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

For the lens system shown the magnitudes of the focal lengths are given. You supply the signs. The original object is 800 cm to the left of lens A. The lenses are 200 cm apart.

(a) If lens B was not there, calculate the position of the image as a distance right or left of lens A.

(b) For (a) state the nature of the image (real, virtual, erect, inverted).

(c) With lens B in place, calculate the position of the final image as a distance right or left of lens B.

(d) State the nature of the final image (real, virtual, and erect or inverted with respect to the original object).

\[
\frac{1}{f_a} = \frac{1}{l_a} + \frac{1}{l'_a} \quad \Rightarrow \quad \frac{1}{l'_a} = \frac{1}{f_a} - \frac{1}{l_a}
\]

\[
image_a = l_a' = \left(\frac{1}{+600 \text{ cm}} - \frac{1}{800 \text{ cm}}\right)^{-1} = +2400 \text{ cm} \quad \text{(right side of lens A)}
\]

(b) \text{ image } a \text{ is inverted (because } m = \frac{f'}{l} = \frac{-2400 \text{ cm}}{800 \text{ cm}} = -3 \text{ (negative sign = inverted) \text{ and real (because light rays converge to an image point, positive image unstated)}}

(c) \[l_b = -(+2400 \text{ cm} - 200 \text{ cm}) = -2200 \text{ cm}\]

\[\frac{1}{l'_b} = \frac{1}{f_b} - \frac{1}{l_b} \quad \Rightarrow \quad l'_b = \left(\frac{1}{-300 \text{ cm}} - \frac{1}{-2200 \text{ cm}}\right)^{-1} = -3.47 \text{ cm} \quad \text{(left side of lens B)}
\]

(d) \text{ final image is erect (because } M_{\text{total}} = M_a \cdot M_b = (-3) \cdot \frac{-l'_b}{l_b} = 3 \cdot \frac{3.47 \text{ cm}}{-2200 \text{ cm}} = 0.047 \text{ and virtual (negative image length)}\]