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

Given the lens system shown with a real object 145 cm to the left of lens 1. You supply the signs for the focal lengths.

(a) Calculate the position, right or left of lens 1, and the distance for the image just of lens 1.
(b) Is the image in (a) real or virtual?
(c) Calculate the position, measured from lens 2, distance and right or left, of the final image in this system.
(d) Is the final image erect or inverted, with respect to the original object? Justify your answer.

7 pts. (a) \( \frac{1}{p} + \frac{1}{q} = \frac{1}{f} \)

\[ p = \text{object distance} = 145 \text{ cm} \]
\[ q = \text{image distance} = ? \]
\[ f = +120 \text{ cm} \]

\[ \frac{1}{145 \text{ cm}} + \frac{1}{q} = \frac{1}{120 \text{ cm}} \]

\[ q = 696 \text{ cm to the right of lens 1} \]

3 pts. (b) The image is real because \( q \), the image distance, is positive.

10 pts. (c) The image from lens 1 is considered to be the object for lens 2

\[ p_2 = 100 \text{ cm} - q_1 = -596 \text{ cm} \]

\[ q_2 = ? \]

\[ f_2 = -120 \text{ cm} \]

\[ \frac{1}{p_2} + \frac{1}{q_2} = \frac{1}{f_2} \]

\[ q_2 = -150 \text{ cm or 150 cm to the left of lens 2} \]

5 pts. (d) Total magnification \( M = m_1 \cdot m_2 = \left( \frac{-q_1}{p} \right) \cdot \left( \frac{q_2}{f_2} \right) = +1.21 \)

The sign of the total magnification is positive, so the final image is erect/upright.