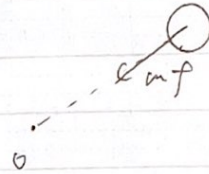


2021 暑期 中不 七 学 期

$$(1) (i) \quad \dot{L} = m(\dot{r} \times \omega + r \times \dot{\omega})$$

$$\omega \times \omega = 0$$

$$= r \times \frac{m\dot{v}}{F} = 0$$



角運動量

$$L = m(r \times v)$$

(ii) F は中心を向う力

(2)

$$\ddot{r} = \frac{d}{dt} \frac{d}{dt} r$$

$$= \frac{d\theta}{dt} \frac{d}{d\theta} \frac{d\theta}{dt} \frac{dr}{d\theta} r$$

$$= \dot{\theta} \frac{d}{d\theta} \left(\dot{\theta} \frac{dr}{d\theta} \right)$$

$$\ddot{r} - r\dot{\theta}^2 = \dot{\theta} \frac{d}{d\theta} \left(\dot{\theta} \frac{dr}{d\theta} \right) - r\dot{\theta}^2$$

$$= \frac{h}{r^2} \frac{d}{d\theta} \left(\frac{h}{r^2} \frac{dr}{d\theta} \right) - \frac{h^2}{r^3} = f$$

$$\text{EOM} \quad \begin{cases} m(\ddot{r} - r\dot{\theta}^2) = mf \\ m \frac{d}{dt} (r^2 \dot{\theta}) = 0 \end{cases}$$

$$\dot{\theta} = \frac{h}{r^2}$$

代入

$$(3) \quad \begin{cases} r = \frac{1}{u} \\ \frac{dr}{du} = -\frac{1}{u^2} \end{cases}$$

2. (2) の方程式を微分変換

$$u^2 h \frac{d}{d\theta} \left(u^2 h \frac{du}{d\theta} \frac{dr}{du} \right) - u^3 h^2 = f$$

$$= -u^2 h^2 \frac{d^2 u}{d\theta^2} - u^3 h^2 = f$$

(4)

$$-u^2 h^2 \ddot{u} - u^3 h^2 = -a h^2 u^2$$

$$(u-a)'' = -(u-a)$$

$$f\left(\frac{1}{u}\right) = -a h^2 u^2$$

* 要計算

$$\therefore u - a = ab \cos \theta$$

$$u = a + ab \cos \theta$$

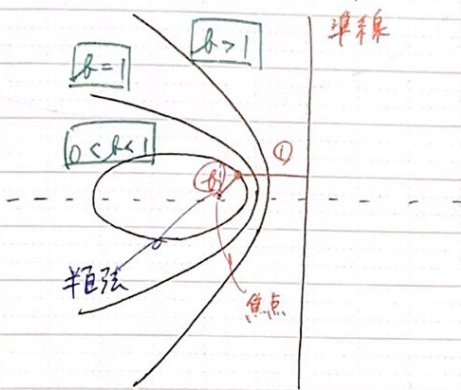
$$\begin{aligned} u(0) &= 0 \\ u''(0) &= -ab \end{aligned}$$

(5)

$$r = \frac{1}{a(1 + b \cos \theta)}$$

$$u = \frac{1}{r} = \lambda \mu \delta T = "7$$

(6)

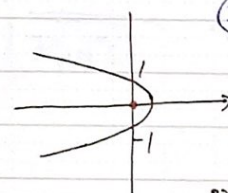


$$r = \frac{\frac{1}{a}}{1 + b \cos \theta}$$

$\frac{1}{a}$... 半直弦

b ... 離心率

$$r = \frac{1}{1 + \cos \theta}$$



$$\ddot{x} = -\dot{x} \quad \begin{matrix} \uparrow \\ p^2 = \omega^2 \end{matrix} \quad p^2 = 1.$$

$$x = A \sin(\omega t + \phi)$$

$$\dot{x} = \omega A \cos(\omega t + \phi) = \omega A \cos \phi = 0$$

$$\ddot{x} = -\omega^2 A \sin(\omega t + \phi) = -\omega^2 A \sin \phi = -ab$$

$$A = 0 \quad \phi = \frac{\pi}{2}$$

$$A = ab$$