

問1. (1)  $x = A \sin \omega t + B \cos \omega t$  ( $\omega = \sqrt{\frac{k}{m}}$ )

(2) (1) 7.

$$v = \omega (A \cos \omega t - B \sin \omega t)$$

$$t=0 \text{ 時 } x = -a, v = 0 \text{ 7.}$$

$$-a = A \times 0 + B \times 1 \quad \therefore B = -a$$

$$0 = \omega (A \times 1 - B \times 0) \quad \therefore A = 0$$

$$\therefore x = -a \cos \omega t.$$

$$= -a \cos \sqrt{\frac{k}{m}} t$$

(3)  $t=0 \text{ 時 } x=0, v = -v_0 \text{ 7.}$

$$0 = A \times 0 + B \times 1 \quad \therefore B = 0$$

$$-v_0 = \omega (A \times 1 - B \times 0) \quad \therefore A = -\frac{v_0}{\omega}$$

$$\therefore x = -\frac{v_0}{\omega} \sin \omega t$$

$$= -\frac{v_0}{\omega} \sin \sqrt{\frac{k}{m}} t$$

問2. (1)  $K = \frac{1}{2} m (\dot{r}^2 + r^2 \dot{\theta}^2) = \frac{1}{2} m (\dot{r}^2 + r^2 \dot{\theta}^2)$

(2) (1) 7.

$$\frac{dK}{dt} = \frac{1}{2} m (2\dot{r} \times \ddot{r} + 2r \times \dot{r} \times \ddot{\theta} + r^2 \times 2\dot{\theta} \times \ddot{\theta})$$

$$= m \{ (\ddot{r} - r\dot{\theta}^2) \dot{r} + (2\dot{r}\dot{\theta} + r\ddot{\theta}) r\dot{\theta} \}$$

$$= m (a_r r + a_\theta r)$$

$$= \frac{dW}{dt}$$

(3) 万有引力は  $F_r = -\frac{GmM}{r^2}$ ,  $F_\theta = 0 \text{ 7.}$

$$\frac{dW}{dt} = -\frac{GmM}{r^2} \times v_r$$

7.  $T_c$ .

$$\frac{dU}{dt} = - \left( GmM \times \left( -\frac{1}{r^2} \right) \times \frac{dr}{dt} \right)$$

$$= \frac{GmM}{r^2} \times v_r$$

$$\therefore \frac{dW}{dt} = -\frac{dU}{dt}$$

(2) 7.

$$\frac{dK}{dt} = -\frac{dU}{dt}$$

$$\therefore \frac{d}{dt} (K+U) = 0$$

$$\therefore E = K+U \text{ (7) 一定}$$