Math 3E HW #3

Answers must be submitted on Moodle by 11AM on Thursday, March 3rd.

Good luck!

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Find the matrix product AB, if it is defined.

1) $A = \begin{bmatrix} -1 & 3 \\ 1 & 6 \end{bmatrix}$, $B = \begin{bmatrix} 0 & -2 & 7 \\ 1 & -3 & 2 \end{bmatrix}$. 1) _____

A) $\begin{bmatrix} 0 & -6 \\ 21 & 1 \\ -18 & 12 \end{bmatrix}$

B) $\begin{bmatrix} 3 & -7 & -1 \\ 6 & -20 & 19 \end{bmatrix}$

C) $\begin{bmatrix} 3 & 6 & -7 \\ -20 & -1 & 19 \end{bmatrix}$

D) AB is undefined.

2) $A = \begin{bmatrix} 3 & -2 & 1 \\ 0 & 4 & -2 \end{bmatrix}$, $B = \begin{bmatrix} 4 & 0 \\ -2 & 3 \end{bmatrix}$. 2) _____

A) $\begin{bmatrix} 12 & 0 \\ 0 & 12 \end{bmatrix}$

B) $\begin{bmatrix} 12 & -6 \\ -8 & 16 \\ 4 & -8 \end{bmatrix}$

C) AB is undefined.

D) $\begin{bmatrix} 12 & -8 & 4 \\ -6 & 16 & -8 \end{bmatrix}$

3) $A = \begin{bmatrix} 1 & 3 & -2 \\ 2 & 0 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 0 \\ -2 & 1 \\ 0 & 3 \end{bmatrix}$. 3) _____

A) $\begin{bmatrix} -3 & -3 \\ 6 & 9 \end{bmatrix}$

B) $\begin{bmatrix} -3 & -3 \\ 9 & 6 \end{bmatrix}$

C) AB is undefined.

D) $\begin{bmatrix} 3 & -6 & 0 \\ 0 & 0 & 9 \end{bmatrix}$

The sizes of two matrices A and B are given. Find the sizes of the product AB and the product BA, if the products are defined.

4) A is 2×3, B is 3×2. 4) _____

A) AB is 2×2, BA is undefined.

B) AB is undefined, BA is 3×3.

C) AB is 2×2, BA is 3×3.

D) AB is 3×3, BA is 2×2.

Solve the problem.

5) Find the general solution of the simple homogeneous "system" below, which consists of a single linear equation. Give your answer as a linear combination of vectors. Let $x_2 = s$ and $x_3 = t$ be free variables. 5) _____

$-2x_1 - 14x_2 + 8x_3 = 0$

A)
$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = s\begin{bmatrix} 7 \\ 1 \\ 0 \end{bmatrix} + t\begin{bmatrix} -4 \\ 0 \\ 1 \end{bmatrix} \quad \text{(with } x_2, x_3 \text{ free)}$$

B)
$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = -7\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} - 4\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \quad \text{(with } x_2, x_3 \text{ free)}$$

C)
$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = s\begin{bmatrix} -7 \\ 0 \\ 1 \end{bmatrix} + t\begin{bmatrix} 4 \\ 1 \\ 0 \end{bmatrix} \quad \text{(with } x_2, x_3 \text{ free)}$$

D)
$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = s\begin{bmatrix} -7 \\ 1 \\ 0 \end{bmatrix} + t\begin{bmatrix} 4 \\ 0 \\ 1 \end{bmatrix} \quad \text{(with } x_2, x_3 \text{ free)}$$

6) For what values of h are the given vectors linearly dependent? 6) _____

$$\begin{bmatrix} -1 \\ 4 \\ 6 \end{bmatrix}, \begin{bmatrix} 5 \\ 2 \\ -3 \end{bmatrix}, \begin{bmatrix} 6 \\ 2 \\ 6 \end{bmatrix}, \begin{bmatrix} -24 \\ -8 \\ h \end{bmatrix}$$

A) Vectors are linearly dependent for $h = -24$
B) Vectors are linearly dependent for $h \neq -24$
C) Vectors are linearly dependent for all h
D) Vectors are linearly independent for all h

7) Let T: $\mathcal{R}^2 \to \mathcal{R}^2$ be a linear transformation that maps $\mathbf{u} = \begin{bmatrix} -3 \\ 4 \end{bmatrix}$ into $\begin{bmatrix} -13 \\ 6 \end{bmatrix}$ and maps $\mathbf{v} = \begin{bmatrix} 4 \\ 6 \end{bmatrix}$ into $\begin{bmatrix} 6 \\ -8 \end{bmatrix}$. 7) _____

Use the fact that T is linear to find the image of $3\mathbf{u} + \mathbf{v}$.

A) $\begin{bmatrix} -33 \\ 10 \end{bmatrix}$ B) $\begin{bmatrix} -5 \\ 18 \end{bmatrix}$ C) $\begin{bmatrix} -21 \\ -6 \end{bmatrix}$ D) $\begin{bmatrix} -7 \\ -2 \end{bmatrix}$