

Linear Algebra I: Homework 3

Due Friday, February 9, 2018

1. Find the following matrix product, being sure to show your work:

$$\begin{pmatrix} 2 & 0 & -1 & 0 & 4 \\ 1 & 1 & 3 & 0 & 2 \\ -1 & 2 & 0 & -1 & 1 \end{pmatrix} \begin{pmatrix} 1 & 1 \\ -1 & 1 \\ 0 & 3 \\ 2 & 4 \\ 1 & 0 \end{pmatrix}$$

You are welcome to use a calculator or computer program to check your answer, but I strongly advise you to first compute the result by hand. Remember, you won't have a calculator on our upcoming test.

2. Express the following system of linear equations as a matrix equation $A\vec{x} = b$. You do not have to solve the system.

$$\begin{aligned} 2a + 2b + 2c - d &= 0 \\ -2a + 5b + 2c + d &= 1 \\ 8a + b + 4c + 2d &= -1 \end{aligned}$$

3. This question has two parts.

- a. Use Gauss-Jordan elimination to put the following matrix in **reduced row echelon form**.

$$\begin{pmatrix} 2 & 1 & 2 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 \end{pmatrix}$$

- b. Use your answer to part (a) to find the inverse A^{-1} of the matrix

$$A = \begin{pmatrix} 2 & 1 & 2 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix}$$

4. Find all values of t that satisfy the equation,

$$(2 \ 2 \ t) \begin{pmatrix} 1 & 2 & 0 \\ 2 & 0 & 3 \\ 0 & 3 & 1 \end{pmatrix} \begin{pmatrix} 2 \\ 2 \\ t \end{pmatrix} = 0$$

5. Use the **definition of a linear function** to explain whether the following functions are linear or not. Answers that don't use the definition cannot receive full credit.

a. $f\left(\begin{pmatrix} x \\ y \end{pmatrix}\right) = \begin{pmatrix} 2x + y \\ y \end{pmatrix}$

b. $f\left(\begin{pmatrix} x \\ y \\ z \end{pmatrix}\right) = \begin{pmatrix} x + y + z \\ y + \frac{2}{z} \end{pmatrix}$