



Geogebra: <https://www.geogebra.org/classic>

## Matic

- Násobení matic

$$\{\{1, 2\}, \{3, 4\}, \{5, 6\}\} * \{\{1, 2, 3\}, \{4, 5, 6\}\}$$

$$M_1 = \begin{pmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{pmatrix} \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} \quad M_1 = \begin{pmatrix} 9 & 12 & 15 \\ 19 & 26 & 33 \\ 29 & 40 & 51 \end{pmatrix}$$

- Inverzní matice

```
Invert({{1, 2}, {3, 4}})
```

$$M_2 = \text{Invertovat}(\{\{1, 2\}, \{3, 4\}\})$$

$$\rightarrow \begin{pmatrix} -2 & 1 \\ 1.5 & -0.5 \end{pmatrix}$$

**Zkouška:**  $M_3 = \{\{1, 2\}, \{3, 4\}\} \{\{-2, 1\}, \{1.5, -0.5\}\}$

$$M_3 = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \begin{pmatrix} -2 & 1 \\ 1.5 & -0.5 \end{pmatrix} \quad M_3 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

## Polynomy

- Kořeny polynomu  
`solve(x^2-2x-3)` nebo `Vyresit(x^2)-2x-3`
- Rozklad na součin  
`rozklad(x^2)-2x-3` nebo `factor(x^5)-8x^3-6x^2+7x+6`

## Soustavy rovnic


```
vyresit[{2x+3y-z=9,x-y+z=-2,-x+2y-3z=6}]
```

**Wolframalpha – návodná prezentace**

[http://user.mendelu.cz/qqrihova/zvm/PDF\\_WA/W\\_algebra.pdf](http://user.mendelu.cz/qqrihova/zvm/PDF_WA/W_algebra.pdf)

- Součet matic

$\{\{2,-1,0\},\{-1,2,-3\},\{-2,0,1\}\} + \{\{-3,-1,1\},\{0,-2,1\},\{2,3,-1\}\}$



Input:


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

Result:

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

- Součin matic

$\{\{2,-1,0\},\{-1,2,-3\},\{-2,0,1\}\} \cdot \{\{-3,-1,1\},\{0,-2,1\},\{2,3,-1\}\}$



Input:

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

Result:

$$\begin{pmatrix} -6 & 0 & 1 \\ -3 & -12 & 4 \\ 8 & 5 & -3 \end{pmatrix}$$

- Hodnost matice

rank  $\{\{2,-1,-1\},\{-1,2,0\},\{0,2,-1\},\{-1,5,2\}\}$

$\text{rank } \{\{2,-1,-1\},\{-1,2,0\},\{0,2,-1\},\{-1,5,2\}\}$






**Input:**

rank	$\begin{pmatrix} 2 & -1 & -1 \\ -1 & 2 & 0 \\ 0 & 2 & -1 \\ -1 & 5 & 2 \end{pmatrix}$
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**Result:**

3

- Inverzní matice

inverse  $\{\{-2,0,1\},\{3,-1,0\},\{2,1,-2\}\}$

$\text{inverse } \{\{-2,0,1\},\{3,-1,0\},\{2,1,-2\}\}$

**Input:**

$$\begin{pmatrix} -2 & 0 & 1 \\ 3 & -1 & 0 \\ 2 & 1 & -2 \end{pmatrix}^{-1}$$
(matrix inverse)

---

**Result:**

$$\begin{pmatrix} 2 & 1 & 1 \\ 6 & 2 & 3 \\ 5 & 2 & 2 \end{pmatrix}$$

## Soustava rovnic

solve  $2x+3y-z=9$ ,  $x-y+z=-2$ ,  $-x+2y-3z=6$

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Input interpretation:

	$2x + 3y - z = 9$
solve	$x - y + z = -2$
	$-x + 2y - 3z = 6$

Result:

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

- **Maticový přístup**

rowreduce  $\{\{2,-2,3,7\},\{1,1,-2,-3\},\{-2,2,-1,-1\}\}$

- pravá strana je čtvrtý sloupec

rowreduce  $\{\{2,-2,3,7\},\{1,1,-2,-3\},\{-2,2,-1,-1\}\}$



Input interpretation:

	$2x + 3y - z = 9$
solve	$x - y + z = -2$
	$-x + 2y - 3z = 6$

Result:

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

- **Gaussova eliminační metoda:**

- nekonečně mnoho řešení

solve  $x_1 - 3x_2 + 2x_3 - 2x_4 = 1$ ,  $3x_1 + 2x_2 - x_3 + x_4 = 2$ ,  $2x_1 - x_2 + x_3 - 2x_4 = 3$

solve  $x_1 - 3x_2 + 2x_3 - 2x_4 = 1$ ,  $3x_1 + 2x_2 - x_3 + x_4 = 2$ ,  $2x_1 - x_2 + x_3 - 2x_4 = 3$



Input interpretation:

	$x_1 - 3x_2 + 2x_3 - 2x_4 = 1$
solve	$3x_1 + 2x_2 - x_3 + x_4 = 2$
	$2x_1 - x_2 + x_3 - 2x_4 = 3$

Result:

$$x_2 = 5 - 7x_1 \text{ and } x_3 = 8 - 13x_1 \text{ and } x_4 = -2x_1$$

## Kongruence

$2x \equiv 1 \pmod{5}$

$2x \equiv 1 \pmod{5}$



Input interpretation:

solve	$2x = 1 \pmod{5}$
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Result:

$$x = 3 + 5n \text{ and } n \in \mathbb{Z}$$

Solution in the least residue system modulo 5:

$$x = 3$$

## Polynomy

- Dosazení do polynomu:  $\{x^4-7x^3+6x^2+28x-10, x=-1\}$
- Kořeny polynomu  
`solve(x^2-2x-3)`
- Rozklad na součin  
`factor x^5-8x^3-6x^2+7x+6`