## 

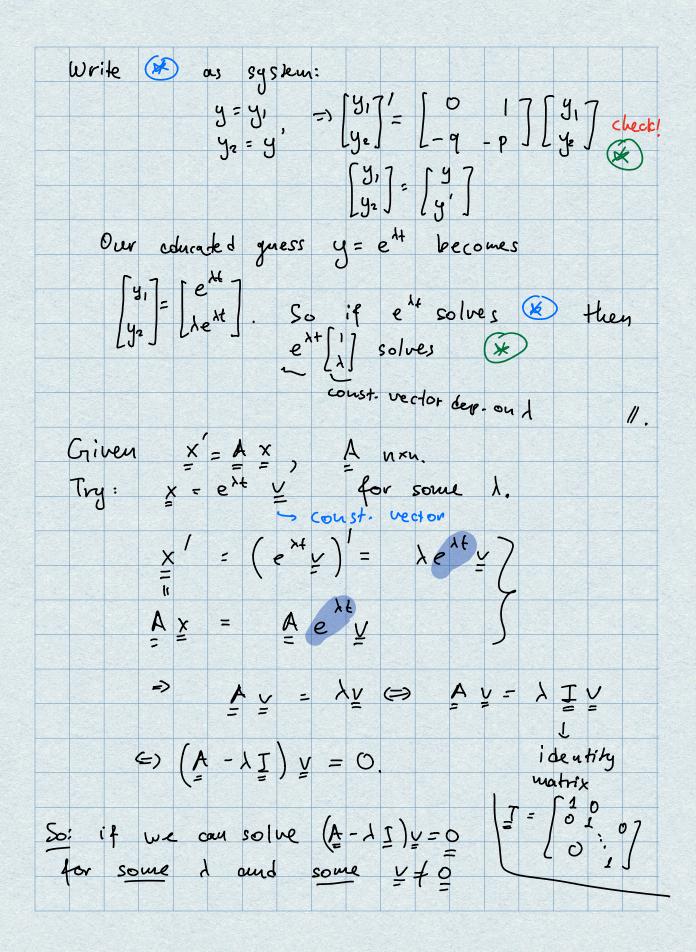
Learning goals/important concepts:

- 1. Be able to solve a 1st order system using the eigenvalue method when the characteristic equation has distinct real roots.
- 2. Eigenvalue, eigenvector of a matrix. Characteristic equation

Reminders/announcements

- 1. Quiz grades will be posted today
- 2. Computer Project 2 due Friday
- 3. Read the textbook!

Discussed linear systems (method of elimination) <u>Today</u>: Eigenslue method.  $\frac{d\underline{x}}{dt} = \begin{bmatrix} 1 & 2 \\ 3 & -5 \end{bmatrix} \xrightarrow{\mathbf{x}} \qquad \underbrace{\mathbf{x}}_{z} = \begin{bmatrix} x_{1} \\ x_{z} \end{bmatrix}$ ٤x: n lin. indep. sols. Any other solin will Want: be linear comb. of them.  $\frac{\sum x p (o ration: y'' + py' + q = 0)}{\sum p + py' + q = 0}$ Set:  $y = e^{\lambda t} \Rightarrow y \text{ is solin ex. when }$   $\frac{\lambda^2 + p\lambda + q = 0}{\lambda^2 + p\lambda + q = 0}$ found  $\lambda$ , found solin  $y = e^{\lambda t}$ .



then 
$$e^{\lambda t} y$$
 will solve  $\chi' = A \chi$ .  
Fort  
Can solve  $(A - \lambda I) y = 0$  for a  $y \neq 0$   
exactly when  $det(A - \lambda I) = 0$ ,  
 $characteristic equ of A$ .  
Defin: A number  $\lambda$  (real, cplx, 0) is an eigenvalue  
of A (uxn) if  
 $det(A - \lambda I) = 0$   
polynomial of deg. n  
An eigenvector associated  $\psi \lambda$  is a non-zero  
vector  $y$  such that  
 $(A - \lambda I)y = 0 \Leftrightarrow Ay = \lambda y$   
 $f = \frac{1}{2} \int_{0}^{1} \int$ 

3. If process gives n. lin. indep. U; Hen x = e<sup>k</sup>it v, ..., xn = e vy are n lin. indep. sul's for x' = d x 4. Any solin is  $X = c_1 X_1 + \dots + c_n X_n$ =  $c_1 e^{\lambda_1 t} v_1 + \dots + c_n e^{\lambda_n t} v_n$ Tf lj are all distinct then method works.  $\frac{x'}{2} = \frac{A}{2} = \frac{x}{2} = \frac{5}{2} = \frac{5$  $det (\underline{A} - \underline{\lambda}\underline{I}) = 0 \qquad \underline{\lambda}\underline{I}$  $det \begin{pmatrix} 5 & 0 & -6 \\ 2 & -1 & -2 \\ 4 & -2 & -4 \end{pmatrix} = \begin{pmatrix} \lambda & 0 & 0 \\ 0 & \lambda & 0 \\ 0 & 0 & \lambda \end{pmatrix} = 0$  $det\left(\begin{bmatrix} 5-\lambda & 0 & -6\\ 2 & -1-\lambda & -2\\ 4 & -2 & -4-\lambda \end{bmatrix}\right) = 0$ 

