Pre-class Warm-up!!!

Consider a system x' = Ax where A has an eigenvector $\begin{bmatrix} 1 \\ 2-i \end{bmatrix}$ with eigenvalue $\lambda = 1 + 3i$.

We get solutions
$$\begin{bmatrix} i \\ 2-i \end{bmatrix} e^{(1+3i)t}$$

and its complex conjections $\begin{bmatrix} i \\ 2-i \end{bmatrix} e^{t} (\cos 3t + i \sin 3t)$

$$t \int cos 3t + cs \ln 3t$$

$$e \int 2cos 3t + s \ln 3t + i (2s \ln 3 + - cos 3t)$$

3. Which of the following are solutions?

4. Which of the following are solutions? a. $e^{t} \begin{bmatrix} \cos 3t \\ 2\sin 3t \end{bmatrix}$ b. $e^{t} \begin{bmatrix} \cos 3t \\ 2\cos 3t \end{bmatrix}$

8.1 Matrix exponentials and linear systems

We learn

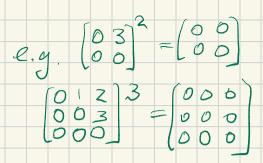
- a new approach to solving homogeneous systems
- how to solve homogeneous systems when the matrix is not diagonalizable

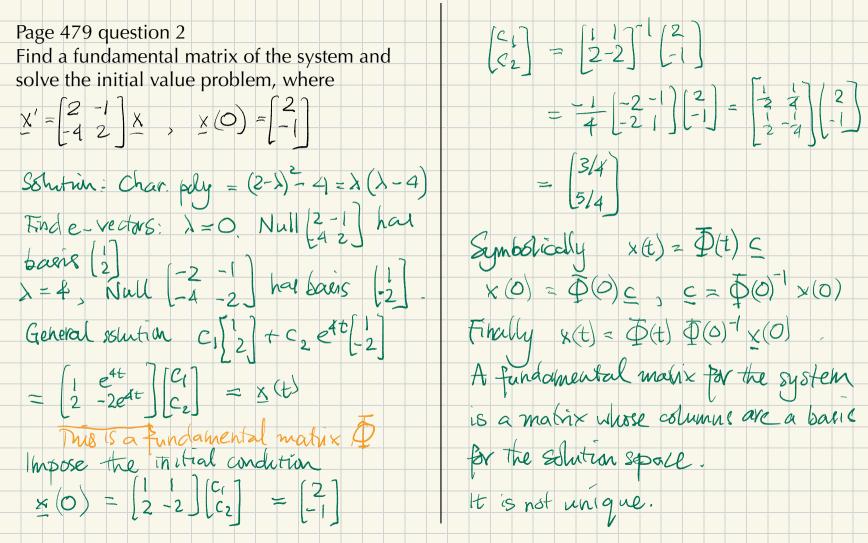
Vocabulary:

- fundamental matrix of a linear system
- Matrix exponential
- Nilpotent matrix = matrix A with $A^{+}=0$

for some n.

A different approach when the matrix is not diagonalizable is described in section 7.6 in terms of generalized eigenvectors and generalized eigenspaces. This is done in more advanced courses like Math 4242.



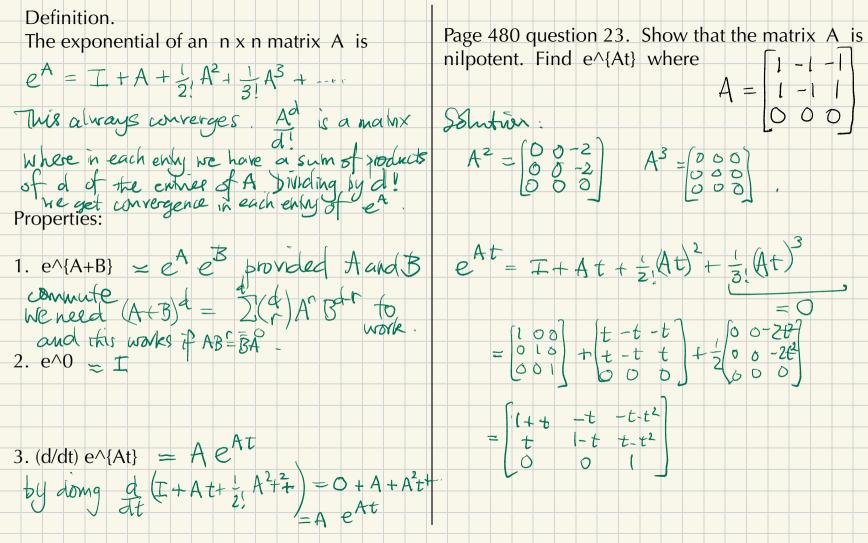


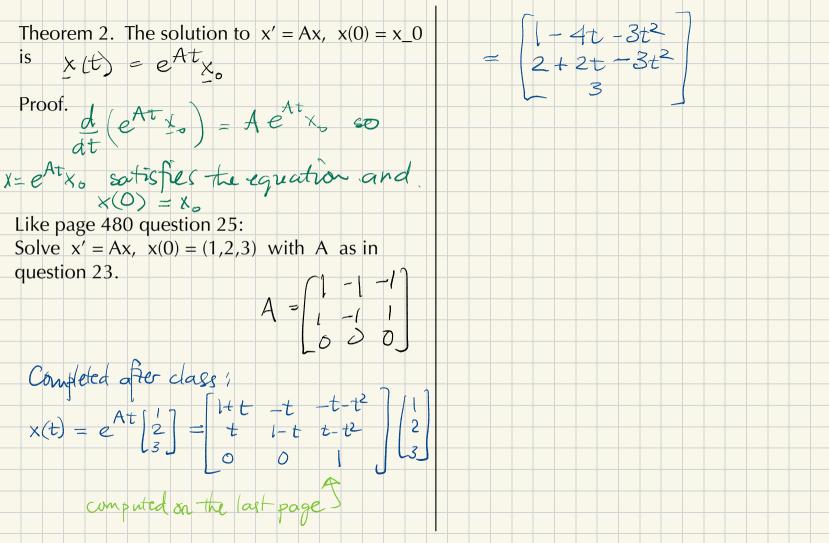
Definition.

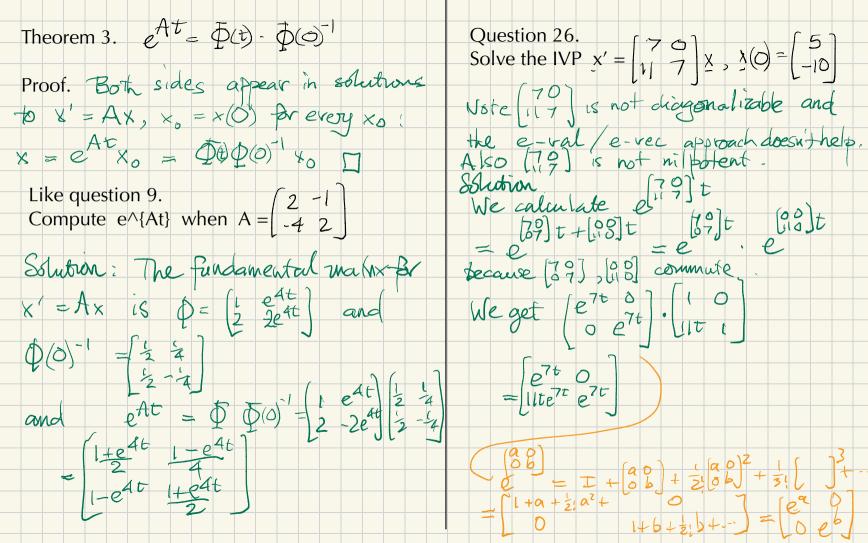
A fundamental matrix for a system x' = Ax is a matrix Φ whose columns form a basis for the space of solutions to the system.

Theorem. Let \oint be a fundamental matrix for x' = Ax, and suppose there is an initial condition x(0) = x_0. Then the solution to this initial value problem is

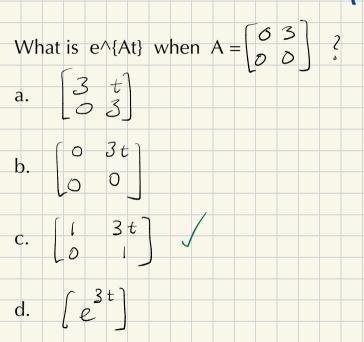
$$x(t) = \overline{\Phi}(t)\overline{\Phi}(0)x_{c}$$











e. None of the above.

Another question: what is e^{Bt} when

