

Soustavy lineárních rovnic

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[ > restart;
[ > with(linalg): with(LinearAlgebra):
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a)

```
[ > Ar:=Matrix([[4,3,2,1],[1,3,5,1],[3,6,9,2]]);
[                                     Ar:=
[                                     
$$\begin{bmatrix} 4 & 3 & 2 & 1 \\ 1 & 3 & 5 & 1 \\ 3 & 6 & 9 & 2 \end{bmatrix}$$

[ > A:=SubMatrix(Ar,1..3,1..3); B:=SubMatrix(Ar,1..3,[4]);
[                                     A:=
[                                     
$$\begin{bmatrix} 4 & 3 & 2 \\ 1 & 3 & 5 \\ 3 & 6 & 9 \end{bmatrix}$$

[                                     B:=
[                                     
$$\begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}$$

[ > gausselim(Ar);
[                                     
$$\begin{bmatrix} 4 & 3 & 2 & 1 \\ 0 & 9 & 9 & 3 \\ 0 & 4 & 2 & 4 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

[ > LinearSolve(A,B,free='t');
[                                     
$$\begin{bmatrix} t_{1,1} \\ \frac{1}{3}-2t_{1,1} \\ t_{1,1} \end{bmatrix}$$

```

b)

```
[ > Ar:=Matrix([[1,2,3,-1],[-3,-6,-7,7],[2,4,7,0]]);
[                                     Ar:=
[                                     
$$\begin{bmatrix} 1 & 2 & 3 & -1 \\ -3 & -6 & -7 & 7 \\ 2 & 4 & 7 & 0 \end{bmatrix}$$

[ > A:=SubMatrix(Ar,1..3,1..3); B:=SubMatrix(Ar,1..3,[4]);
[                                     A:=
[                                     
$$\begin{bmatrix} 1 & 2 & 3 \\ -3 & -6 & -7 \\ 2 & 4 & 7 \end{bmatrix}$$

[                                     B:=
[                                     
$$\begin{bmatrix} -1 \\ 7 \\ 0 \end{bmatrix}$$

[ > gausselim(Ar);
[                                     
$$\begin{bmatrix} 1 & 2 & 3 & -1 \\ 0 & 0 & 2 & 4 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

[ > LinearSolve(A,B,free='t');
[                                     
$$\begin{bmatrix} -7-2t_{1,1} \\ t_{1,1} \\ 2 \end{bmatrix}$$

```

c)

```
[ > Ar:=Matrix([[1,-2,3,-4,4],[0,1,-1,1,-3],[1,3,0,-3,1],[0,-7,3,1,-3]]);
[                                     Ar:=
[                                     
$$\begin{bmatrix} 1 & -2 & 3 & -4 & 4 \\ 0 & 1 & -1 & 1 & -3 \\ 1 & 3 & 0 & -3 & 1 \\ 0 & -7 & 3 & 1 & -3 \end{bmatrix}$$

[ > A:=SubMatrix(Ar,1..4,1..4); B:=SubMatrix(Ar,1..4,[5]);
```

$$A := \begin{bmatrix} 1 & -2 & 3 & -4 \\ 0 & 1 & -1 & 1 \\ 1 & 3 & 0 & -3 \\ 0 & -7 & 3 & 1 \end{bmatrix}$$

$$B := \begin{bmatrix} 4 \\ -3 \\ 1 \\ -3 \end{bmatrix}$$

> `gausselim(Ar);`

$$\begin{bmatrix} 1 & -2 & 3 & -4 & 4 \\ 0 & 1 & -1 & 1 & -3 \\ 0 & 0 & 2 & -4 & 12 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

> `LinearSolve(A,B,free='t');`

$$\begin{bmatrix} -8 \\ 3+t_{1,1} \\ 6+2t_{1,1} \\ t_{1,1} \end{bmatrix}$$

d)

> `Ar:=Matrix([[1,3,2,2],[2,-1,3,7],[3,-5,4,12],[1,17,4,-4]]);`

$$Ar := \begin{bmatrix} 1 & 3 & 2 & 2 \\ 2 & -1 & 3 & 7 \\ 3 & -5 & 4 & 12 \\ 1 & 17 & 4 & -4 \end{bmatrix}$$

> `A:=SubMatrix(Ar,1..4,1..3); B:=SubMatrix(Ar,1..4,[4]);`

$$A := \begin{bmatrix} 1 & 3 & 2 \\ 2 & -1 & 3 \\ 3 & -5 & 4 \\ 1 & 17 & 4 \end{bmatrix}$$

$$B := \begin{bmatrix} 2 \\ 7 \\ 12 \\ -4 \end{bmatrix}$$

> `gausselim(Ar);`

$$\begin{bmatrix} 1 & 3 & 2 & 2 \\ 0 & -7 & -1 & 3 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

> `LinearSolve(A,B,free='t');`

$$\begin{bmatrix} \frac{23}{7} - \frac{11}{7}t_{1,1} \\ -\frac{3}{7} - \frac{1}{7}t_{1,1} \\ t_{1,1} \end{bmatrix}$$

e)

> `Ar:=Matrix([[1,2,-1,3,1],[-3,-6,5,-10,-1],[2,4,0,5,4],[1,2,1,2,3]]);`

$$Ar := \begin{bmatrix} 1 & 2 & -1 & 3 & 1 \\ -3 & -6 & 5 & -10 & -1 \\ 2 & 4 & 0 & 5 & 4 \\ 1 & 2 & 1 & 2 & 3 \end{bmatrix}$$

> `A:=SubMatrix(Ar,1..4,1..4); B:=SubMatrix(Ar,1..4,[5]);`

$$A := \begin{bmatrix} 1 & 2 & -1 & 3 \\ -3 & -6 & 5 & -10 \\ 2 & 4 & 0 & 5 \\ 1 & 2 & 1 & 2 \end{bmatrix}$$

$$B := \begin{bmatrix} 1 \\ -1 \\ 4 \\ 3 \end{bmatrix}$$

> `gausselim(Ar);`

$$\begin{bmatrix} 1 & 2 & -1 & 3 & 1 \\ 0 & 0 & 2 & -1 & 2 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

> `LinearSolve(A,B,free='t');`

$$\begin{bmatrix} 2 - 2t_{2,1} - \frac{5}{2}t_{1,1} \\ t_{2,1} \\ 1 + \frac{1}{2}t_{1,1} \\ t_{1,1} \end{bmatrix}$$

f)

> `Ar:=Matrix([[1,-2,4,-5,1],[2,-3,5,-7,3],[2,-2,2,-3,7],[3,-4,6,-10,2]]);`

$$Ar := \begin{bmatrix} 1 & -2 & 4 & -5 & 1 \\ 2 & -3 & 5 & -7 & 3 \\ 2 & -2 & 2 & -3 & 7 \\ 3 & -4 & 6 & -10 & 2 \end{bmatrix}$$

> `A:=SubMatrix(Ar,1..4,1..4); B:=SubMatrix(Ar,1..4,[5]);`

$$A := \begin{bmatrix} 1 & -2 & 4 & -5 \\ 2 & -3 & 5 & -7 \\ 2 & -2 & 2 & -3 \\ 3 & -4 & 6 & -10 \end{bmatrix}$$

$$B := \begin{bmatrix} 1 \\ 3 \\ 7 \\ 2 \end{bmatrix}$$

> `gausselim(Ar);`

$$\begin{bmatrix} 1 & -2 & 4 & -5 & 1 \\ 0 & 1 & -3 & 3 & 1 \\ 0 & 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

> `LinearSolve(A,B,free='t');`

$$\begin{bmatrix} 2t_{1,1} \\ -8 + 3t_{1,1} \\ t_{1,1} \\ 3 \end{bmatrix}$$

g)

> `Ar:=Matrix([[2,-6,4,2],[-1,3,-2,-1]]);`

$$Ar := \begin{bmatrix} 2 & -6 & 4 & 2 \\ -1 & 3 & -2 & -1 \end{bmatrix}$$

> `A:=SubMatrix(Ar,1..2,1..3); B:=SubMatrix(Ar,1..2,[4]);`

$$A := \begin{bmatrix} 2 & -6 & 4 \\ -1 & 3 & -2 \end{bmatrix}$$

$$B := \begin{bmatrix} 2 \\ -1 \end{bmatrix}$$

> `gausselim(Ar);`

$$\begin{bmatrix} 2 & -6 & 4 & 2 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

> `LinearSolve(A,B,free='t');`

$$\begin{bmatrix} 1 + 3t_{2,1} - 2t_{1,1} \\ t_{2,1} \\ t_{1,1} \end{bmatrix}$$

h)

```

> Ar:=Matrix([[1,1,1,9,8],[0,1,2,8,7],[-3,0,1,-7,9]]);
Ar:=

$$\begin{bmatrix} 1 & 1 & 1 & 9 & 8 \\ 0 & 1 & 2 & 8 & 7 \\ -3 & 0 & 1 & -7 & 9 \end{bmatrix}$$

> A:=SubMatrix(Ar,1..3,1..4); B:=SubMatrix(Ar,1..3,[5]);
A:=

$$\begin{bmatrix} 1 & 1 & 1 & 9 \\ 0 & 1 & 2 & 8 \\ -3 & 0 & 1 & -7 \end{bmatrix}$$

B:=

$$\begin{bmatrix} 8 \\ 7 \\ 9 \end{bmatrix}$$

> gausselim(Ar);

$$\begin{bmatrix} 1 & 1 & 1 & 9 & 8 \\ 0 & 1 & 2 & 8 & 7 \\ 0 & 0 & -2 & -4 & 12 \end{bmatrix}$$

> LinearSolve(A,B,free='t');

$$\begin{bmatrix} -5 - 3t_{1,1} \\ 19 - 4t_{1,1} \\ -6 - 2t_{1,1} \\ t_{1,1} \end{bmatrix}$$


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