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sandipan_dey ~

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Lecture due Sep 15, 2021 20:30 IST

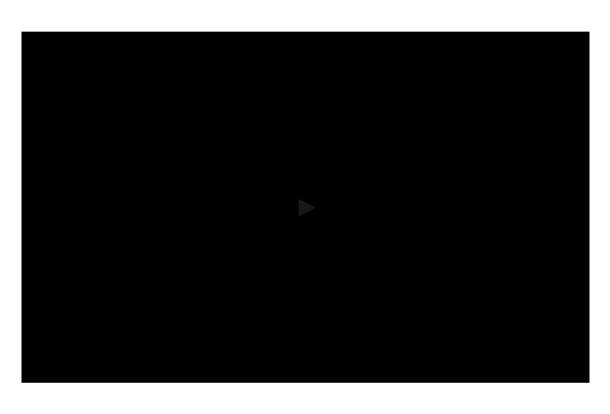


Explore

Inverse Matrix

There is another method that allows us to solve for $ec{x}$ in $Aec{x}=ec{b}$ without having to do elimination. One may use the inverse matrix.

Inverse Matrix



with matrices,

where the vectors are column vectors --

I mean, it's just something to remember that if you have

a square matrix times a column vector --

I mean the product which makes sense

is with a matrix on the left, the vector on the right.

The other one just doesn't work.

It's not sized.

You cannot take X times A, if A and X

if A is a square matrix, and X is a column vector,

this product makes sense.

The other one doesn't make sense.

It's not the right size.

4:38 / 4:38

▶ 2.0x

X

CC

66

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The Inverse Matrix (2×2)

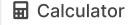
If
$$oldsymbol{A} = egin{pmatrix} a & b \ c & d \end{pmatrix}$$
 then the inverse of $oldsymbol{A}$ is

$$A^{-1} = \frac{1}{ad - bc} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix} \tag{5.63}$$

The most important property of A^{-1} is that

(Inverse Matrix Property)
$$AA^{-1} = A^{-1}A = I$$
. (5.64)

(Recall that $m{I}$ is the identity matrix). This property can be used to define the inverse of larger matrices. To see why this property is important, imagine we want to solve for $ec{x}$ in the equation $Aec{x}=ec{b}$. We can multiply both sides by A^{-1} and simplify:





$$\vec{x} = A^{-1}\vec{b} \tag{5.66}$$

This gives us a recipe for finding \vec{x} : we can just multiply out $A^{-1}\vec{b}$. This method is also useful if we need to solve for \vec{x} several times for different values of \vec{b} .

Example

Let $A=egin{pmatrix} -1 & 1 \ 1 & 3 \end{pmatrix}$. Then A^{-1} is given by

$$A^{-1} = \frac{1}{-4} \begin{pmatrix} 3 & -1 \\ -1 & -1 \end{pmatrix} \tag{5.67}$$

Suppose we want to solve for $ec{x}$ in $Aec{x}=inom{1}{7}.$ The solution is given by

$$\vec{x} = A^{-1} \begin{pmatrix} 1 \\ 7 \end{pmatrix} = \frac{1}{-4} \begin{pmatrix} 3 & -1 \\ -1 & -1 \end{pmatrix} \begin{pmatrix} 1 \\ 7 \end{pmatrix} = \frac{1}{-4} \begin{pmatrix} -4 \\ 8 \end{pmatrix} = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$$
 (5.68)

This agrees with the solution we found by elimination.

Find an Inverse

1/1 point (graded)

Let
$$A = \begin{pmatrix} 1 & 2 \\ 1 & -1 \end{pmatrix}$$
.

(Enter a matrix using notation such as [[a,b],[c,d]].)

? INPUT HELP

Solution:

Using the formula
$$A^{-1}=rac{1}{ad-bc}inom{d}{-c} -rac{d}{a}$$
 , we have $A^{-1}=rac{1}{-3}inom{-1}{-1} -rac{1}{1}$.

Submit

You have used 2 of 3 attempts

Answers are displayed within the problem

Solve a System

2/2 points (graded)

Let
$$A=egin{pmatrix} 2 & 1 \ 1 & 1 \end{pmatrix}$$
 . Find A^{-1} and solve for $ec{x}$ in $Aec{x}=egin{pmatrix} 5 \ 0 \end{pmatrix}$.

(Enter a matrix using notation such as [[a,b],[c,d]].)

(Enter a vector using notation such as [a,b].)



? INPUT HELP

Solution:

$$A^{-1}=egin{pmatrix}1&-1\-1&2\end{pmatrix}$$
. So $ec{x}=A^{-1}egin{pmatrix}5\0\end{pmatrix}=egin{pmatrix}5\-5\end{pmatrix}$.

Submit

You have used 1 of 3 attempts

1 Answers are displayed within the problem

Caution

The inverse matrix method will not always work because the denominator ad-bc could equal zero. This is explored in more detail on the next page.

5. Inverse Matrix

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