MATH 261 · Linear Algebra
Spring 2017

Written Homework 4: Due in class March 9

Reminder

Your submitted homework solutions should show not only your answers, but should show a clearly reasoned logical argument, written using **complete English sentences**, leading to that solution. Each mathematical symbol that you will encounter stands for one or more English words[1], and if you elect to use symbols, you must use them properly. In particular, please avoid the use of the "running equals sign", as this is an abuse of notation and is unacceptable: `http://www.wikiwand.com/en/Equals_sign#/Incorrect_usage`. Write your solutions so that a student one course behind you in the sequence would understand them.

Problem 1. Sketch $\vec{u}$ and its image under the given matrix transformation. Describe the transformation in words if applicable, and give the transformation matrix if applicable:

(a) $f : \mathbb{R}^2 \to \mathbb{R}^2$ defined by $f\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$; $\vec{u} := \begin{bmatrix} 2 \\ 3 \end{bmatrix}$.

(b) $f : \mathbb{R}^2 \to \mathbb{R}^2$ defined by $f\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$; $\vec{u} := \begin{bmatrix} 1 \\ 2 \end{bmatrix}$.

(c) $f : \mathbb{R}^2 \to \mathbb{R}^2$ is a counterclockwise rotation through $2\pi/3$ radians; $\vec{u} := \begin{bmatrix} -2 \\ -3 \end{bmatrix}$.

(d) $f : \mathbb{R}^3 \to \mathbb{R}^3$ defined by $f\left(\begin{bmatrix} x \\ y \\ z \end{bmatrix}\right) = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$; $\vec{u} := \begin{bmatrix} 2 \\ 3 \end{bmatrix}$.

Problem 2. Suppose that L is a linear transformation, and that $L\left(\begin{bmatrix} 1 \\ 0 \end{bmatrix}\right) = \begin{bmatrix} 5 \\ 3 \end{bmatrix}$ and $L\left(\begin{bmatrix} 0 \\ 1 \end{bmatrix}\right) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$. Find the values of...

(a) $L\left(\begin{bmatrix} 0 \\ 5 \end{bmatrix}\right)$

(b) $L\left(\begin{bmatrix} 3 \\ 0 \end{bmatrix}\right)$

(c) $L\left(\begin{bmatrix} 17 \\ 2 \end{bmatrix}\right)$

Problem 3. Cherney book, Section 6.5, Problems 4(a) and (b)

Problem 4. Cherney book, Section 6.5, Problem 2

[1] See a list of mathematical symbols and their meanings here: `http://en.wikipedia.org/wiki/List_of_mathematical_symbols`