Name:________________________________ Date:_______

PC: Inverses of Matrices Ms. Loughran

Do Now:

Find *AB* if possible.

1. $A = \begin{bmatrix} 0 & -1 & 0 \\ 4 & 0 & 2 \\ 8 & -1 & 7 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 1 \\ -3 & 4 \\ 1 & 6 \end{bmatrix}$

2. $A = \begin{bmatrix} 10 \\ 12 \end{bmatrix} \quad B = \begin{bmatrix} 6 & -2 & 1 & 6 \end{bmatrix}$

The identity matrix of a square matrix has entries of 1 on its main diagonal and 0's as all other entries.

I_2 means the identity matrix of a 2×2 matrix , I_3 means the identity matrix of a 3×3 matrix and so on.

$$I_2 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \qquad I_3 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \qquad I_4 = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Let *A* be an $n \times n$ matrix. If there exists a matrix A^{-1} such that $AA^{-1} = I_n = A^{-1}A$, A^{-1} is called the **inverse** of *A*.

1. Show that *B* is the inverse of *A*, where

$$A = \begin{bmatrix} -1 & 2 \\ -1 & 1 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 1 & -2 \\ 1 & -1 \end{bmatrix}$$

2. Show that B is the inverse of A, where

$$A = \begin{bmatrix} 2 & 1 \\ 5 & 3 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 3 & -1 \\ -5 & 2 \end{bmatrix}$$

3. Show that B is the inverse of A, where

$$A = \begin{bmatrix} 1 & -1 & 0 \\ 1 & 0 & -1 \\ 6 & -2 & -3 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} -2 & -3 & 1 \\ -3 & -3 & 1 \\ -2 & -4 & 1 \end{bmatrix}$$

To find the inverse of a 2×2 matrix we are going to use the determinant.

If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ then the determinant of *A* is $ad - bc$, and $A^{-1} = \frac{1}{ad - bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$

4. Find A^{-1} and verify that $AA^{-1} = A^{-1}A = I_2$

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

5. Find the inverse of *A*.

$$A = \begin{bmatrix} 7 & -4 \\ 8 & 0 \end{bmatrix}$$

6. Find the inverse of *B,* if it exists.

$$B = \begin{bmatrix} 8 & 4 \\ -4 & -2 \end{bmatrix}$$

We can use inverses to solve systems of linear equations.

If A is an invertible matrix (if A has an inverse), the system of linear equations represented by $AX = B$ has a unique solution:

$$AX = B$$

$$X =$$

7. Solve the system using the inverse, if possible.

$$\begin{aligned} 2x - 5y &= 15 \\ 3x - 6y &= 36 \end{aligned}$$

8. Solve the system using the inverse, if possible.

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

Homework: Textbook pp. 625-626 #2-16 even, 38, 40, 46, 48