

Solving a system of equations

Comparison of Matlab, MathCAD and Maple

System:

$$1x+3y+4z=1$$

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

$$1x-z=-1$$

Method:

In all three programs, the solution is found by inverting the matrix of coefficients and multiplying by the vector of answers. $A^{-1} \times X = B$

Matlab:

In Matlab both matrices and vectors are defined using [] brackets, and entering values as the element is constructed.

In this example Matrix A corresponds to the coefficients of the system, and is a 3x3 square matrix.

The built in Matlab function "inv()" is used to define the inverse of A, as $\text{invA}=\text{inv}(A)$.

The vector of solutions is defined as the inverse of A is multiplied by the vector X, the right hand side of the system. (Note, $\text{invA}*X$, not $\text{invA}.*X$)

Matlab Code:

```
A=[1 3 4;
   -2 -2 1;
   1 0 -1]
X= [1;
    3;
    -1]
invA=inv(A)
B=invA*X
```

Matlab Command Window:

```
>> Solvelinear
```

A =

```
     1     3     4
    -2    -2     1
     1     0    -1
```

X =

```
     1
     3
    -1
```



invA =

$$\begin{pmatrix} 0.2857 & 0.4286 & 1.5714 \\ -0.1429 & -0.7143 & -1.2857 \\ 0.2857 & 0.4286 & 0.5714 \end{pmatrix}$$

B =

$$\begin{pmatrix} 0 \\ -1 \\ 1 \end{pmatrix}$$

MathCad:

In MathCad vectors and matrices are defined using the  menu in the top tool box, and selecting  from that menu.

Again A is defined as a matrix of coefficients, and X is defined as the right side of the system.

To obtain the inverse of A in Mathcad, open the  menu from the top tool box, and select , A was entered in the resulting prompt.

The vector of solutions, B, is obtained by multiplying the inverse of A, invA, by the right hand side vector, X, and storing the result in vector B.

Mathcad Code:

$$A := \begin{pmatrix} 1 & 3 & 4 \\ -2 & -2 & 1 \\ 1 & 0 & -1 \end{pmatrix} \quad X := \begin{pmatrix} 1 \\ 3 \\ -1 \end{pmatrix}$$

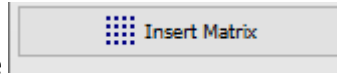
$$\text{invA} := A^{-1}$$

$$\text{invA} = \begin{pmatrix} 0.286 & 0.429 & 1.571 \\ -0.143 & -0.714 & -1.286 \\ 0.286 & 0.429 & 0.571 \end{pmatrix}$$

$$B := \text{invA} \cdot X = \begin{pmatrix} 0 \\ -1 \\ 1 \end{pmatrix}$$

Maple:

In Maple vectors and matrices are defined using the Matrix Palette. The row and column sizes are



defined, and then the button enters the matrix on the worksheet. To assign the entered matrix to a variable, enter the variable name followed by := (signifying “defined by”) and use an equation label to define the variable using a matrix. In this example, the square matrix of coefficients was entered to the worksheet, next “A:=” was typed, followed by “Ctrl+L” to enter an equation label, and 1 was entered in the resulting dialogue box. (1 corresponds to the element on the worksheet). Variables X, invA, and B were defined in the same way (equation labels).

Right clicking on the matrix defining A, and then hovering over “Standard Operations”, the “Inverse” option was selected. The result was used to define variable “invA.”

The vector of solutions was then defined by multiplying invA by X, and the vector was stored under variable name “B”.

Maple Code: (as an image)

$\begin{bmatrix} 1 & 3 & 4 \\ -2 & -2 & 1 \\ 1 & 0 & -1 \end{bmatrix}$			
A := (1)	$\begin{bmatrix} 1 & 3 & 4 \\ -2 & -2 & 1 \\ 1 & 0 & -1 \end{bmatrix}$		(1)
	$\begin{bmatrix} 1 & 3 & 4 \\ -2 & -2 & 1 \\ 1 & 0 & -1 \end{bmatrix}$		(2)
$\begin{bmatrix} 1 \\ 3 \\ -1 \end{bmatrix}$			
X := (3)	$\begin{bmatrix} 1 \\ 3 \\ -1 \end{bmatrix}$		(3)
	$\begin{bmatrix} 1 \\ 3 \\ -1 \end{bmatrix}$		(4)
A			
	$\begin{bmatrix} 1 & 3 & 4 \\ -2 & -2 & 1 \\ 1 & 0 & -1 \end{bmatrix}$		(5)
<u>inverse</u> ,			
	$\begin{bmatrix} \frac{2}{7} & \frac{3}{7} & \frac{11}{7} \\ -\frac{1}{7} & -\frac{5}{7} & -\frac{9}{7} \\ \frac{2}{7} & \frac{3}{7} & \frac{4}{7} \end{bmatrix}$		(6)
invA := (6)			
	$\begin{bmatrix} \frac{2}{7} & \frac{3}{7} & \frac{11}{7} \\ -\frac{1}{7} & -\frac{5}{7} & -\frac{9}{7} \\ \frac{2}{7} & \frac{3}{7} & \frac{4}{7} \end{bmatrix}$		(7)
B = invAX			
	$B = \begin{bmatrix} 0 \\ -1 \\ 1 \end{bmatrix}$		(8)