Homework: Week of April 23d

- Homework Assigned Monday: Section 7.1, 1, 3, 4, 5, 7, 8, 11, 12, 14, 18, 22
- Homework Assigned Tuesday:

  1. Find the eigenvalues and eigenvectors for each of the following matrices:

  $$\begin{bmatrix} 3 & -2 \\ 2 & -2 \end{bmatrix} \quad \begin{bmatrix} 3 & -2 \\ 4 & -1 \end{bmatrix} \quad \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$$

  2. For each matrix below, find the eigenvalues in terms of the parameter α. Describe how the eigenvalues change with respect to α.

  $$\begin{bmatrix} \alpha & 1 \\ -1 & \alpha \end{bmatrix} \qquad \begin{bmatrix} -1 & \alpha \\ -1 & -1 \end{bmatrix}$$

  3. Show that the given function solves the given differential equation:

  (a)
  $$\mathbf{x}' = \begin{bmatrix} 3 & -2 \\ 2 & -2 \end{bmatrix} \mathbf{x} \qquad x = \begin{bmatrix} 4 \\ 2 \end{bmatrix} \mathrm{e}^{2t}$$

  (b)
  $$\mathbf{x}' = \begin{bmatrix} 2 & -1 \\ 3 & -2 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 1 \\ -1 \end{bmatrix} \qquad \mathbf{x} = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \mathrm{e}^{t} + \begin{bmatrix} 2 \\ 2 \end{bmatrix} t\mathrm{e}^{t}$$

  4. Given the vector function below, compute $\int \mathbf{x}(t)\, dt$:

  $$\mathbf{x}(t) = \begin{bmatrix} \sin(t) \\ t\mathrm{e}^{-3t} \end{bmatrix}$$

  5. Given that we can integrate componentwise, we can then also compute Laplace transforms. Compute the Laplace transform of:

  $$\mathbf{x}' = \begin{bmatrix} 3 & -2 \\ 2 & -2 \end{bmatrix} \mathbf{x} \qquad \mathbf{x}(0) = \begin{bmatrix} 2 \\ -3 \end{bmatrix}$$

  (For notation, you might let $\hat{x}_1$ be the Laplace transform of $x_1(t)$, etc.).

- Homework Assigned Thursday:
  - Page 398: 1, 3, 5, 15, 24
  - Page 410: 1, 3, 5, 13, 15
  - Page 428: 1, 3, 5, 7