CHEM-E7190/2023: Exercise Extra - Dynamics

1. Find the eigenvalues and eigenvectors of
$$\begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix}$$

2. Find the matrix that diagonalizes
$$\begin{bmatrix} 2 & 6 \\ 0 & -1 \end{bmatrix}$$

3. Consider a (2×2) matrix A, we want to determine the state transition matrix e^{At}
$$A = \begin{bmatrix} 0 & 1 \\ 0 & -2 \end{bmatrix}$$
Solve the e^{At} by using Sylvester's expansion and plot the results in Matlab

4. Determine the state transition matrix, and the response to the initial conditions $x_1(0) = 2$, $x_2(0) = 3$ of the system with state equations:
$$\dot{x}_1 = -2x_1 + u$$
$$\dot{x}_2 = x_1 - x_2$$

5. Find the response of the two state variables of the system
$$\dot{x}_1 = -2x_1 + u$$
$$\dot{x}_2 = x_1 - x_2$$
to a constant input $u(t) = 5$ for $t > 0$, if $x_1(0) = 0$ and $x_2(0) = 0$.

6. Find the response of the output variable
$$y = 2x_1 + x_2$$
in the system described by state equations
$$\dot{x}_1 = -2x_1 + u$$
$$\dot{x}_2 = x_1 - x_2$$
to a constant input $u(t) = 5$ for $t > 0$, if $x_1(0) = 0$, and $x_2(0) = 0$