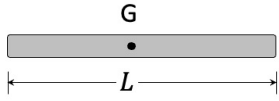
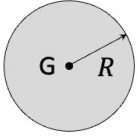


The Purdue Honor Code: As a Boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together. We are Purdue.

Please Circle Your Section

Sotelo 8:30 -9:20 am	Gibert 10:30 am -11:20 am	Wagner 11:30-12:20 pm	Krousgrill 1:30-2:20 pm
	Ramachandran 2:30-3:20 pm	Krousgrill 3:30-4:20 pm	

Please read the questions on this exam carefully and answer only the questions we ask. Don't waste your time doing extra work, and don't skip any of the smaller questions within a problem. The graders cannot grade what they cannot see, and they cannot give partial credit for something in your head.

$\begin{aligned}\vec{v}_B &= \dot{x}\hat{i} + \dot{y}\hat{j} \\ &= v\hat{e}_t \\ &= \dot{r}\hat{e}_r + r\dot{\theta}\hat{e}_\theta \\ &= \vec{v}_A + \vec{\omega} \times \vec{r}_{B/A} \\ &= \vec{v}_A + (\vec{v}_{B/A})_{rel} + \vec{\omega} \times \vec{r}_{B/A}\end{aligned}$	$\begin{aligned}\vec{a}_B &= \ddot{x}\hat{i} + \ddot{y}\hat{j} \\ &= \dot{v}\hat{e}_t + (v^2 / \rho)\hat{e}_n \\ &= (\ddot{r} - r\dot{\theta}^2)\hat{e}_r + (r\ddot{\theta} + 2\dot{r}\dot{\theta})\hat{e}_\theta \\ &= \vec{a}_A + \vec{\alpha} \times \vec{r}_{B/A} - \omega^2\vec{r}_{B/A} \\ &= \vec{a}_A + (\vec{a}_{B/A})_{rel} + \vec{\alpha} \times \vec{r}_{B/A} + 2\vec{\omega} \times (\vec{v}_{B/A})_{rel} + \vec{\omega} \times (\vec{\omega} \times \vec{r}_{B/A})\end{aligned}$
$\begin{aligned}\sum \vec{F} &= m\vec{a}_G \\ \sum \vec{M}_A &= I_A\vec{\alpha} + m\vec{r}_{G/A} \times \vec{a}_A\end{aligned}$	$\begin{aligned}T_1 + V_1 + U_{1 \rightarrow 2}^{(nc)} &= T_2 + V_2 \\ T &= \frac{1}{2}mv_A^2 + \frac{1}{2}I_A\omega^2 + m\vec{v}_A \cdot (\vec{\omega} \times \vec{r}_{G/A}) \\ V_{gr} &= mgh ; \quad V_{sp} = \frac{1}{2}k\Delta^2 \\ U_{1 \rightarrow 2}^{(nc)} &= \int_1^2 (\vec{F} \cdot \hat{e}_t) ds\end{aligned}$
$\begin{aligned}m\vec{v}_{G2} &= m\vec{v}_{G1} + \int_1^2 \vec{F} dt \\ e &= -\left(\frac{v_{Bn2} - v_{An2}}{v_{Bn1} - v_{An1}}\right)\end{aligned}$	$\begin{aligned}(\vec{H}_A)_2 &= (\vec{H}_A)_1 + \int_1^2 \vec{M}_A dt \\ \vec{H}_A &= m\vec{r}_{P/A} \times \vec{v}_P \\ \vec{H}_A &= I_A\vec{\omega}\end{aligned}$
$\begin{aligned}M\ddot{x} + C\dot{x} + Kx &= f(t) \\ \ddot{x} + 2\zeta\omega_n\dot{x} + \omega_n^2x &= f(t)/M \\ x_C(t) &= e^{-\zeta\omega_n t}(C\cos\omega_d t + S\sin\omega_d t) \\ x_P(t) &= A\cos\omega t + B\sin\omega t \\ \omega_d &= \omega_n\sqrt{1 - \zeta^2}\end{aligned}$	 $I_G = \frac{1}{12}mL^2$  $I_G = \frac{1}{2}mR^2$