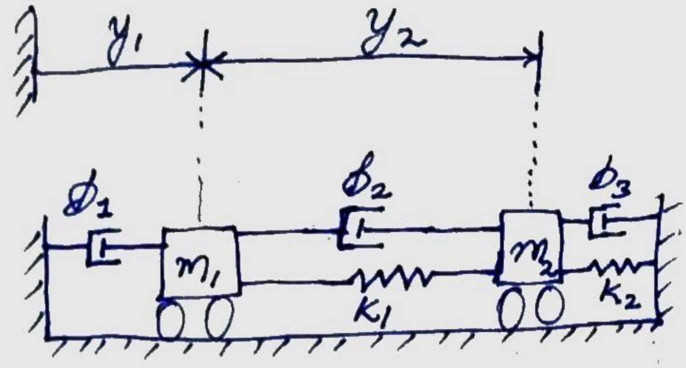
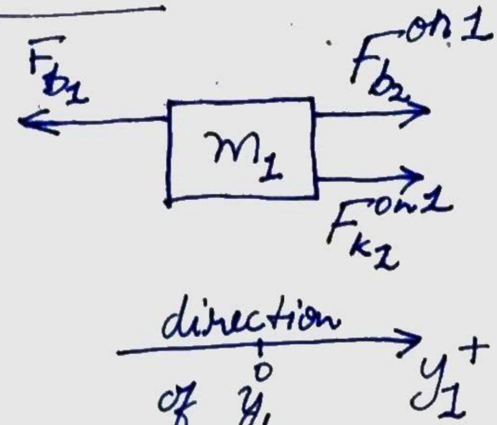
Q3)

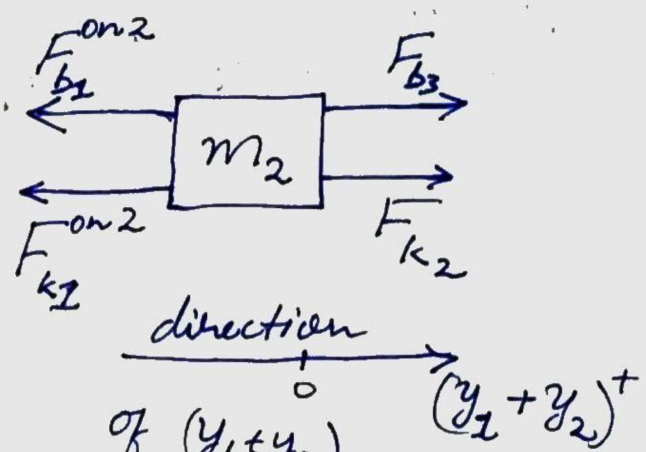


→ Free-body diagrams

mass 1:



mass 2:



$$F_{b_1} = b_1 \dot{y}_1$$

$$F_{b_2}^{on\,1} = b_2 \dot{y}_2$$

$$F_{k_1}^{on\,1} = +k_1 y_2$$

$$F_{b_2}^{on\,2} = b_2 \dot{y}_2$$

$$F_{k_1}^{on\,2} = +k_1 y_2$$

$$F_{b_3} = -b_3(\dot{y}_1 + \dot{y}_2)$$

$$F_{k_2} = -k_2(y_1 + y_2)$$

For determination of the forces $F_{b_2}^{on\,1}$, $F_{b_2}^{on\,2}$, $F_{k_1}^{on\,1}$, & $F_{k_1}^{on\,2}$ the positive y_2 & $\dot{y}_2$ are considered to be increasing seperation between the masses. This causes tension in the damper, b_2 & spring, k_2. Hence they will be pulling on the masses m_1 & m_2.

Applying Newton's laws on the masses.

$$m_1(\ddot{y}_1) = \sum F^{on\,1} = -F_{b_1} + F_{b_2}^{on\,1} + F_{k_1}^{on\,1}$$

$$m_2(\ddot{y}_1+\ddot{y}_2) = \sum F^{on\,2} = -F_{b_2}^{on\,2} - F_{k_1}^{on\,2} + F_{b_3} + F_{k_2}$$

$$\boxed{\begin{aligned} m_1\ddot{y}_1 &= -b_1\dot{y}_1 + b_2\dot{y}_2 + k_1 y_2 \\ m_2(\ddot{y}_1+\ddot{y}_2) &= -b_2\dot{y}_2 - k_1 y_2 - b_3(\dot{y}_1+\dot{y}_2) - k_2(y_1+y_2) \end{aligned}}$$