

MATH 210 FINITE MATHEMATICS

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2.6 Inverse of a Square Matrix

Definition 1: Inverse of Square Matrix

- 1.
- 2.
- 3.
- 4.

Example 1

Show that the following two matrices are inverses.

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

$$\begin{bmatrix} -2 & 1 \\ 3/2 & -1/2 \end{bmatrix}$$

Steps 1: Finding the Inverse of a Matrix

1. Adjoin the $n \times n$ identity matrix I to obtain the augmented matrix
2. Use a sequence of row operations to reduce $[A|I]$ to
3. Matrix B is the inverse
4. If you don't end up with the identity matrix, then the inverse doesn't exist.

Example 2

Find the inverse to

$$\begin{bmatrix} 1 & -1 & 1 \\ -1 & 3 & -3 \\ 2 & 1 & 1 \end{bmatrix}$$

Continued

Example 3

Does $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 2 \\ 3 & 3 & 5 \end{bmatrix}$ have an inverse?

Definition 2: Solving Systems of Equations with Inverses

Consider the following system:

$$2x + y + z = 1$$

$$3x + 2y + z = 2$$

$$2x + y + 2z = -1$$

1. Covert to the form $AX = B$

2. Solution is

1. Set up matrices

2. Find A^{-1}

3. Solve for X

But what if we have a new system?

$$2x + y + z = 2$$

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

$$2x + y + 2z = 1$$