$$m\frac{d^2}{dt^2}x_A = mg + k(x_B - x_A - L) \tag{1}$$

$$m\frac{d^2}{dt^2}x_B = mg - k(x_B - x_A - L) \tag{2}$$

(1) の両辺に$\frac{d^2}{dt^2}$をかける (3)

$$m\frac{d^4}{dt^4}x_A = k\left(\frac{d^2}{dt^2}x_B - \frac{d^2}{dt^2}x_A\right) \tag{4}$$

(1)(2) を代入すると (5)

$$m\frac{d^4}{dt^4}x_A = k(-2k(L - x_A + x_B)) \tag{6}$$

$$m\frac{d^4}{dt^4}x_A = -2k^2(L - x_A + x_B) \tag{7}$$

$$m\frac{d^4}{dt^4}x_A = -2k\left(m\frac{d^2}{dt^2}x_A - mg\right) \tag{8}$$

$$\frac{d^4}{dt^4}x_A = -2k\frac{d^2}{dt^2}x_A + 2kg \tag{9}$$

(10)