

Given the matrix (as a function of $\alpha \in \mathbb{Q}$):

$$M_\alpha := \begin{pmatrix} -2 + \alpha & 1 & -\alpha \\ -4 + 2\alpha & 2 & -2\alpha \\ -2 & 1 + \alpha & -2\alpha \end{pmatrix} \in \mathbb{Q}^{3 \times 3}$$

- a) For every $\alpha \in \mathbb{Q}$ determine the characteristic polynomial and the minimal polynomial of M_α .
- b) For every $\alpha \in \mathbb{Q}$ and every eigenvalue λ of M_α determine a basis of the eigenspace $E_{\lambda, \alpha}$ as well as a basis of the generalized eigenvectors $H_{\lambda, \alpha}$ each.