# 1. Inverses and solving linear systems

## Find the inverse

4.0/4 points (graded)

Find the inverse of the matrix

$$\mathbf{D} = \begin{pmatrix} 7 & 2 & 1 \\ 0 & 3 & -1 \\ -3 & 4 & -2 \end{pmatrix}.$$

(Enter a matrix in MATLAB notation. That is, enter coordinates between square brackets separated by commas, with semicolons at the end of each row: e.g. type **[1, 0, 0; 0, 1, 0; 0, 0, 1]** for the $3 \times 3$ identity matrix.)

$\mathbf{D}^{-1} =$ [-2,8,-5;3,-11,7;9,-34,21] ✔

Find a solution to the following system of equations.

$$\begin{aligned} 7x_1 + 2x_2 + x_3 &= 21 \\ 3x_2 - x_3 &= 5 \\ -3x_1 + 4x_2 - 2x_3 &= -1 \end{aligned}$$

$x_1 =$ 3 ✔

$x_2 =$ 1 ✔

$x_3 =$ -2

Submit You have used 2 of 4 attempts

## More about inverses

2/2 points (graded)

Which of the following must be true for $\mathbf{Ax} = \mathbf{b}$ to imply that $\mathbf{x} = \mathbf{A}^{-1}\mathbf{b}$?

- [ ] $\mathbf{A}$ is singular.
- [x] $\mathbf{A}$ is nonsingular.
- [x] $\mathbf{A}$ is a square matrix.
- [ ] The nullspace of $\mathbf{A}$ is 1 dimensional.
- [x] The nullspace of $\mathbf{A}$ is zero dimensional.
- [ ] The matrix $\mathbf{A}$ is $1 \times 1$.
- [ ] None of the above.

Which of the following must be true for $\mathbf{Ax} = \mathbf{b}$ to imply that $\mathbf{x} = \mathbf{bA}^{-1}$?

- [ ] $\mathbf{A}$ is singular.
- [x] $\mathbf{A}$ is nonsingular.
- [x] $\mathbf{A}$ is a square matrix.

- [ ] The nullspace of $\mathbf{A}$ is 1 dimensional.
- [x] The nullspace of $\mathbf{A}$ is zero dimensional. ✔
- [x] The matrix $\mathbf{A}$ is $1 \times 1$. ✔
- [ ] None of the above.

✔

**Solution:**

In order for $\mathbf{Ax} = \mathbf{b}$ to imply that $\mathbf{x} = \mathbf{A}^{-1}\mathbf{b}$, it must be true that $\mathbf{A}$ is invertible. Therefore $\mathbf{A}$ must be square and nonsingular. A nonsingular matrix is equivalent to $\mathbf{A}$ having a zero dimensional nullspace.

In order for $\mathbf{Ax} = \mathbf{b}$ to imply that $\mathbf{x} = \mathbf{bA}^{-1}$, again $\mathbf{A}$ must be square and invertible (nonsingular and zero dimensional nullspace). However, in this case, $\mathbf{A}$ must also be $1 \times 1$. Let's see why.

If $\mathbf{A}$ is $n \times n$, $\mathbf{A}^{-1}$ is also $n \times n$, and $\mathbf{x}$ and $\mathbf{b}$ are both $n \times 1$ column vectors. Therefore $\mathbf{bA}^{-1}$ is the product of a $n \times 1$ vector by an $n \times n$ matrix. This product is only valid in the case that $n = 1$.

Submit You have used 1 of 2 attempts

Answers are displayed within the problem

## 1. Inverses and solving linear systems

Hide Discussion

**Topic:** Unit 2: Linear Algebra, Part 2 / 1. Inverses and solving linear systems

Add a Post

Show all posts ▼ by recent activity ▼

There are no posts in this topic yet.

✖

Learn About Verified Certificates