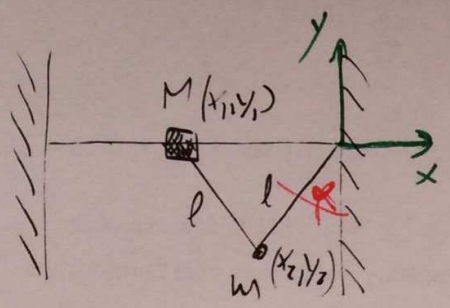
#1



1; x_1, y_1, x_2, y_2

2. $y_1 = a'll$

$x_2^2 + y_2^2 = l^2$

$(x_2 - x_1)^2 + y_2^2 = l^2$

3. α

4.

$x_1 = -2l \sin\alpha \qquad \dot{x}_1 = -2l\cos\alpha$

$y_1 = 0 \qquad \dot{y}_1 = \phi$

$x_2 = -l\sin\alpha \qquad \dot{x}_2 = -l\cos\alpha\,\dot{\alpha}$

$y_2 = -l\cos\alpha \qquad \dot{y}_2 = l\sin\alpha\,\dot{\alpha}$

6.

$$T = \frac{1}{2}M\left(\dot{x}_1^2 + \dot{y}_1^2\right) + \frac{1}{2}m\left(\dot{x}_2^2 + \dot{y}_2^2\right) = 2Ml^2\cos^2\alpha\,\dot{\alpha}^2 + \frac{1}{2}ml^2\dot{\alpha}^2$$

$$V = mgy_2 = -mgl\cos\alpha$$

$$L = T - V = 2Ml^2\cos^2\alpha\,\dot{\alpha}^2 + \frac{1}{2}ml^2\dot{\alpha}^2 + mgl\cos\alpha$$

6.

$$\frac{\partial L}{\partial \alpha} = -4Ml^2\dot{\alpha}^2\cos\alpha\sin\alpha - mgl\sin\alpha$$

$$\frac{\partial L}{\partial \dot{\alpha}} = 4Ml^2\dot{\alpha}\cos^2\alpha + ml^2\dot{\alpha} \xrightarrow{d/dt} \frac{d}{dt}\frac{\partial L}{\partial \dot{\alpha}} = 4Ml^2\ddot{\alpha}\cos^2\alpha - 8Ml^2\dot{\alpha}\cos\alpha\sin\alpha\,\dot{\alpha} + ml^2\ddot{\alpha}$$

$$\boxed{ml^2\ddot{\alpha} = 4Ml^2\dot{\alpha}\cos\alpha\sin\alpha\,\dot{\alpha} - 4Ml^2\ddot{\alpha}\cos^2\alpha - mgl\sin\alpha}$$