

USEFUL FORMULAS

$n - t$ coordinates: $\vec{v} = v\vec{e}_t$ where $v = \dot{s} = \rho\dot{\beta}$

$$\vec{a} = a_n\vec{e}_n + a_t\vec{e}_t \quad \text{where } a_n = \frac{v^2}{\rho} = \rho\dot{\beta}^2, a_t = \dot{v} \quad (vdv = a_t ds)$$

Polar coordinates: $\vec{v} = v_r\vec{e}_r + v_\theta\vec{e}_\theta$ where $v_r = \dot{r}$, $v_\theta = r\dot{\theta}$

$$\vec{a} = a_r\vec{e}_r + a_\theta\vec{e}_\theta \quad \text{where } a_r = \ddot{r} - r\dot{\theta}^2, a_\theta = 2\dot{r}\dot{\theta} + r\ddot{\theta}$$

$$\vec{r}_A = \vec{r}_B + \vec{r}_{A/B}, \quad \vec{v}_A = \vec{v}_B + \vec{v}_{A/B}, \quad \vec{a}_A = \vec{a}_B + \vec{a}_{A/B}$$