

1. Bring the following matrices to Jordan normal form

$$A = \begin{bmatrix} 4 & 2 & 1 \\ 0 & 3 & 0 \\ 1 & 2 & 4 \end{bmatrix}$$

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

and find the matrices S, T that bring A, B to their Jordan normal form.

2. Write down the matrix

$$B^{20}$$

Needless to say, straightforward multiplication should be avoided!

3. Find the fundamental matrix of the matrix equation

$$U' = BU$$

4. solve the vectorial differential equation, i.e., system of equations

$$\mathbf{u}' = B\mathbf{u}; \quad \mathbf{u}(0) = (1, 1, 1)^T$$