

Equation Sheet

$$\begin{aligned}\vec{v}_P &= \dot{x}\hat{i} + \dot{y}\hat{j} + \dot{z}\hat{k} & \vec{a}_P &= \ddot{x}\hat{i} + \ddot{y}\hat{j} + \ddot{z}\hat{k} \\ &= v_P\hat{e}_t & &= \dot{v}_P\hat{e}_t + \frac{v_P^2}{\rho}\hat{e}_n + 0\hat{e}_b \\ &= \dot{r}\hat{e}_r + r\dot{\theta}\hat{e}_\theta + \dot{z}\hat{k} & &= (\ddot{r} - r\dot{\theta}^2)\hat{e}_r + (r\ddot{\theta} + 2\dot{r}\dot{\theta})\hat{e}_\theta + \ddot{z}\hat{k}\end{aligned}$$

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

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