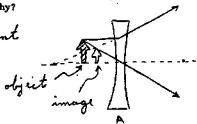
$$\frac{1}{q_A} = \frac{1}{f_A} - \frac{1}{p_A} = \frac{1}{-50.0\text{cm}} - \frac{1}{25.0\text{cm}}$$

$$q_A = -16.7\text{ cm} \quad (\text{to the left of lens A})$$

This image acts as the object for lens B, with $p_B = 100\text{cm} + 16.7\text{cm} = 116.7\text{cm}$. This is positive because it is to the left of lens B.

$$\frac{1}{q_B} = \frac{1}{f_B} - \frac{1}{p_B} = \frac{1}{-125\text{cm}} - \frac{1}{116.7\text{cm}}$$

$$q_B = -60.3\text{ cm} \quad (\text{to the left of B})$$



Thus, the distance from lens A is

$$100 \text{ cm} - 60.3 \text{ cm} = \boxed{39.7 \text{ cm}} \quad (\text{to the right of lens A})$$

(b) The magnification is given by

$$M_A = -\frac{q_A}{p_A} = -\frac{-16.7 \text{ cm}}{25.0 \text{ cm}} = 0.667 \quad (\text{magnification due to A})$$

$$M_B = -\frac{q_B}{p_B} = -\frac{-60.3 \text{ cm}}{116.7 \text{ cm}} = 0.517 \quad (\text{magnification due to B})$$

$$M = M_A M_B = 0.345 \quad (\text{total magnification})$$

Thus, the height of the final image is

$$(2.00 \text{ cm})(0.345) = \boxed{0.690 \text{ cm}}$$

(c) The final image is **virtual**. We can see this either from the second diagram (the actual light rays do not focus at the image location) or from the fact that $q_B < 0$.

(d) The final image is **erect**. We can see this either from the second diagram (yep, it's erect all right) or from the fact that $M > 0$.