

Unity University
Department of Computer Science
Linear Algebra (Math 2022) Assignment II

General Instructions

- Direct copy of the answer from each other worth's mark "0".
- Don't use black pen to write your answer.
- Each answer should be submitted with clear and neat hand writing.

1. Let $J : V \rightarrow R$ be an integral mapping, say

$$J(f(t)) = \int_0^1 f(t)dt$$

Show that integral mapping is linear.

2. Find the volume of the parallelepiped with one vertex at the origin and adjacent vertices at $(1, 3, 0)$, $(2, 0, 2)$, and $(-1, 3, -1)$.
3. Find out an inverse of the given matrices if the matrix is invertible.

$$(a) A = \begin{bmatrix} 2 & 6 & 0 \\ 1 & 3 & 2 \\ 3 & 9 & 2 \end{bmatrix} \quad (b) C = \begin{bmatrix} 5 & 1 & -1 \\ 1 & -3 & -2 \\ 0 & 5 & 3 \end{bmatrix}$$

4. A rotation on a computer screen is sometimes implemented as the product of two shear-and-scale transformations, which can speed up calculations that determine how a graphic image actually appears in terms of screen pixels. (The screen consists of rows and columns of small dots, called pixels.) The first transformation A_1 shears vertically and then compresses each column of pixels; the second transformation A_2 shears horizontally and then stretches each row of pixels. Let

$$A_1 = \begin{bmatrix} 1 & 0 & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad A_2 = \begin{bmatrix} \sec \theta & -\tan \theta & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Show that the composition of the two transformations is a rotation in R^2 .

5. The actual color a viewer sees on a screen is influenced by the specific type and amount of phosphors on the screen. So each computer screen manufacturer must convert between the (R, G, B) data and an international *CIE* standard for color, which uses three primary colors, called X, Y , and Z . A typical conversion for short-persistence phosphors is

$$\begin{bmatrix} 0.61 & 0.29 & 0.150 \\ 0.35 & 0.59 & 0.063 \\ 0.04 & 0.12 & 0.787 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}$$

A computer program will send a stream of color information to the screen, using standard CIE data (X, Y, Z) . Find the equation that converts these data to the (R, G, B) data needed for the screen's electron gun.