Instructor: Dr. Rola Alseidi	Philadelphia University Faculty/College of Science Department of Basic Science and Mathematics midterm exam	Academic Year: 2021/2022. Semester: Second. Date: 22/5/2022. Course : LAVC Duration of Exam: 75 minutes.
Name:		

- The exam consists of **4 pages**. Make sure you have all of them.

1. (10 points) Let

$$A = \begin{bmatrix} 1 & 4 \\ -2 & 3 \\ 1 & -2 \end{bmatrix}, \; B = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 1 & -1 \end{bmatrix} \; C = \begin{bmatrix} 1 & 2 & 0 \\ 1 & 0 & 1 \\ -1 & 0 & 0 \end{bmatrix}$$

Find (if possible)

(a) (3 points) AB.

(b) (2 points) $A^T + B$.

(c) (3 points) C^{-1}.

(d) (2 points) $\det(C)$.

2. (3 points) Let $\begin{bmatrix} -2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 1 \end{bmatrix}$. Find

(a) B^2

(b) $(2B)^{-1}$

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3. (3 points) For the system of equations

$$\begin{aligned} x + ky &= 1 \\ 3x + 5y &= 0, \end{aligned}$$

find the value of k such that .

(a) the system is consistent.

(b) the system has no solution.

4. (3 points) Solve the following system by Cramer's Rule

$$\begin{aligned} x + y &= -2 \\ 2x + y &= -1 \end{aligned}$$

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5. (5 points) Circle True or False. Read each statement carefully before answering.

(a) True False Let A be an $n \times n$ matrix, then the linear system $Ax = 0$ has the trivial solution if and only if A is invertible.

(b) True False The matrix$A = \begin{bmatrix} 1 & 4 & 5 \\ 4 & 1 & 0 \\ 5 & 0 & 7 \end{bmatrix}$ is symmetric.

(c) True False The sum of two invertible matrices of the same size must be invertible.

(d) True False If $A^2 = 0$, then $A = 0$ for any square matrix A.

(e) True False If A and B and C are square invertible matrices, and $ABC = I$, then $B^{-1} = (AC)^{-1}$

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6. (6 points) Circle the correct answer

(a) If $B = \begin{bmatrix} 2 & 1 & 0 \\ -2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$, then the minor $M_{23} =$

A. -3 B. 3 C. 6 D. -6 E. 4 F. None

(b) If

$$A = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -2 \end{bmatrix}$$

then $adj(A)$=

A. $\begin{bmatrix} 2 & 0 & 0 \\ 0 & -6 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ B. $\begin{bmatrix} -2 & 0 & 0 \\ 0 & 6 & 3 \\ 0 & 0 & 3 \end{bmatrix}$ C. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ D. $\begin{bmatrix} -2 & 0 & 0 \\ 0 & -6 & 0 \\ 0 & 0 & 3 \end{bmatrix}$

E. $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 6 & 3 \\ 0 & 0 & -3 \end{bmatrix}$ F. None

(c) Let A and B be 2×2 matrices with $\det(A) = 2$, $\det(B) = 5$. Find $\det(2A^{-1}(B^2)^T) =$

A. 5 B. 10 C. 100 D. 50 E. 32 F. None

(d) If $A = \begin{bmatrix} -2 & 6 & 1 \\ -3 & 4 & 5 \\ 4 & 2 & 3 \end{bmatrix}$, $B = \begin{bmatrix} -2 & 0 & 0 \\ 0 & 3 & 2 \\ 1 & 2 & 4 \end{bmatrix}$ then $tr(2A + B) =$

A. 5 B. 10 C. 15 D. 19 E. 3 F. None

(e) If A is 6×4 matrix and B is an $m \times n$ matrix such that $B^T A^T$ is a 2×6 matrix, then =

A. $m = 4$, $n = 6$ B. $m = 6$, $n = 4$ C. $m = 2$, $n = 6$ D. $m = 4$, $n = 2$
E. $m = 6$, $n = 3$ F. None

(f) Let A and B be 2×2 matrices with $\det(adj(A)) = -8$, $\det(B) = 4$. Find $\det(AB) =$

A. -32 B. 8 C. -8 D. 32 E. 4 F. None
