Name: ____ Period: __________ Date: _______________

Matrix Multiplication, Inverses, and Determinants Assignment

Find AB and BA, if possible.

1. $A = \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$, $B = \begin{bmatrix} -1 & 0 \\ 5 & 3 \end{bmatrix}$

2. $A = \begin{bmatrix} -1 & 3 \\ 2 & 2 \end{bmatrix}$, $B = \begin{bmatrix} -2 & 5 & 0 \\ -3 & 1 & 2 \end{bmatrix}$

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Matrix Multiplication, Inverses, and Determinants Assignment

Use the matrices $A = \begin{bmatrix} -1 & 4 \\ 2 & 0 \end{bmatrix}$, $B = \begin{bmatrix} -3 & 1 & 2 \\ 0 & -4 & 3 \end{bmatrix}$, $C = \begin{bmatrix} -1 & 2 & 4 \\ 3 & -2 & 1 \end{bmatrix}$ to evaluate expressions below.

1. $AB + C$

2. $A(B - C)$

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Matrix Multiplication, Inverses, and Determinants Assignment

Find the determinant of each matrix, then find its inverse if it exists.

1. $A = \begin{bmatrix} 11 & 5 \\ 2 & 1 \end{bmatrix}$

2. $A = \begin{bmatrix} 5 & -1 \\ -10 & 2 \end{bmatrix}$

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

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

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Matrix Multiplication, Inverses, and Determinants Assignment

Answers

Find AB and BA, if possible.

1. $A = \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$, $B = \begin{bmatrix} -1 & 0 \\ 5 & 3 \end{bmatrix}$

$$AB = \begin{bmatrix} 2(-1) + 3(5) & 2(0) + 3(3) \\ 1(-1) + 4(5) & 1(0) + 4(3) \end{bmatrix}$$

$$AB = \begin{bmatrix} -2 + 15 & 0 + 9 \\ -1 + 20 & 0 + 12 \end{bmatrix}$$

$$AB = \begin{bmatrix} 13 & 9 \\ 19 & 12 \end{bmatrix}$$

$$BA = \begin{bmatrix} -1(2) + 0(1) & -1(3) + 0(4) \\ 5(2) + 3(1) & 5(3) + 3(4) \end{bmatrix}$$

$$BA = \begin{bmatrix} -2 + 0 & -3 + 0 \\ 10 + 3 & 15 + 12 \end{bmatrix}$$

$$BA = \begin{bmatrix} -2 & -3 \\ 13 & 27 \end{bmatrix}$$

2. $A = \begin{bmatrix} -1 & 3 \\ 2 & 2 \end{bmatrix}$, $B = \begin{bmatrix} -2 & 5 & 0 \\ -3 & 1 & 2 \end{bmatrix}$

$$AB = \begin{bmatrix} -1(-2) + 3(-3) & -1(5) + 3(1) & -1(0) + 3(2) \\ 2(-2) + 2(-3) & 2(5) + 2(1) & 2(0) + 2(2) \end{bmatrix}$$

$$AB = \begin{bmatrix} 2 - 9 & -5 + 3 & 0 + 6 \\ -4 - 6 & 10 + 2 & 0 + 4 \end{bmatrix}$$

$$AB = \begin{bmatrix} -7 & -2 & 6 \\ -10 & 12 & 4 \end{bmatrix}$$

Since the dimensions of $B = 2 \times 3$ and dimensions of $A = 2 \times 2$

→ BA is not possible.

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Matrix Multiplication, Inverses, and Determinants Assignment

Use the matrices $A = \begin{bmatrix} -1 & 4 \\ 2 & 0 \end{bmatrix}$, $B = \begin{bmatrix} -3 & 1 & 2 \\ 0 & -4 & 3 \end{bmatrix}$, $C = \begin{bmatrix} -1 & 2 & 4 \\ 3 & -2 & 1 \end{bmatrix}$ **to evaluate expressions below.**

1. $AB + C$

$$AB = \begin{bmatrix} -1(-3)+4(0) & -1(1)+4(-4) & -1(2)+4(3) \\ 2(-3)+0(0) & 2(1)+0(-4) & 2(2)+0(3) \end{bmatrix}$$

$$AB = \begin{bmatrix} 3+0 & -1-16 & -2+12 \\ -6+0 & 2+0 & 4+0 \end{bmatrix}$$

$$AB = \begin{bmatrix} 3 & -17 & 10 \\ -6 & 2 & 4 \end{bmatrix}$$

$$AB + C = \begin{bmatrix} 3 & -17 & 10 \\ -6 & 2 & 4 \end{bmatrix} + \begin{bmatrix} -1 & 2 & 4 \\ 3 & -2 & 1 \end{bmatrix}$$

$$AB + C = \begin{bmatrix} 3-1 & -17+2 & 10+4 \\ -6+3 & 2-2 & 4+1 \end{bmatrix}$$

$$AB + C = \begin{bmatrix} 2 & -15 & 14 \\ -3 & 0 & 5 \end{bmatrix}$$

2. $A(B - C)$

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

$$B - C = \begin{bmatrix} -3-(-1) & 1-(-1) & 2-4 \\ 0-3 & -4-(-2) & 3-1 \end{bmatrix}$$

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

$$A(B - C) = \begin{bmatrix} -1(-2)+4(-3) & -1(2)+4(-2) & -1(-2)+4(2) \\ 2(-2)+0(-3) & 2(2)+0(-2) & 2(-2)+0(2) \end{bmatrix}$$

$$A(B - C) = \begin{bmatrix} -3-12 & -2-8 & 2+8 \\ -4+0 & 4+0 & -4+0 \end{bmatrix}$$

$$A(B - C) = \begin{bmatrix} -15 & -10 & 10 \\ -4 & 4 & -4 \end{bmatrix}$$

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Matrix Multiplication, Inverses, and Determinants Assignment

Find the determinant of each matrix, then find its inverse if it exists.

1. $A = \begin{bmatrix} 11 & 5 \\ 2 & 1 \end{bmatrix}$

$det(A) = 11(1) - 2(5) = 11 - 10 = 1$

Since $det(A) \neq 0$, A is invertible.

$A^{-1} = \frac{1}{det(A)} \begin{bmatrix} 1 & -5 \\ -2 & 11 \end{bmatrix}$

$A^{-1} = \frac{1}{1} \begin{bmatrix} 1 & -5 \\ -2 & 11 \end{bmatrix}$

$\rightarrow A^{-1} = \begin{bmatrix} 1 & -5 \\ -2 & 11 \end{bmatrix}$

2. $A = \begin{bmatrix} 5 & -1 \\ -10 & 2 \end{bmatrix}$

$det(A) = 5(2) - (-10)(-1) = 10 - 10 = 0$

Since $det(A) = 0$,

$\rightarrow$ **A is not invertible.**

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

$det(A) = 3(1) - 2(1) = 3 - 2 = 1$

Since $det(A) \neq 0$, A is invertible.

$A^{-1} = \frac{1}{det(A)} \begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix}$

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

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

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

The determinant and inverse of a matrix exist if and only if the matrix is a square matrix.

Here, dimensions of $A = 3 \times 2$

Since A is not a square matrix, its inverse does not exist.

$\rightarrow$ **A is not invertible.**