

No.

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2022 中 大 秋 中 学

$$(1) U = -\int_0^x \rho g x dx$$

$$= -\frac{1}{2} \rho g x^2$$

$$(2) K = \frac{\rho l}{2} v^2$$

$$(3) -\frac{1}{2} \rho g a^2 = \frac{\rho l}{2} v^2 - \frac{\rho g}{2} x^2$$

$$-g a^2 = l v^2 - g x^2$$

$$v = \sqrt{\frac{g}{l} (x^2 - a^2)}$$

(4)

$$(5) \frac{dx}{dt} = \sqrt{\frac{g}{l}} \sqrt{(x^2 - a^2)}$$

$$\Rightarrow \int \frac{1}{\sqrt{(x^2 - a^2)}} dx = \sqrt{\frac{g}{l}} \int dt$$

$$\log |x + \sqrt{x^2 - a^2}| = \sqrt{\frac{g}{l}} t + C$$

$$x + \sqrt{x^2 - a^2} = C e^{\gamma t} \quad (\because \gamma = \sqrt{\frac{g}{l}})$$

$$x(0) = a \Rightarrow$$

$$C = a$$

$$\rightarrow \sqrt{x^2 - a^2} = a e^{\gamma t} - x$$

} 两式相乘

$$x^2 - a^2 = a^2 e^{2\gamma t} - 2a e^{\gamma t} x + x^2$$

$$x = \frac{a(e^{\gamma t} + e^{-\gamma t})}{2} = a \cosh \sqrt{\frac{g}{l}} t$$

