An object (the arrow) is placed 30 cm in front of a converging lens of focal length 10 cm (focal points labeled F₁), which is 27 cm in front of a diverging lens of focal length −7 cm (focal points labeled F₂). The drawing below shows a scaled version of this situation.

(a) Using the three principal rays, find the location, size and orientation of the final image for the two lenses.

Final image is \( \text{upright (inverted)} \) (Circle one)

Final image is \( \text{real (virtual)} \) (Circle one)

Approximate overall magnification is \( \frac{-1}{6} \) (judge by the drawing)

(b) Now use the thin lens equations to calculate the total distance of the final image from the original object, and the overall magnification of the system of lenses. Does it agree with your diagram, roughly?

\[
\frac{1}{30 \text{ cm}} + \frac{1}{9} = \frac{1}{10 \text{ cm}} \quad \Rightarrow \quad 9 = 15 \text{ cm}
\]

This is 12 cm in front of the diverging lens.

\[
\frac{1}{12 \text{ cm}} + \frac{1}{9} = \frac{1}{7 \text{ cm}} \quad \Rightarrow \quad 9 = -4.42 \text{ cm}
\]

\( \therefore \) The final image is 52.58 cm from the object

\[ M_1 = \frac{-15}{30} = \frac{-1}{2} \quad M_2 = \frac{4.42}{12} = 0.368 \]

\[ M = M_1 M_2 \approx -0.184 \]