

# MATH 308. Differential Equations

## Homework 12

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Deadline: December 6, 11:00 pm

**Task 1.** (2+2 pt) (a) Solve the system

$$\begin{aligned}x_1' &= -x_1 - x_2 \\x_2' &= 4x_1 - 5x_2\end{aligned}$$

using the Eigenvalue method.

(b) Solve the system

$$\begin{aligned}x_1' &= -x_1 - x_2 + 1 \\x_2' &= 4x_1 - 5x_2 + e^t\end{aligned}$$

using the Undetermined Coefficients method.

**Task 2.** (3+1+2 pt) (a) Find  $e^{At}$  for the matrix

$$A = \begin{pmatrix} 3 & 1 \\ -1 & 3 \end{pmatrix}$$

using the fact that the columns of the matrix  $e^{At}$  are solutions with initial conditions  $(1, 0)$  and  $(0, 1)$ .

(b) Solve the equation  $x' = Ax$  with initial condition  $x(0) = x_0 = (1, 2)$ .

(c) Solve the equation

$$x' = Ax + \begin{pmatrix} \frac{e^{3t}}{\cos t} \\ 0 \end{pmatrix}$$

using the Variation of Parameters.