MATH 152 SI
2/17/2021

Key concepts: matrix multiplication and matrix inverses.

1 Definitions

1. What are the properties of matrix multiplication?
2. What are the properties of inverse matrices?

2 Practice Problems

1. Let $A = \begin{bmatrix} 2 & 1 \\ 0 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 3 & -1 & 2 \\ 0 & 1 & 4 \end{bmatrix}$, $C = \begin{bmatrix} 1 & 2 \\ -1 & -2 \\ 1 & 2 \end{bmatrix}$, $D = \begin{bmatrix} 1 & 3 \\ -1 & 0 \\ 1 & 4 \end{bmatrix}$, and $E = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ -1 & -2 & -3 \end{bmatrix}$.
   Compute the following, if the matrices exist. If they do not, explain why.

   a) EC b) $B(C - E)$ c) $(AB)C$

   d) $D((BC)A + A)$ e) $E(BD)$ f) DE

2. Is the product of two skew-symmetric matrices also skew-symmetric? Explain why, or why not.
3. Using the matrix inversion algorithm, find the inverses of the following matrices, if possible.

   a) $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 2 & -1 \\ 3 & 5 & -2 \end{bmatrix}$ b) $\begin{bmatrix} 0 & 2 & 1 \\ 6 & 2 & -3 \\ 3 & 4 & 0 \end{bmatrix}$

4. Solve the following linear system using the inverse-matrix method (find A^{-1} and solve for $\mathbf{x}$).

$$\begin{bmatrix} 2 & 2 & 1 \\ 1 & 2 & -1 \\ 3 & 5 & -2 \end{bmatrix} \mathbf{x} = \begin{bmatrix} -1 \\ 1 \\ -1 \end{bmatrix}$$

5. Let A, B, and C be matrices, and suppose that A is invertible. Complete the following statements, and prove why they are true.

   1) If $AB = AC$, then

   2) If $BA = CA$, then

6. Find square matrices A, B, and C for which $AB = AC$ but $B \neq C$.