

力学 H 19

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問題 1

$$x = \underline{b \sin \theta}, \quad y = \underline{b \cos \theta} \quad (1), (2)$$

$$T = \frac{1}{2} m \left(\left(\frac{dx}{dt} \right)^2 + \left(\frac{dy}{dt} \right)^2 \right)$$

$$= \underline{\frac{1}{2} m (b\theta')^2} \quad (3)$$

$$V = -mgy = \underline{-mgb \cos \theta} \quad (4)$$

・力学のエネルギー保存則

$$\underline{\frac{1}{2} m (b\theta')^2} - mgb \cos \theta = -mgb \cos \theta_0 \quad (5)$$

両辺 t で微分して

$$mb^2 \theta' \frac{d^2 \theta}{dt^2} + mgb \theta' \sin \theta = 0$$

$$\text{よって} \quad \underline{\frac{d^2 \theta}{dt^2} = -\frac{g}{b} \sin \theta} \quad (6)$$

$$L = T - V = \frac{1}{2} m (b\theta')^2 + mgb \cos \theta$$

$$\frac{d}{dt} \left(\frac{\partial L}{\partial \theta'} \right) - \frac{\partial L}{\partial \theta} = \underline{mb^2 \frac{d^2 \theta}{dt^2} + mgb \sin \theta} = 0 \quad (7)$$

$$H = \underline{mb^2 \theta'} \quad (8)$$

$$\frac{dH}{dt} = \underline{mb^2 \theta''} = -b \times mg \sin \theta = \underline{-b \sin \theta mg} \quad (9)$$

$$m \cdot \underline{x''} = -F \sin \theta \quad m \cdot \underline{y''} = -F \cos \theta + mg \quad (10), (11)$$

$$F = \underline{mb\theta''^2} + mg \cos \theta \quad (12)$$

質点の重力と遠心力によってその大きさが決まる