Test 2, 69.114 Section E
Exam Version 1

1. Let $T : \mathbb{R}^2 \mapsto \mathbb{R}^2$ be given by $T\left(\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}\right) = \begin{bmatrix} x_1^2 \\ x_2^2 \end{bmatrix}$. Is T linear?

(a)Yes (b)No.

Answer: (b).

2. Is the matrix $\begin{pmatrix} 1 & 1 & 2 \\ -1 & 1 & 7 \\ 2 & 2 & 4 \end{pmatrix}$ invertible?

(a)Yes (b)No.

Answer: (b).

3. Let $A = \begin{pmatrix} 3-\lambda & 2 \\ 2 & 6-\lambda \end{pmatrix}$. There are two values of λ that make $\det A = 0$. Find the sum of these two values of λ.

(a)7 (b)10 (c)8 (d)9.

Answer: (d).

4. Consider the matrix $A = \begin{pmatrix} 1 & 0 & 1 \\ 2 & 2 & 7 \\ -1 & 3 & 1 \end{pmatrix}$. What is $\det A$?

(a)10 (b)-10 (c)11 (d)-11.

Answer: (d).

5. Let $A = \begin{pmatrix} 7 & -1 & 1 & 0 \\ 3 & 0 & 1 & 0 \\ 4 & 0 & 0 & 0 \\ 9 & 5 & 3 & 7 \end{pmatrix}$. What is $\det A$?

(a)-6 (b)-28 (c)28 (d)6.

Answer: (b).

6. Let T be the linear transformation given by $T\left(\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}\right) = \begin{bmatrix} 2x_1 + 3x_2 \\ -x_1 + x_2 \end{bmatrix}$. Let S be the inverse linear transformation of T. Then, S is

(a) $\begin{bmatrix} \frac{1}{5}x_1 - \frac{3}{5}x_2 \\ \frac{1}{5}x_1 + \frac{2}{5}x_2 \end{bmatrix}$ (b) $\begin{bmatrix} x_1 - 3x_2 \\ x_1 + 2x_2 \end{bmatrix}$ (c) $\begin{bmatrix} x_2 \\ x_1 \end{bmatrix}$ (d) $\begin{bmatrix} \frac{2}{5}x_1 + \frac{3}{5}x_2 \\ -\frac{1}{5}x_1 + \frac{1}{5}x_2 \end{bmatrix}$.

Answer: (a).

7. Let $A = \begin{pmatrix} 3 & 7 & -2 \\ 0 & 5 & 3 \\ 1 & 2 & -1 \end{pmatrix}$. What is the largest positive entry of A^{-1}?

(a)11/2 (b)15/2 (c)17/2 (d)13/2.

Answer: (a).

8. If $\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix}$ is the solution of the system $A \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} -2 \\ 3 \\ 1 \end{pmatrix}$, where

$$A^{-1} = \begin{pmatrix} 1 & 2 & 4 \\ 1 & -3 & 0 \\ 2 & 1 & 5 \end{pmatrix}.$$

Then what is $x_1 + x_2 + x_3$?

(a)1 (b)19/3 (c)6 (d)0.

Answer: (a).

9. Let $A = \begin{pmatrix} a & b & c \\ d & e & f \\ g & h & i \end{pmatrix}$. We know that $\det A = 4$. Let $B = \begin{pmatrix} a-b & b & 2c \\ d-e & e & 2f \\ g-h & h & 2i \end{pmatrix}$. What is $\det B$?

(a)8 (b)-8 (c)4 (d)-4 .

Answer: (a).

10. Let $T : \mathbb{R}^2 \mapsto \mathbb{R}^3$ be defined by $T\left(\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}\right) = \begin{bmatrix} 2x_1 + x_2 \\ x_1 - x_2 \\ 6x_1 + 3x_2 \end{bmatrix}$. Then,

(a) T is 1-1 (injective) and onto (surjective)

(b) T is 1-1, but not onto

(c) T is onto, but not 1-1

(d) T is neither 1-1 nor onto.

Answer: (b).