Final Exam

Name (print) Nathan Rex
Name (signed)

Discussion Instructor (circle): Gramada Hansen Li Rex Zhukov
Discussion Section #

Show all work!!!!!!
Report all numbers to three significant figures!
Use the conversion constants and data given on the front page.

The length of the spring when unstretched and unsqueezed is 1.00 m. Block A is placed on the plane and the length of the spring is 0.75 m. Block B is launched down the plane with an initial speed \( v_0 = 4.00 \text{ m/s} \). The distance \( d \) is 1.500 m.

(a) Calculate the speed of block B just before its impact with block A.
(b) If block B strikes block A in a completely inelastic collision, what is the energy lost in the collision?
(c) Find the length of the spring at its maximum compression.

\[ \mu_k = 0.40 \]
\[ \mu_s = 0.50 \]
\[ m_A = 1.75 \text{ kg} \]
\[ m_B = 2.45 \text{ kg} \]
\[ k = 39.35 \text{ N/m} \]

10 a. \[ E_i = E_f + W_f \]
\[ E_i = m g d \sin 35^\circ + \frac{1}{2} m v_0^2 \]
\[ E_f = \frac{1}{2} m v_f^2 \]
\[ W_f = -\mu_k N d = -\mu_k m g d \cos \theta \]
\[ v_f = \sqrt{2 g d \sin 35^\circ + v_0^2 - 2 \mu_k g d \cos \theta} = 4.82 \text{ m/s} \]

10 b. \[ P_i = P_f \]
\[ m_B v_f = (m_A + m_B) v \]
\[ v = \frac{m_B v_f}{m_A + m_B} = 2.81 \text{ m/s} \]
\[ \Delta E = \Delta KE = \frac{1}{2} m_B v_f^2 - \frac{1}{2} (m_A + m_B) v^2 \]
\[ = 11.9 \text{ J} \]
\[ KE_f = \frac{1}{2} (m_A + m_B) v^2 \]

10 c. \[ E_i = E_f + W_f \]
\[ E_i = \frac{1}{2} k x_0^2 + KE_f + m g x \sin \theta \]
\[ E_f = \frac{1}{2} k (x + x_0)^2 \]
\[ W_f = m_k m g x \cos \theta \]
\[ \frac{1}{2} k x_0^2 + KE_f + m g x \sin \theta = \frac{1}{2} k (x + x_0)^2 + m_k m g x \cos \theta \]
\[ 19.675 x^2 - 0.2844 x - 16.60 = 0 \]

by quadratic, \[ x = 0.926 \text{ m} \]

\[ x + x_0 > L \]