In the drawing, the tabletop is frictionless. Mass 1 is launched by the spring. It strikes and sticks to mass 2. The two masses swing on a string in a vertical circle. At the exact top the tension in the string is 155 N. Calculate the distance the spring must be squeezed initially to achieve the results described.

\[ m_1 = 1.50 \text{ kg} \]
\[ m_2 = 10.00 \text{ kg} \]
\[ k = 3.00 \times 10^8 \text{ N/m} \]
\[ L = 2.75 \text{ m} \]

\[ \frac{1}{2} m_1 v_0^2 = \frac{1}{2} k x^2 \]
\[ x = \sqrt{\frac{m_1}{k}} \]

\[ m_1 v_0 = (m_1 + m_2) v_B \]
\[ m_1 + m_2 = M \]
\[ v_0 = \frac{M v_B}{m_1} \]

\[ \frac{1}{2} M v_B^2 = \frac{1}{2} M v_T^2 + Mg (2L) \]
\[ v_B = \sqrt{v_T^2 + 4gL} \]

\[ \begin{align*}
T + Mg &= \frac{M v_T^2}{L} \\
\int mg &= \int T
\end{align*} \]

\[ v_T = \sqrt{\frac{1L}{M} + 9g} = 8.00 \text{ m/s} \]

So
\[ v_B = \sqrt{\frac{1L}{M} + 5gL} = 13.11 \text{ m/s} \]

\[ v_0 = \frac{(11.5)(13.11)}{1.5} = 100.5 \text{ m/s} \]

\[ x = \sqrt{\frac{1.5}{3 \times 10^4}} (100.5) = .711 \text{ m} \]