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

Initially block 2 is at rest and the spring is at its equilibrium length. The two masses are on a frictionless table. Mass 1 is launched with an initial velocity $v_o$, and collides in a completely inelastic collision with Mass 2.

(a) Find the frequency $f$, and the angular frequency $\omega$, for the resulting oscillations.

(b) Write a complete expression describing the oscillations in the form $x = A \cos(\omega t - \phi)$, and evaluate $A$, $\omega$ and $\phi$ numerically, including the sign in front of $\phi$.

$m_1 = 4.35 \text{ kg} \\
 m_2 = 6.75 \text{ kg} \\
k = 750 \text{ N/m} \\
v_o = 4.00 \text{ m/s}$

\[ a) \omega = \sqrt{\frac{k}{m_1 + m_2}} = \sqrt{\frac{750}{4.35 + 6.75}} = 8.22 \text{ s}^{-1}, \quad f = \frac{\omega}{2\pi} = 1.31 \text{ Hz} \]

\[ b) \text{ to find } A : \text{ collision, } P_i = P_f \text{, the } E_{\text{before collis.}} = E_{\text{after collis.}} \]

\[ m_1v_o = (m_1 + m_2)v_f \rightarrow v_f = \frac{m_1v_o}{m_1 + m_2} = 1.57 \text{ m/s} \]

at $x = 0$ spring is relaxed; at $x = A$, spring is totally compressed

\[ \frac{1}{2}(m_1 + m_2)v_f^2 = \frac{1}{2}kA^2 \]

\[ A = \sqrt{\frac{(m_1 + m_2)v_f^2}{k}} = 1.91 \times 10^{-1} \text{ m} = 0.191 \text{ m} \]

at $t = 0, x = 0$;

$X = 0 = (0.191 \text{ m}) \cos(-\phi)$

$\cos \theta = 0$ when $\theta = \pm \pi/2$, so need more info...

at $t = \pi/4, x = +A$ so $A = A \cos(\omega(\pi/4) - \phi) = A \cos(\omega \pi/4 - \phi)$

or $\cos(\pi/2 - \phi) = 1$ when $\phi = 0$

$\Rightarrow \pi/2 = \phi$ ...

$X = (0.191 \text{ m}) \cos((8.22 \text{ s}^{-1})t - \pi/2)$

$= \frac{\pi}{6} = 2$ for incorrect sign.