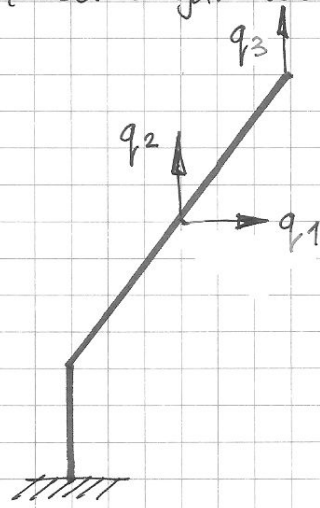
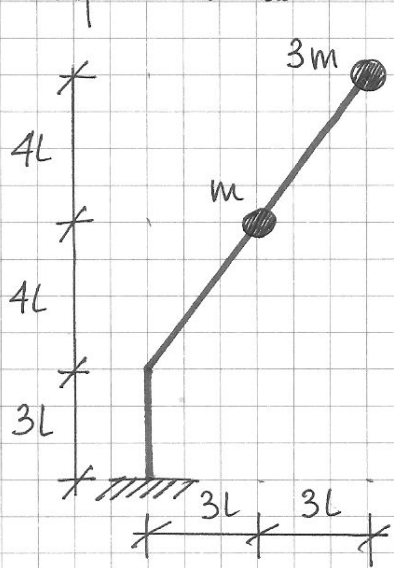


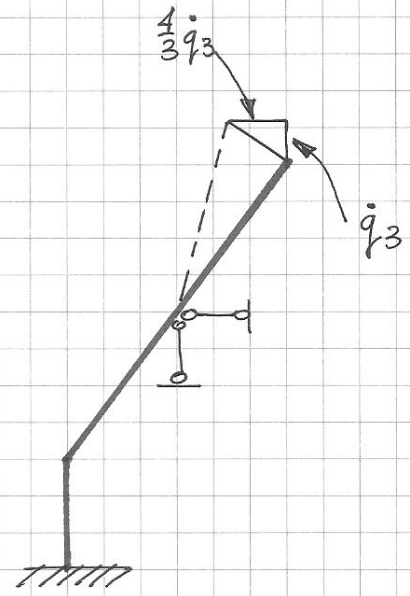
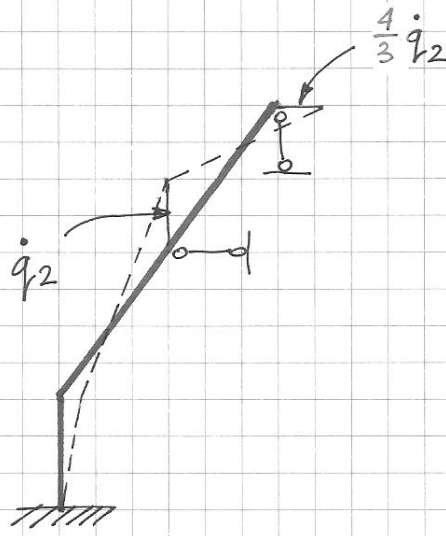
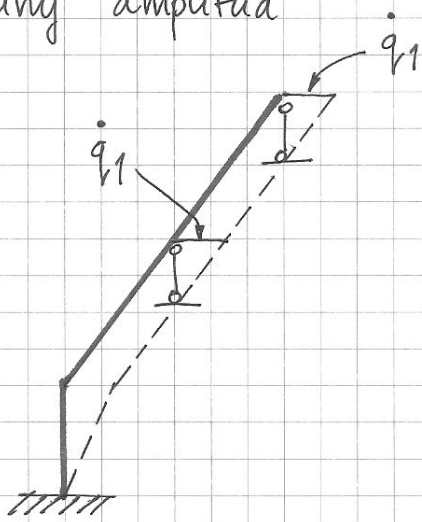
Zapisać układ równań na częstotści drgań własnych. $EJ = \text{const.}$



Współrzędne Lagrange'a

$$\underline{q} = \begin{bmatrix} q_1 \\ q_2 \\ q_3 \end{bmatrix}$$

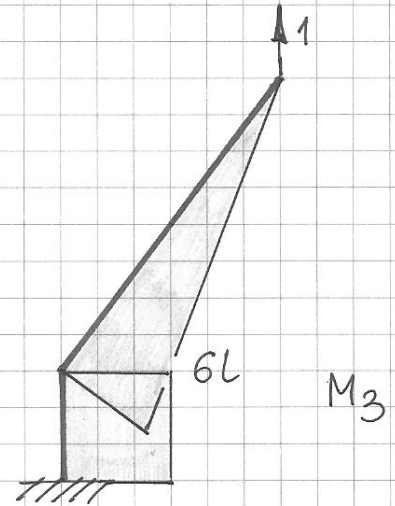
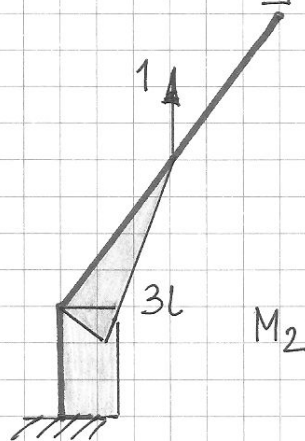
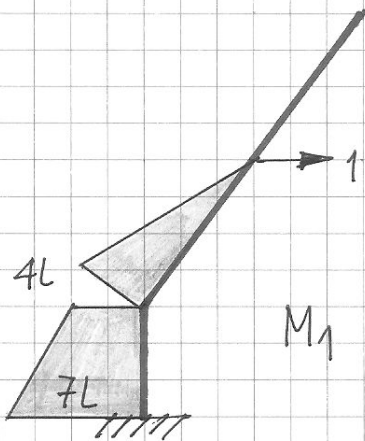
Plany amplitud



Energia kinetyczna

$$2E_k = m [\dot{q}_1^2 + \dot{q}_2^2] + 3m \left[\left(\dot{q}_1 + \frac{4}{3} \dot{q}_2 - \frac{4}{3} \dot{q}_3 \right)^2 + \dot{q}_3^2 \right] = \dot{\underline{q}}^T \underline{M} \dot{\underline{q}}$$

$$\underline{M} = \begin{bmatrix} 4 & 4 & -4 \\ 4 & \frac{19}{3} & -\frac{16}{3} \\ -4 & -\frac{16}{3} & \frac{25}{3} \end{bmatrix} m$$

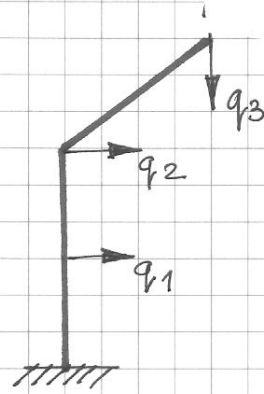
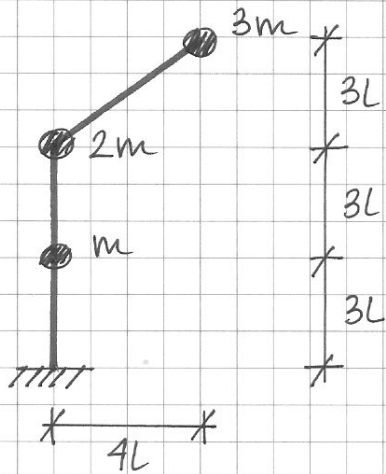


$$D = \begin{bmatrix} 119,67 & -69,5 & -149 \\ -69,5 & 42 & 91,5 \\ -149 & 91,5 & 228 \end{bmatrix} \frac{L^3}{EJ}$$

$$I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\det(I - \omega^2 D I M) q_L = 0 \rightarrow \omega_i, i=1,2,3$$

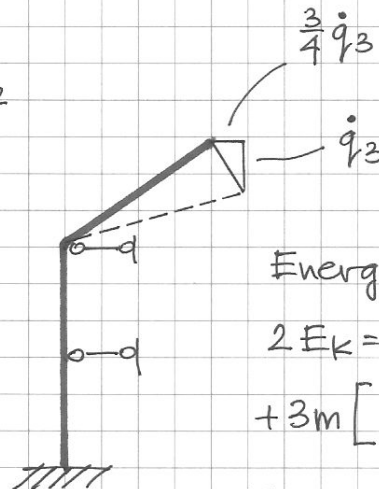
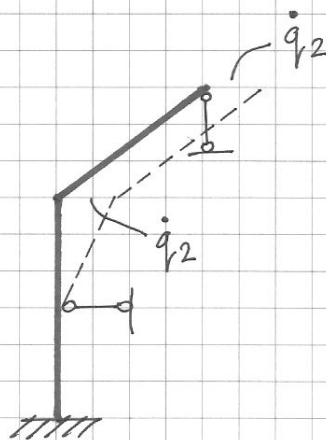
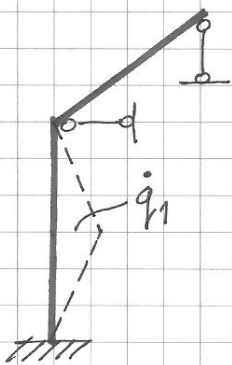
Zapisać układ równań na częstości drgań własnych. $EJ = \text{const.}$



Współrzędne Lagrange'a

$$q = \begin{bmatrix} q_1 \\ q_2 \\ q_3 \end{bmatrix}$$

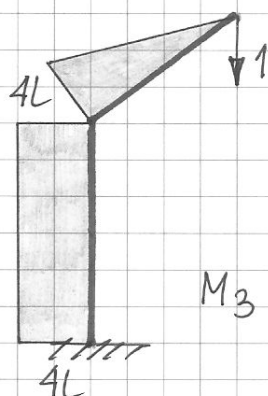
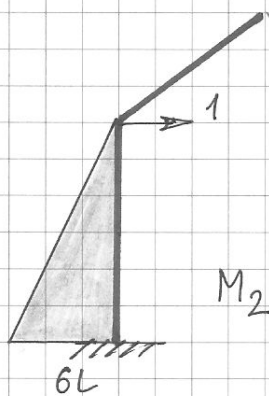
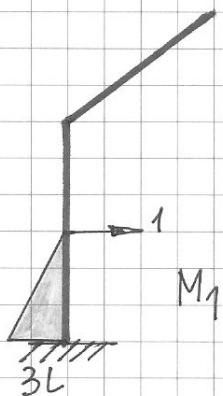
Plany amplitud



Energia kinetyczna

$$2E_k = m\dot{q}_1^2 + 2m\dot{q}_2^2 + 3m\left[\dot{q}_3^2 + \left(\dot{q}_2 + \frac{3}{4}\dot{q}_3\right)^2\right]$$

$$M = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 5 & -\frac{9}{4} \\ 0 & -\frac{9}{4} & \frac{75}{16} \end{bmatrix} m$$



$$D = \begin{bmatrix} 9 & 22,5 & 18 \\ 22,5 & 72 & 72 \\ 18 & 72 & 122,67 \end{bmatrix} \frac{L^3}{EJ}$$

$$\det(\mathbb{I} - \omega^2 \mathbb{D} M) = 0$$

$$\downarrow$$

$$\omega_1, \omega_2, \omega_3$$

$$\mathbb{I} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$