

HOMEWORK 9  
DUE: MONDAY, JUNE 15

1. Find the general solutions of following DE's a) without using Matrix methods and b) using Matrix methods

i)

$$\begin{aligned}x' &= x + 2y \\ y' &= y\end{aligned}$$

iii)

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ -2 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

ii)

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 7 & 1 \\ -4 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

iv)

$$\begin{aligned}x' &= x + 2y \\ y' &= -2x + y\end{aligned}$$

2. Solve the following initial value problems using variation of parameters for the initial conditions  $x(0) = 1, y(0) = 0$ ,

i)

$$\begin{aligned}x' &= x + 2y + e^t \\ y' &= -2x + y\end{aligned}$$

ii)

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 2 \\ t \end{bmatrix}$$

Phase portraits are widely used for describing systems of DE's. You should pick random problems from the book and practice drawing their phase portraits. Here is a link where you can verify your answers: <http://www.math.missouri.edu/~bartonae/pplane.html>