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| **Student:** Cole Lamers<br>**Date:** 06/30/19 | **Instructor:** Kelly Galarneau<br>**Course:** CA&T Internet (70263)<br>Galarneau  **Assignment:** 9.3 Matrix Inverse |

1. For $n \times n$ matrices A and B, if AB = I = BA, then B is called the _____ of A.

   For $n \times n$ matrices A and B, if AB = I = BA, then B is called the  inverse  of A.

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2. Fill in the blank so that the resulting statement is true.

   To find the multiplicative inverse of an invertible matrix A, perform row operations on $\left[ \begin{array}{c|c} A & I_n \end{array} \right]$ to obtain a matrix of the form $\left[ \begin{array}{c|c} I_n & B \end{array} \right]$, where B = _____.

   To find the multiplicative inverse of an invertible matrix A, perform row operations on $\left[ \begin{array}{c|c} A & I_n \end{array} \right]$ to obtain a matrix of the form $\left[ \begin{array}{c|c} I_n & B \end{array} \right]$, where B = $A^{-1}$.

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3. Fill in the blank so that the resulting statement is true.

   If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, the matrix A is invertible if and only if _____.

   If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, the matrix A is invertible if and only if  $ad - bc \neq 0$.

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4. Every square matrix is invertible. State whether this statement is true or false.

   Choose the correct answer below.

   ○ True
   ✔ False

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5. Determine whether the following statement is true or false.

   $A = \begin{bmatrix} 3 & 2 \\ 9 & 6 \end{bmatrix}$ is invertible.

   Choose the correct answer below.

   ✔ False
   ○ True

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6. Determine whether B is the inverse of A.

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

   Is B the inverse of A?

   ○ No
   ✔ Yes

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7. Find the products AB and BA to determine whether B is the multiplicative inverse of A.

$$A = \begin{bmatrix} -5 & 5 \\ 9 & -8 \end{bmatrix}, \quad B = \begin{bmatrix} \dfrac{8}{5} & 1 \\ \dfrac{9}{5} & 1 \end{bmatrix}$$

$$AB = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$BA = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Is B a multiplicative inverse of A?

✔ ◉ Yes
○ No

8. Determine whether B is the inverse of A by computing AB and BA.

$$A = \begin{bmatrix} -1 & 3 & 1 \\ 0 & -3 & 3 \\ 3 & 1 & 0 \end{bmatrix}, \quad B = \frac{1}{39}\begin{bmatrix} -3 & 1 & 12 \\ 9 & -3 & 3 \\ 9 & 10 & 3 \end{bmatrix}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

✔ ◉ **A.**
$$AB = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

○ **B.** This matrix operation is not possible.

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

✔ ◉ **A.**
$$BA = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

○ **B.** This matrix operation is not possible.

Is B the inverse of A?

✔ ◉ Yes
○ No

9. Find the inverse of the following matrix A, if possible. Check that $A \cdot A^{-1} = I$ and $A^{-1} \cdot A = I$.

$$A = \begin{bmatrix} 3 & 2 \\ 3 & 4 \end{bmatrix}$$

Find the inverse. Select the correct choice below and, if necessary, fill in the answer boxes to complete your choice.

✔ ◉ **A.** The inverse, $A^{-1}$ is $\begin{bmatrix} \dfrac{2}{3} & -\dfrac{1}{3} \\ -\dfrac{1}{2} & \dfrac{1}{2} \end{bmatrix}$ . (Simplify your answers.)

○ **B.** Finding the inverse is not possible.

10. Find the inverse of the following matrix A, if possible. Check that $A \cdot A^{-1}$ and $A^{-1} \cdot A = I$.

$A = \begin{bmatrix} -3 & -6 \\ -4 & -8 \end{bmatrix}$

Find the inverse. Select the correct choice below and, if necessary, fill in the answer boxes to complete your choice.

  ◯ **A.** The inverse, $A^{-1}$ is $\begin{bmatrix} \rule{3cm}{0.4pt} & \rule{3cm}{0.4pt} \\ \rule{3cm}{0.4pt} & \rule{3cm}{0.4pt} \end{bmatrix}$.

  ✅ **B.** Finding the inverse is not possible.

11. Find $M^{-1}$ (if it exists) by forming the matrix [M|I] and using row operations to obtain [I|B], where $B = M^{-1}$.

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

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

(Type an integer or simplified fraction for each matrix element.)

  ✅ **A.** $M^{-1} = \begin{bmatrix} -3 & -2 & -2 \\ -2 & -1 & -1 \\ -4 & -2 & -3 \end{bmatrix}$

  ◯ **B.** $M^{-1}$ does not exist.

12. Use the fact that if $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then $A^{-1} = \dfrac{1}{ad-bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$ to find the inverse of the given matrix, if possible. Check that $AA^{-1} = I_2$ and $A^{-1}A = I_2$.

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

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

  ✅ **A.** $A^{-1} = \begin{bmatrix} -\dfrac{1}{24} & -\dfrac{5}{24} \\ \dfrac{5}{24} & \dfrac{1}{24} \end{bmatrix}$ (Simplify your answers.)

  ◯ **B.** The inverse matrix is not possible.

13. Write a matrix equation of the form AX = B that corresponds to the following system of equations.

$2x + 3y = 7$
$2x - y = 2$

The matrix equation is:

$\begin{bmatrix} 2 & 3 \\ 2 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 7 \\ 2 \end{bmatrix}$.

14. 

Write the matrix equation as a system of equations.

$\begin{bmatrix} 5 & -3 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -3 \\ 5 \end{bmatrix}$

Complete the first equation of the system of equations.

$5x - 3y = -3$

Complete the second equation of the system of equations.

$2x + 4y = 5$

15.  **a.**  Write the linear system as a matrix equation
     in the form AX = B.

   **b.**  Solve the system using the inverse that is
   given for the coefficient matrix.

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

$$\begin{aligned} x - y + z &= 0 \\ 2y - z &= -1 \\ -2x - 3y &= 3 \end{aligned}$$

**a.**  AX = B  →
$$\begin{bmatrix} 1 & -1 & 1 \\ 0 & 2 & -1 \\ -2 & -3 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ -1 \\ 3 \end{bmatrix}$$

**b.**  The solution set is $\{(\ 0\ ,\ -1\ ,\ -1\ )\}$.

16.  Solve the following linear system by using an inverse matrix.

$$\begin{cases} x + 3y = 4 \\ 4x + 8y = 4 \end{cases}$$

The solution of the system is $\{\ (-5,3)\ \}$. (Type an ordered pair.)

17.  An investor inherited $90,000, and she split it into three investments. Part of the money she invested in a treasury bill that yields 3% annual interest, part she invested in bonds with an annual yield of 7%, and the rest she invested in a mutual fund. In 2008, when the mutual fund lost 7%, her net income from all three investments was $800. In 2009, when the mutual fund gained 10%, her net income from all three investments was $6750. How much money did the investor put into each investment?

The investor invested $ 15000 in the treasury bill, $ 40000 in bonds, and $ 35000 in the mutual fund.

18.  Watch the video and then solve the problem given below.

Click here to watch the video.[1]

Find the inverse (if it exists) of the matrix A = $\begin{bmatrix} 0 & 3 & 2 \\ 2 & 1 & 0 \\ 3 & 0 & 1 \end{bmatrix}$.

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○  **A.**  $A^{-1}$ does not exist.

◉  **B.**  $A^{-1} = \dfrac{1}{12}\begin{bmatrix} -1 & 3 & 2 \\ 2 & 6 & -4 \\ 3 & -9 & 6 \end{bmatrix}$

1: http://mediaplayer.pearsoncmg.com/assets/8Sw_4ZmhDodOxshZGlPVDADaaqv8ChzC?clip=4