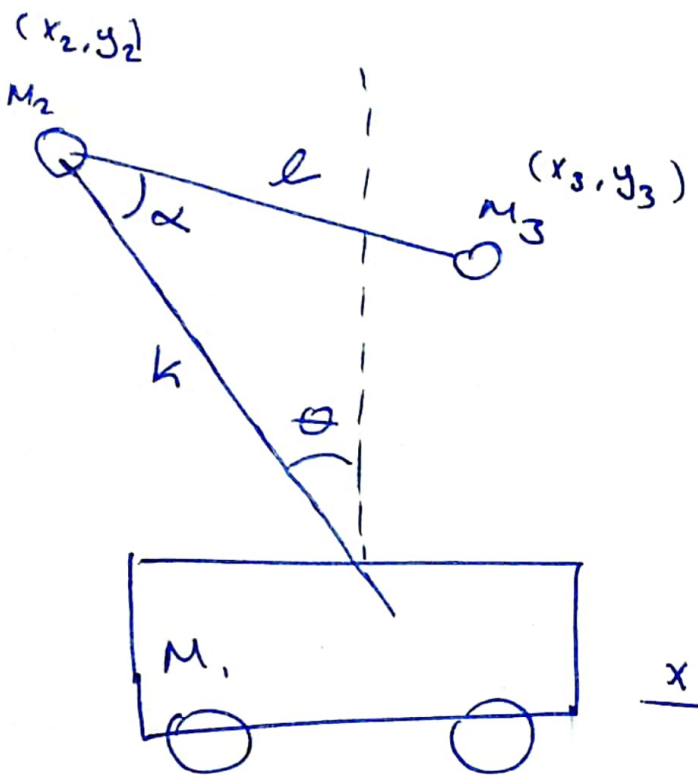

$$x_2 = x - k\sin\theta$$

$$y_2 = k\cos\theta$$

$$x_3 = x - k\sin\theta + \ell\sin(\alpha+\theta)$$

$$y_3 = k\cos\theta - \ell\cos(\alpha+\theta)$$

$$\dot{x}_2 = \dot{x} - k\dot{\theta}\cos(\theta)$$

$$\dot{y}_2 = -k\dot{\theta}\sin(\theta)$$

$$\dot{x}_3 = \dot{x} - k\dot{\theta}\cos(\theta) + \ell\cos(\alpha+\theta)(\dot{\alpha}+\dot{\theta})$$

$$\dot{y}_3 = -k\dot{\theta}\sin(\theta) + \ell\sin(\alpha+\theta)(\dot{\alpha}+\dot{\theta})$$

$$V = g\left[k\cos(\theta)(M_2+M_3) - M_3\ell\cos(\alpha+\theta)\right]$$

$$K_x = \frac{1}{2}\left[M_1\dot{x}^2 + M_2\left(\dot{x} - k\dot{\theta}\cos(\theta)\right)^2 + M_3\left(\dot{x} - k\dot{\theta}\cos(\theta) + \ell\cos(\alpha+\theta)(\dot{\alpha}+\dot{\theta})\right)^2\right]$$

$$K_y = \frac{1}{2}\left[M_2\left(-k\dot{\theta}\sin(\theta)\right)^2 + M_3\left(-k\dot{\theta}\sin(\theta) + \ell\sin(\alpha+\theta)(\dot{\alpha}+\dot{\theta})\right)^2\right]$$

$$L = K_x + K_y - V$$