

MATH 54 SUMMER 2017, QUIZ 27

Reduce the following higher order ODE to a system of first order ODEs and then write that system in normal form.

$$y''' + 8t^t y'' - y' + t^2 \sin(5t)y = e^{4e^t}$$

New variables

$$y_1 = y$$

$$y_2 = y'$$

$$y_3 = y''$$



$$y_1' = y_2$$

$$y_2' = y_3$$

$$y_3' = y''' = -8t^t y'' + y' - t^2 \sin(5t)y + e^{4e^t}$$

$$= -8t^t y_3 + y_2 - t^2 \sin(5t)y_1 + e^{4e^t}$$

→ System of linear  
1st order ODE

Normal Form

$$\begin{bmatrix} y_1' \\ y_2' \\ y_3' \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -t^2 \sin(5t) & 1 & -8t^t \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ e^{4e^t} \end{bmatrix}$$