

Exam 2: Equation Sheet

$$\begin{aligned}\vec{v}_P &= \dot{x}\hat{i} + \dot{y}\hat{j} \\ &= v_P\hat{e}_t \\ &= \dot{r}\hat{e}_r + r\dot{\theta}\hat{e}_\theta\end{aligned}$$

$$\begin{aligned}\vec{a}_P &= \ddot{x}\hat{i} + \ddot{y}\hat{j} \\ &= \dot{v}_P\hat{e}_t + \frac{v_P^2}{\rho}\hat{e}_n \\ &= (\ddot{r} - r\dot{\theta}^2)\hat{e}_r + (r\ddot{\theta} + 2\dot{r}\dot{\theta})\hat{e}_\theta\end{aligned}$$

$$\vec{v}_B = \vec{v}_A + \vec{\omega} \times \vec{r}_{B/A}$$

$$\vec{a}_B = \vec{a}_A + \vec{\alpha} \times \vec{r}_{B/A} + \vec{\omega} \times (\vec{\omega} \times \vec{r}_{B/A})$$

$$\vec{v}_B = \vec{v}_A + (\vec{v}_{B/A})_{rel} + \vec{\omega} \times \vec{r}_{B/A}$$

$$\vec{a}_B = \vec{a}_A + (\vec{a}_{B/A})_{rel} + \vec{\alpha} \times \vec{r}_{B/A} + 2\vec{\omega} \times (\vec{v}_{B/A})_{rel} + \vec{\omega} \times (\vec{\omega} \times \vec{r}_{B/A})$$

$$\dot{\hat{e}}_i = \vec{\omega} \times \hat{e}_i$$

$$\vec{F} = m\vec{a}$$

$$T_1 + V_1 + U_{1 \rightarrow 2}^{nc} = T_2 + V_2$$

$$m\vec{v}_1 + \int_{t_1}^{t_2} \sum \vec{F} dt = m\vec{v}_2$$