77. If we neglect the time required for the spring to decelerate the leftward moving glider m_2 and re-accelerate it (rightward), then we are effectively assuming that glider bounces elastically off the wall (with the spring playing no dynamic role). Thus, we assume the time t required for m_2 to travel distance $d + x$ (to the wall and then rightward to position x, assuming the origin is at the wall) is simply $t = (d + x)/v$ where $v = |v_{2f}|$ is its speed resulting from the first elastic collision. This velocity is found from Eq. 10-31:

$$v_{2f} = \frac{2m_1}{m_1 + m_2}\, v_{1i} = \frac{2(590)}{940}(-75)$$

which yields -94 cm/s. Thus, with $d = 53$ cm, we have the relation $t = (53 + x)/94$ with x in cm and t in s. During that time, glider m_1 has a displacement $\Delta x = x - d$ due its velocity v_{1f} where

$$v_{1f} = \frac{m_1 - m_2}{m_1 + m_2}\, v_{1i} = \frac{240}{940}(-75)$$

which yields $v_{1f} = -19$ cm/s. This provides another relation between t and x: $t = (x - d)/v_{1f} = (53 - x)/19$. Equating these to relations, we obtain

$$\frac{53 + x}{94} = \frac{53 - x}{19} \quad \Longrightarrow \quad x = 35 \text{ cm} .$$