THIRD MIDTERM

Name (print) ____________________________ Name (signed) ____________________________

Discussion Instructor (circle): Gramada Hansen Li Rex Zhukov

Discussion Section # ____________________________

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

(a) Calculate $\mathbf{A} \cdot \mathbf{B}$ if

\[
\mathbf{A} = 4.70\hat{i} + 3.30\hat{j} \\
\mathbf{B} = 2.75\hat{i} - 4.29\hat{j}
\]

\[
\mathbf{A} \cdot \mathbf{B} = A_x B_x + A_y B_y = (4.70 \times 2.75) - (3.30 \times 4.29) = -1.23
\]

(b) Convert 427 Joules into ft-lbs using the data given.

\[
1 \text{ Joule} = 1 \text{ Newton \cdot meter} = 0.225 \times 3.28 \text{ lb} \cdot \text{ft} = 0.738 \text{ ft} \cdot \text{lbs}
\]

\[
427 \text{ J} = 315 \text{ ft} \cdot \text{lbs} \quad \checkmark
\]

(c) An object whose weight is 350 pounds is lifted a distance of 75.0 ft. Calculate the work, in Joules, necessary to do this.

\[
W = 350 \times 75 = 26250 \text{ lbs} \cdot \text{ft} = 3.56 \times 10^4 \text{ J}
\]

(d) The coefficient of static friction between the block and plane shown is 0.75.
Calculate the frictional force on the block.

\[
m = 4.23 \text{ kg}
\]

\[
\sum F_{\text{max}} = \mu mg \cos \theta = 0.75 \times 4.23 \times 9.8 \cos 9^\circ = 32.7 \text{ Newtons}
\]

\[
\sum F = mg \sin \theta = 4.23 \times 9.8 \sin 9^\circ = 6.48 \text{ Newtons} \quad \checkmark
\]

(e) Assume a peculiar spring with the force law $F = -kx^5$. If $k = 175 \text{ N/m}^5$, calculate the work that must be done on the spring to stretch it from $x = 0$ to $x = 2.0 \text{ cm}$.

\[
\Delta W = \int_{x_1}^{x_2} -kx^5 \, dx = -\frac{k}{6} (x_2^6 - x_1^6) = -\frac{175}{6} (0.02^6 - 0) = -1.87 \times 10^{-9} \text{ J}
\]