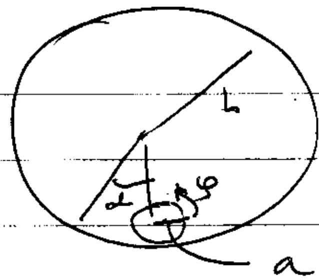
2)



$$a\varphi = (b-a)\alpha$$

$$L = T - V = \tfrac{1}{2}M\dot\alpha^2(b-a)^2 + \tfrac{1}{2}\dot\varphi^2 a^2 \tfrac{1}{2}M$$
$$+ Mg(b-a)\cos\alpha$$

constraint $\quad a\varphi - (b-a)\alpha = 0$

Eq-s. of motion: $\quad \alpha: \quad \frac{d}{dt}\left(M\dot\alpha(b-a)^2\right) + Mg(b-a)\sin\alpha$
$$+\lambda a + \lambda(-b) = 0$$

$$\varphi: \quad \frac{d}{dt}\frac{1}{2}\left(Ma^2\dot\varphi\right) + \lambda a = 0$$

$$\lambda a = -\tfrac{1}{2}Ma^2\frac{b-a}{a}\ddot\alpha$$

$$\Rightarrow \quad M(b-a)^2\ddot\alpha + Mg(b-a)\sin\alpha + (a-b)\left(-\tfrac{1}{2}M(b-a)\ddot\alpha\right)$$

$$\Rightarrow \quad \tfrac{3}{2}(b-a)^2\ddot\alpha = -g(b-a)\sin\alpha$$

$$\ddot\alpha = \frac{-2}{3}\frac{g}{b-a}\sin\alpha$$
$$\sim\alpha$$

$$\Rightarrow \quad \omega^2 = \frac{2}{3}\frac{g}{b-a} \qquad \alpha \sim e^{i\omega t}$$