The matrices

$$K_2 = \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$$

and

$$K_3 = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$

arose in lectures when studying the free oscillations of $N = 2$ and $N = 3$ masses in a line between two fixed walls and with springs in between them.

(1) What is K_4?

(2) What is the general form K_N for $N \geq 2$?

(3) Can you find a way to determine the eigenvectors and eigenvalues of K_N for arbitrary $N \geq 2$?