Computational Phy.

HW 3

1. $$E_{tot} = \frac{mL^2}{2} w^2(t) + \frac{mgL}{2} \theta^2(t) - mgL$$

$$\theta(t) = \theta_0 + \tau \omega_0 \quad ; \quad \theta^2(t) = \theta_0^2 + 2\tau\omega_0 + \tau^2\omega_0^2$$

$$\omega(t) = \omega_0 + \tau \frac{d\omega_0}{dt} \quad ; \quad \omega^2(t) = \omega_0^2 + 2\tau \frac{d\omega_0}{dt} + \tau^2 \left(\frac{d\omega_0}{dt}\right)^2$$

$$E_{tot} = \frac{mL^2}{2}\omega_0^2 + 2\frac{mL^2}{2}\tau\frac{d\omega_0}{dt} + \frac{mL^2}{2}\tau^2\left(\frac{d\omega_0}{dt}\right)^2 + \frac{mgL}{2}\omega_0^2 + 2\tau + \text{const.}$$

$$= mL^2\tau\left(\frac{d\omega_0}{dt}\right)^2 + mL^2\tau\frac{d\omega_0}{dt} + \text{const.}$$

3 (a) $$\frac{\partial v}{\partial t} = \frac{\partial v}{\partial y}\frac{\partial y}{\partial t} = v'(y)(-c) \qquad y = x - ct$$

$$\frac{\partial v}{\partial x} = \frac{\partial v}{\partial y}\frac{\partial y}{\partial x} = v'(y) \quad , \quad \frac{\partial^3 v}{\partial x^3} = v'''(y)$$

$$\rightarrow \quad -cv'(y) + 6v(y)v'(y) + v'''(y) = 0$$

(b)

2.