(2) $L_z = I\dot{\phi}$ を $\frac{dL_z}{dt} = N_z$ へ入れる

$$I\ddot{\phi} = -Mgh\sin\phi \quad //$$

(3) $\sin\phi \approx \phi$ だから

$$\ddot{\phi} = -\frac{Mgh}{I}\phi \quad \therefore\ \phi = \phi_0\cos(\omega t + \alpha)$$

$$\omega = \sqrt{\frac{Mgh}{I}} \quad \therefore\ T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{I}{Mgh}} \quad //$$

$G\frac{Mm}{r}$ r^{-1} $-r^{-2}$

$$\mathbb{F} = -\frac{\partial U}{\partial x} - \frac{\partial U}{\partial y} - \frac{\partial U}{\partial z}$$

$$= -G\frac{Mm}{r^2}\dot{r}$$

$$\therefore\ F_x = F_y = F_z = -G\frac{Mm}{r^2} \quad //$$

$\frac{dr}{dx} = (x^2+y^2+z^2)^{\frac{1}{2}}$

$\frac{1}{2} \cdot 2x \cdot (\quad)^{-\frac{1}{2}}$

$\frac{x}{r}$

(2) (1)より, $\mathbb{F} = -G\frac{Mm}{r^3}\mathbb{r}$ $(\mathbb{r} = x\mathbb{i} + y\mathbb{j} + z\mathbb{k})$

$-G\frac{Mm}{r}$

—→ ∴ 向心力 //

$F_\theta = m a_\theta = \frac{1}{r}\frac{d}{dt}(r^2\dot{\theta}) = 0$ より.

$\frac{1}{2}r^2\dot{\theta} = 0$ (面積速度)

$\frac{d^2}{dt^2}(\mathbb{r}) = \left(\frac{1}{m_1} + \frac{1}{m_2}\right)F_{12}$ $R(t) = \frac{m_1 r_1 + m_2 r_2}{m_1 + m_2}$

$\left(\frac{1}{m_1} + \frac{1}{m_2}\right)\ddot{r} = -G\frac{m_1 m_2}{r^3}\mathbb{r}$