Linear systems (3.2, 6.1, 6.2)

1. Write the following systems in matrix form and state whether they are autonomous or non-autonomous, and homogeneous or non-homogeneous:

a. $x' = -x + ty, \quad y' = tx - y$

b. $x' = 3x - z, \quad y' = x + y - z, \quad z' = z + t$

2. Transform the 2nd order ODE into a system of first order ODE-s and write it in matrix form: $u'' - 2u' + u = \sin t$

3. Find the general solutions of the following systems.

a. $\mathbf{x}' = \begin{pmatrix} 1 & 1 \\ 4 & -2 \end{pmatrix} \mathbf{x}$

b. $\mathbf{x}' = \begin{pmatrix} 3 & 6 \\ -1 & -2 \end{pmatrix} \mathbf{x}$