

$$\begin{aligned}
 \dot{V}I \Rightarrow & 2\dot{a}l \cos\theta_1 \cos\theta_2 \sin\theta_2 \\
 & -2(a+r)l\dot{\theta}_1 \sin\theta_1 \cos\theta_2 \sin\theta_2 \\
 & -2(a+r)l\dot{\theta}_2 \cos\theta_1 \sin\theta_2^2 \\
 & +2(a+r)l\dot{\theta}_2 \cos\theta_1 \cos\theta_2^2
 \end{aligned}$$

\Rightarrow

$$\text{let } x = I + II + III + IV + V + VI$$

$$\sqrt{x} = x^{\frac{1}{2}}$$

$$\begin{aligned}
 \frac{d}{dt}(x^{\frac{1}{2}}) &= \frac{1}{2} x^{-\frac{1}{2}} \dot{x} \\
 &= \frac{\dot{x}}{2\sqrt{x}}
 \end{aligned}$$

$$\dot{B} = \dot{\theta}_2 l \cos\theta_2 - \frac{\dot{x}}{2\sqrt{x}} + \dot{\theta}_3 + \dot{\theta}_4 \quad (\text{root 1})$$

$$\dot{B} = \dot{\theta}_2 l \cos\theta_2 + \frac{\dot{x}}{2\sqrt{x}} + \dot{\theta}_3 + \dot{\theta}_4 \quad (\text{root 2})$$