

# Determinante

## MATEMATIKA ZA EKONOMISTE 1

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# Sadržaj

prvi zadatak

drugi zadatak

treći zadatak

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peti zadatak

**prvi zadatak**

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# Determinante

## Zadatak 1

*Izračunajte sljedeće determinante:*

$$\text{a) } \begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix},$$

$$\text{b) } \begin{vmatrix} 2 & -5 \\ 1 & -3 \end{vmatrix},$$

$$\text{c) } \begin{vmatrix} x - a & -a \\ a & x + a \end{vmatrix}.$$

## Rješenje

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} =$$

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3)$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) -$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5$$



## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5 = -11$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5 = -11$$

$$\begin{vmatrix} 2 & -5 \\ 1 & -3 \end{vmatrix} =$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5 = -11$$

$$\begin{vmatrix} 2 & -5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3)$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5 = -11$$

$$\begin{vmatrix} 2 & -5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) -$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5 = -11$$

$$\begin{vmatrix} 2 & -5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot (-5)$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5 = -11$$

$$\begin{vmatrix} 2 & -5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot (-5) = -6 + 5$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5 = -11$$

$$\begin{vmatrix} 2 & -5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot (-5) = -6 + 5 = -1$$



## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5 = -11$$

$$\begin{vmatrix} 2 & -5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot (-5) = -6 + 5 = -1$$

$$\begin{vmatrix} x - a & -a \\ a & x + a \end{vmatrix} =$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5 = -11$$

$$\begin{vmatrix} 2 & -5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot (-5) = -6 + 5 = -1$$

$$\begin{vmatrix} x - a & -a \\ a & x + a \end{vmatrix} = (x - a)(x + a)$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5 = -11$$

$$\begin{vmatrix} 2 & -5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot (-5) = -6 + 5 = -1$$

$$\begin{vmatrix} x - a & -a \\ a & x + a \end{vmatrix} = (x - a)(x + a) -$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5 = -11$$

$$\begin{vmatrix} 2 & -5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot (-5) = -6 + 5 = -1$$

$$\begin{vmatrix} x - a & -a \\ a & x + a \end{vmatrix} = (x - a)(x + a) - a \cdot (-a)$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5 = -11$$

$$\begin{vmatrix} 2 & -5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot (-5) = -6 + 5 = -1$$

$$\begin{vmatrix} x - a & -a \\ a & x + a \end{vmatrix} = (x - a)(x + a) - a \cdot (-a) = x^2 - a^2$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5 = -11$$

$$\begin{vmatrix} 2 & -5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot (-5) = -6 + 5 = -1$$

$$\begin{vmatrix} x - a & -a \\ a & x + a \end{vmatrix} = (x - a)(x + a) - a \cdot (-a) = x^2 - a^2 + a^2$$

## Rješenje

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 2 & 5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot 5 = -6 - 5 = -11$$

$$\begin{vmatrix} 2 & -5 \\ 1 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot (-5) = -6 + 5 = -1$$

$$\begin{vmatrix} x - a & -a \\ a & x + a \end{vmatrix} = (x - a)(x + a) - a \cdot (-a) = x^2 - a^2 + a^2 = x^2$$

## **drugi zadatak**

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## Zadatak 2

*Izračunajte determinantu*

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix}$$

- a) *Sarrusovim pravilom,*
- b) *svođenjem na trokutastu determinantu,*
- c) *Laplaceovim razvojem po trećem stupcu,*
- d) *Laplaceovim razvojem po prvom retku.*

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix}$$

## Rješenje

a)

$$\left| \begin{array}{ccc|c} 9 & 4 & -5 & 9 \\ 8 & 7 & -2 & 8 \\ 2 & -1 & 8 & 2 \end{array} \right|$$

## Rješenje

a)

$$\left| \begin{array}{ccc|cc} 9 & 4 & -5 & 9 & 4 \\ 8 & 7 & -2 & 8 & 7 \\ 2 & -1 & 8 & 2 & -1 \end{array} \right|$$

## Rješenje

a)

$$\left| \begin{array}{ccc} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{array} \right| \left| \begin{array}{cc} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{array} \right| =$$

## Rješenje

a)

$$\left| \begin{array}{ccc|cc} 9 & 4 & -5 & 9 & 4 \\ 8 & 7 & -2 & 8 & 7 \\ 2 & -1 & 8 & 2 & -1 \end{array} \right| =$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$= 9 \cdot 7 \cdot 8$$

## Rješenje

a)

$$\left| \begin{array}{ccc|cc} 9 & 4 & -5 & 9 & 4 \\ 8 & 7 & -2 & 8 & 7 \\ 2 & -1 & 8 & 2 & -1 \end{array} \right| =$$

$$= 9 \cdot 7 \cdot 8$$



## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2 + (-5) \cdot 8 \cdot (-1)$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2 + (-5) \cdot 8 \cdot (-1)$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2 + (-5) \cdot 8 \cdot (-1) - 2 \cdot 7 \cdot (-5)$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2 + (-5) \cdot 8 \cdot (-1) - 2 \cdot 7 \cdot (-5)$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$\begin{aligned} &= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2 + (-5) \cdot 8 \cdot (-1) - 2 \cdot 7 \cdot (-5) - \\ &\quad - (-1) \cdot (-2) \cdot 9 \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$\begin{aligned} &= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2 + (-5) \cdot 8 \cdot (-1) - 2 \cdot 7 \cdot (-5) - \\ &\quad - (-1) \cdot (-2) \cdot 9 \end{aligned}$$



## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$\begin{aligned} &= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2 + (-5) \cdot 8 \cdot (-1) - 2 \cdot 7 \cdot (-5) - \\ &\quad - (-1) \cdot (-2) \cdot 9 - 8 \cdot 8 \cdot 4 \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$\begin{aligned} &= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2 + (-5) \cdot 8 \cdot (-1) - 2 \cdot 7 \cdot (-5) - \\ &\quad - (-1) \cdot (-2) \cdot 9 - 8 \cdot 8 \cdot 4 = \\ &= 504 \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$\begin{aligned} &= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2 + (-5) \cdot 8 \cdot (-1) - 2 \cdot 7 \cdot (-5) - \\ &\quad - (-1) \cdot (-2) \cdot 9 - 8 \cdot 8 \cdot 4 = \\ &= 504 - 16 \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$\begin{aligned} &= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2 + (-5) \cdot 8 \cdot (-1) - 2 \cdot 7 \cdot (-5) - \\ &\quad - (-1) \cdot (-2) \cdot 9 - 8 \cdot 8 \cdot 4 = \\ &= 504 - 16 + 40 \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2 + (-5) \cdot 8 \cdot (-1) - 2 \cdot 7 \cdot (-5) -$$
$$- (-1) \cdot (-2) \cdot 9 - 8 \cdot 8 \cdot 4 =$$

$$= 504 - 16 + 40 + 70$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$\begin{aligned} &= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2 + (-5) \cdot 8 \cdot (-1) - 2 \cdot 7 \cdot (-5) - \\ &\quad - (-1) \cdot (-2) \cdot 9 - 8 \cdot 8 \cdot 4 = \end{aligned}$$

$$= 504 - 16 + 40 + 70 - 18$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$\begin{aligned} &= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2 + (-5) \cdot 8 \cdot (-1) - 2 \cdot 7 \cdot (-5) - \\ &\quad - (-1) \cdot (-2) \cdot 9 - 8 \cdot 8 \cdot 4 = \\ &= 504 - 16 + 40 + 70 - 18 - 256 \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{vmatrix} 9 & 4 \\ 8 & 7 \\ 2 & -1 \end{vmatrix} =$$

$$\begin{aligned} &= 9 \cdot 7 \cdot 8 + 4 \cdot (-2) \cdot 2 + (-5) \cdot 8 \cdot (-1) - 2 \cdot 7 \cdot (-5) - \\ &\quad - (-1) \cdot (-2) \cdot 9 - 8 \cdot 8 \cdot 4 = \end{aligned}$$

$$= 504 - 16 + 40 + 70 - 18 - 256 = 324$$



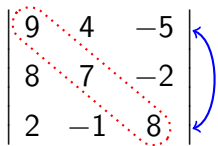
b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix}$$

b)

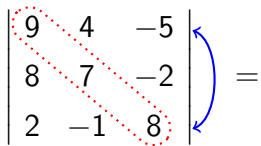
$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix}$$


The diagram shows a 3x3 determinant with elements 9, 4, -5 in the first row; 8, 7, -2 in the second row; and 2, -1, 8 in the third row. A red dotted line connects the top-left element (9) to the middle-right element (-2) and then to the bottom-right element (8). A blue curved arrow on the right side of the determinant points downwards, indicating a cyclic permutation of the rows (1 to 2, 2 to 3, 3 to 1).

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} =$$


b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} \phantom{9} & \phantom{4} & \phantom{-5} \\ \phantom{8} & \phantom{7} & \phantom{-2} \\ \phantom{2} & \phantom{-1} & \phantom{8} \end{vmatrix}$$

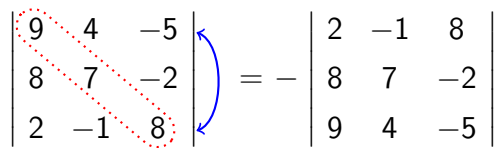
b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} \begin{array}{c} \curvearrowright \\ \curvearrowleft \end{array} = - \begin{vmatrix} 2 & -1 & 8 \\ 9 & 4 & -5 \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix}$$




b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 \\ 7 \\ 4 \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 \\ 7 & 8 \\ 4 & 9 \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix}$$

Diagram illustrating the expansion of a 3x3 determinant using the first column. The first column elements (9, 8, 2) are enclosed in a red dotted line. A blue curved arrow indicates the expansion along the first column, showing the sign change for the second row element (8) and the resulting 2x2 determinant.

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix}$$

The diagram illustrates the Laplace expansion of a 3x3 determinant along the first column. The first determinant has a red dotted line connecting the elements 9, 7, and 2, with a blue curved arrow indicating the expansion. The second determinant is the negative of the first, with a red dotted line connecting 2, 7, and 9, and a blue curved arrow indicating the expansion. The third determinant is the result of the expansion, with the element -1 circled in blue and a red dotted line connecting 2, 8, and -5.



b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} / \cdot 7$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 \\ \leftarrow + \end{matrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 \\ / \cdot 4 \end{matrix}$$

Diagram illustrating the calculation of a 3x3 determinant using row expansion. The first matrix has a red dotted line connecting the elements 9, 7, and 8, with a blue arrow pointing to the 7. The second matrix has a red dotted line connecting the elements 2, 7, and -5, with a blue arrow pointing to the 7. The third matrix has a red dotted line connecting the elements -1, 8, and -5, with a blue arrow pointing to the 8. The third matrix also includes annotations for row operations:  $/ \cdot 7$  and  $/ \cdot 4$ , and a blue arrow pointing to the 7 with a plus sign.

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix}$$

The diagram illustrates the calculation of a 3x3 determinant using row operations. The first matrix has a red dotted line from (1,1) to (3,3) and a blue arrow pointing left. The second matrix has a red dotted line from (1,1) to (3,3) and a blue arrow pointing right. The third matrix has a blue circle around the element -1 in the first row, first column, and blue arrows with plus signs indicating row additions: Row 2 = Row 2 + 7 \* Row 1, and Row 3 = Row 3 + 4 \* Row 1.

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} & & \\ & & \\ & & \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ & & \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & & \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & \end{vmatrix}$$



b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & & \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & 27 \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & 27 \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & 27 \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 \\ / \cdot 4 \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & 27 \end{vmatrix} / \cdot \frac{-17}{22}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & 27 \end{vmatrix} \begin{matrix} / \cdot \frac{-17}{22} \\ + \end{matrix}$$



b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & 27 \end{vmatrix} \begin{matrix} / \cdot \frac{-17}{22} \\ + \end{matrix} = \begin{vmatrix} \phantom{-1} & \phantom{2} & \phantom{8} \\ \phantom{0} & \phantom{22} & \phantom{54} \\ \phantom{0} & \phantom{17} & \phantom{27} \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & 27 \end{vmatrix} \begin{matrix} / \cdot \frac{-17}{22} \\ + \end{matrix} = \begin{vmatrix} -1 & 2 & 8 \\ & & \\ & & \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 \\ / \cdot 4 \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & 27 \end{vmatrix} \begin{matrix} / \cdot \frac{-17}{22} \end{matrix} = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 0 & 0 \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & 27 \end{vmatrix} \begin{matrix} / \cdot \frac{-17}{22} \\ + \end{matrix} = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 0 & 0 \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & 27 \end{vmatrix} \begin{matrix} / \cdot \frac{-17}{22} \\ + \end{matrix} = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 0 & \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 & / \cdot 4 \\ + & + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & 27 \end{vmatrix} \begin{matrix} / \cdot \frac{-17}{22} \\ + \end{matrix} = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 0 & \frac{-162}{11} \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 \\ / \cdot 4 \end{matrix} \begin{matrix} + \\ + \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & 27 \end{vmatrix} \begin{matrix} / \cdot \frac{-17}{22} \\ + \end{matrix} = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 0 & \frac{-162}{11} \end{vmatrix}$$

b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 \\ / \cdot 4 \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & 27 \end{vmatrix} \begin{matrix} / \cdot \frac{-17}{22} \\ + \end{matrix} = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 0 & \frac{-162}{11} \end{vmatrix} = -1 \cdot 22 \cdot \frac{-162}{11}$$



b)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = - \begin{vmatrix} 2 & -1 & 8 \\ 8 & 7 & -2 \\ 9 & 4 & -5 \end{vmatrix} = \begin{vmatrix} -1 & 2 & 8 \\ 7 & 8 & -2 \\ 4 & 9 & -5 \end{vmatrix} \begin{matrix} / \cdot 7 \\ / \cdot 4 \end{matrix} = \\
 = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 17 & 27 \end{vmatrix} \begin{matrix} / \cdot \frac{-17}{22} \end{matrix} = \begin{vmatrix} -1 & 2 & 8 \\ 0 & 22 & 54 \\ 0 & 0 & \frac{-162}{11} \end{vmatrix} = -1 \cdot 22 \cdot \frac{-162}{11} = 324$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} =$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} =$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} +$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} +$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33}$$



$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & 5 \\ 8 & 7 & -2 \\ 2 & -1 & 5 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & 5 \\ 8 & 7 & -2 \\ 2 & -1 & \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix} + (-2) \cdot$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix} + (-2) \cdot (-1)^{2+3}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 1 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 1 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix} + (-2) \cdot (-1)^{2+3}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 2 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix} + (-2) \cdot (-1)^{2+3} \begin{vmatrix} 9 & 4 \\ 2 & -1 \end{vmatrix}$$



$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix} + (-2) \cdot (-1)^{2+3} \begin{vmatrix} 9 & 4 \\ 2 & -1 \end{vmatrix} + 8 \cdot$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix} + (-2) \cdot (-1)^{2+3} \begin{vmatrix} 9 & 4 \\ 2 & -1 \end{vmatrix} + 8 \cdot (-1)^{3+3}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & 1 & 3 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix} + (-2) \cdot (-1)^{2+3} \begin{vmatrix} 9 & 4 \\ 2 & -1 \end{vmatrix} + 8 \cdot (-1)^{3+3}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & 1 & 3 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix} + (-2) \cdot (-1)^{2+3} \begin{vmatrix} 9 & 4 \\ 2 & -1 \end{vmatrix} + 8 \cdot (-1)^{3+3} \begin{vmatrix} 9 & 4 \\ 8 & 7 \end{vmatrix}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix} + (-2) \cdot (-1)^{2+3} \begin{vmatrix} 9 & 4 \\ 2 & -1 \end{vmatrix} + 8 \cdot (-1)^{3+3} \begin{vmatrix} 9 & 4 \\ 8 & 7 \end{vmatrix} =$$

$$= -5 \cdot 1 \cdot (-22)$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix} + (-2) \cdot (-1)^{2+3} \begin{vmatrix} 9 & 4 \\ 2 & -1 \end{vmatrix} + 8 \cdot (-1)^{3+3} \begin{vmatrix} 9 & 4 \\ 8 & 7 \end{vmatrix} =$$

$$= -5 \cdot 1 \cdot (-22) + (-2) \cdot (-1) \cdot (-17)$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix} + (-2) \cdot (-1)^{2+3} \begin{vmatrix} 9 & 4 \\ 2 & -1 \end{vmatrix} + 8 \cdot (-1)^{3+3} \begin{vmatrix} 9 & 4 \\ 8 & 7 \end{vmatrix} =$$

$$= -5 \cdot 1 \cdot (-22) + (-2) \cdot (-1) \cdot (-17) + 8 \cdot 1 \cdot 31$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix} + (-2) \cdot (-1)^{2+3} \begin{vmatrix} 9 & 4 \\ 2 & -1 \end{vmatrix} + 8 \cdot (-1)^{3+3} \begin{vmatrix} 9 & 4 \\ 8 & 7 \end{vmatrix} =$$

$$= -5 \cdot 1 \cdot (-22) + (-2) \cdot (-1) \cdot (-17) + 8 \cdot 1 \cdot 31 =$$

$$= 110 - 34 + 248$$



$$A_{ij} = (-1)^{i+j} M_{ij}$$

c)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = -5 \cdot A_{13} + (-2) \cdot A_{23} + 8 \cdot A_{33} =$$

$$= -5 \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix} + (-2) \cdot (-1)^{2+3} \begin{vmatrix} 9 & 4 \\ 2 & -1 \end{vmatrix} + 8 \cdot (-1)^{3+3} \begin{vmatrix} 9 & 4 \\ 8 & 7 \end{vmatrix} =$$

$$= -5 \cdot 1 \cdot (-22) + (-2) \cdot (-1) \cdot (-17) + 8 \cdot 1 \cdot 31 =$$

$$= 110 - 34 + 248 = 324$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} =$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} =$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} +$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} +$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13}$$



$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1} \begin{vmatrix} 7 & -2 \\ -1 & 8 \end{vmatrix}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1} \begin{vmatrix} 7 & -2 \\ -1 & 8 \end{vmatrix} + 4 \cdot$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1} \begin{vmatrix} 7 & -2 \\ -1 & 8 \end{vmatrix} + 4 \cdot (-1)^{1+2}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & -1 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1} \begin{vmatrix} 7 & -2 \\ -1 & 8 \end{vmatrix} + 4 \cdot (-1)^{1+2}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & -1 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1} \begin{vmatrix} 7 & -2 \\ -1 & 8 \end{vmatrix} + 4 \cdot (-1)^{1+2} \begin{vmatrix} 8 & -2 \\ 2 & 8 \end{vmatrix}$$



$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1} \begin{vmatrix} 7 & -2 \\ -1 & 8 \end{vmatrix} + 4 \cdot (-1)^{1+2} \begin{vmatrix} 8 & -2 \\ 2 & 8 \end{vmatrix} + (-5) \cdot$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1} \begin{vmatrix} 7 & -2 \\ -1 & 8 \end{vmatrix} + 4 \cdot (-1)^{1+2} \begin{vmatrix} 8 & -2 \\ 2 & 8 \end{vmatrix} + (-5) \cdot (-1)^{1+3}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1} \begin{vmatrix} 7 & -2 \\ -1 & 8 \end{vmatrix} + 4 \cdot (-1)^{1+2} \begin{vmatrix} 8 & -2 \\ 2 & 8 \end{vmatrix} + (-5) \cdot (-1)^{1+3}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1} \begin{vmatrix} 7 & -2 \\ -1 & 8 \end{vmatrix} + 4 \cdot (-1)^{1+2} \begin{vmatrix} 8 & -2 \\ 2 & 8 \end{vmatrix} + (-5) \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1} \begin{vmatrix} 7 & -2 \\ -1 & 8 \end{vmatrix} + 4 \cdot (-1)^{1+2} \begin{vmatrix} 8 & -2 \\ 2 & 8 \end{vmatrix} + (-5) \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix}$$

$$= 9 \cdot 1 \cdot 54$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1} \begin{vmatrix} 7 & -2 \\ -1 & 8 \end{vmatrix} + 4 \cdot (-1)^{1+2} \begin{vmatrix} 8 & -2 \\ 2 & 8 \end{vmatrix} + (-5) \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix}$$

$$= 9 \cdot 1 \cdot 54 + 4 \cdot (-1) \cdot 68$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1} \begin{vmatrix} 7 & -2 \\ -1 & 8 \end{vmatrix} + 4 \cdot (-1)^{1+2} \begin{vmatrix} 8 & -2 \\ 2 & 8 \end{vmatrix} + (-5) \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix}$$

$$= 9 \cdot 1 \cdot 54 + 4 \cdot (-1) \cdot 68 + (-5) \cdot 1 \cdot (-22)$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1} \begin{vmatrix} 7 & -2 \\ -1 & 8 \end{vmatrix} + 4 \cdot (-1)^{1+2} \begin{vmatrix} 8 & -2 \\ 2 & 8 \end{vmatrix} + (-5) \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix}$$

$$= 9 \cdot 1 \cdot 54 + 4 \cdot (-1) \cdot 68 + (-5) \cdot 1 \cdot (-22) =$$

$$= 486 - 272 + 110$$



$$A_{ij} = (-1)^{i+j} M_{ij}$$

d)

$$\begin{vmatrix} 9 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix} = 9 \cdot A_{11} + 4 \cdot A_{12} + (-5) \cdot A_{13} =$$

$$= 9 \cdot (-1)^{1+1} \begin{vmatrix} 7 & -2 \\ -1 & 8 \end{vmatrix} + 4 \cdot (-1)^{1+2} \begin{vmatrix} 8 & -2 \\ 2 & 8 \end{vmatrix} + (-5) \cdot (-1)^{1+3} \begin{vmatrix} 8 & 7 \\ 2 & -1 \end{vmatrix}$$

$$= 9 \cdot 1 \cdot 54 + 4 \cdot (-1) \cdot 68 + (-5) \cdot 1 \cdot (-22) =$$

$$= 486 - 272 + 110 = 324$$

## treći zadatak

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### Zadatak 3

*Izračunajte determinantu*

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix}.$$

## Rješenje

1. način: svođenje na trokutastu matricu

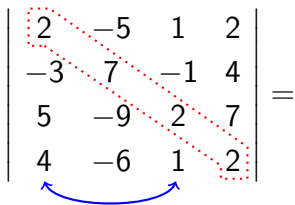
$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} =$$

## Rješenje

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} =$$

1. način: svođenje na trokutastu matricu

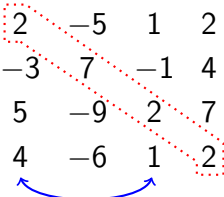
## Rješenje

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} =$$


1. način: svođenje na trokutastu matricu

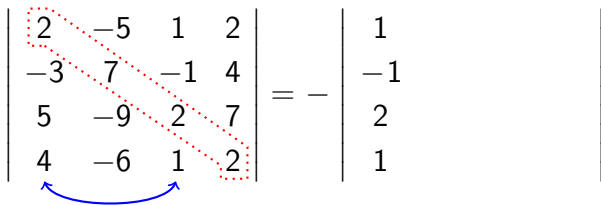
## Rješenje

### 1. način: svođenje na trokutastu matricu

$$\left| \begin{array}{cccc} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{array} \right| = -$$


## Rješenje

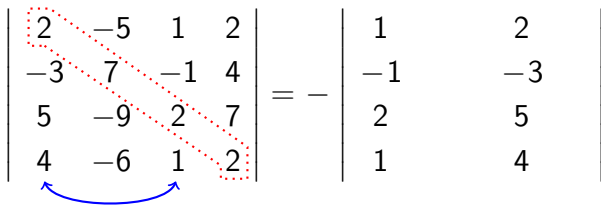
1. način: svođenje na trokutastu matricu

$$\left| \begin{array}{cccc} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{array} \right| = - \left| \begin{array}{ccc} 1 & & \\ -1 & & \\ 2 & & \\ 1 & & \end{array} \right|$$




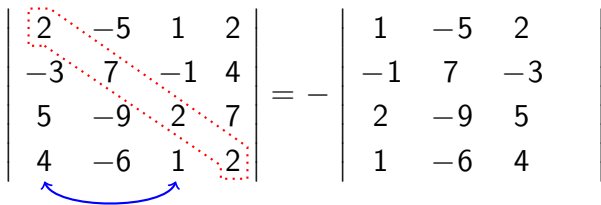
## Rješenje

### 1. način: svođenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & 2 \\ -1 & -3 \\ 2 & 5 \\ 1 & 4 \end{vmatrix}$$


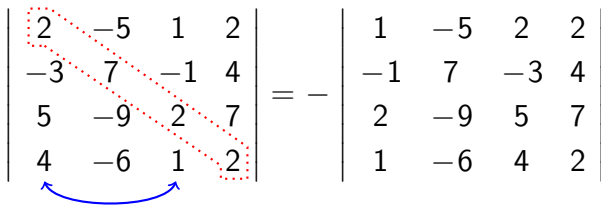
## Rješenje

### 1. način: svođenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 \\ -1 & 7 & -3 \\ 2 & -9 & 5 \\ 1 & -6 & 4 \end{vmatrix}$$


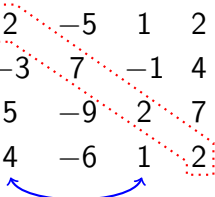
## Rješenje

### 1. način: svođenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix}$$


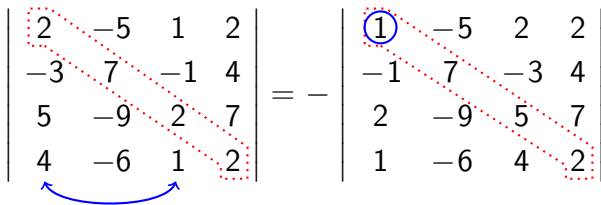
## Rješenje

1. način: svođenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix}$$


## Rješenje

1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix}$$


## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} / \cdot 1$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \\ \leftarrow + \end{array}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \\ \leftarrow + \end{array}$$



## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \\ + \\ + \end{array}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \end{array}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} \phantom{1} & \phantom{-5} & \phantom{2} & \phantom{2} \\ \phantom{-1} & \phantom{7} & \phantom{-3} & \phantom{4} \\ \phantom{2} & \phantom{-9} & \phantom{5} & \phantom{7} \\ \phantom{1} & \phantom{-6} & \phantom{4} & \phantom{2} \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ & & & \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & & & \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & & \end{vmatrix}$$



## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 0 \\ 0 & -3 & 9 & 11 \\ 0 & -10 & 2 & 0 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & & & \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & & \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 1 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & & & \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & & \end{vmatrix}$$



## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} 1 & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix}$$

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### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} =$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 2 \\ -1 \\ 1 \\ 2 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 2 & -5 \\ -1 & 2 \\ 1 & 1 \\ 2 & -1 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 \\ 0 & -1 & 2 \\ 0 & 1 & 1 \\ 0 & 2 & -1 \end{vmatrix}$$



## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = - \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = - \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} / \cdot 1$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \\ \leftarrow + \end{array}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ \leftarrow + \end{array}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$
  
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ \leftarrow + \\ \leftarrow + \end{array}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$

$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ \leftarrow + \\ \leftarrow + \end{array} =$$

$$= \begin{vmatrix} \phantom{0} & \phantom{0} & \phantom{0} & \phantom{0} \\ \phantom{0} & \phantom{0} & \phantom{0} & \phantom{0} \\ \phantom{0} & \phantom{0} & \phantom{0} & \phantom{0} \\ \phantom{0} & \phantom{0} & \phantom{0} & \phantom{0} \end{vmatrix}$$



## Rješenje

### 1. način: svodenje na trokutastu matricu

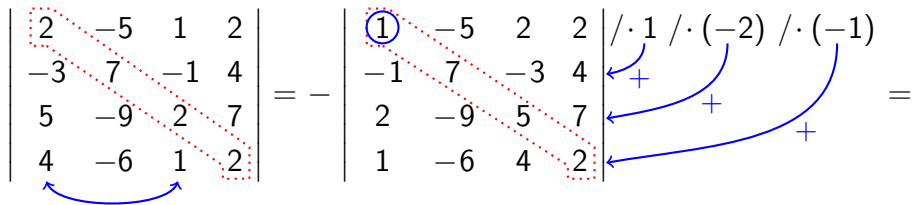
$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$

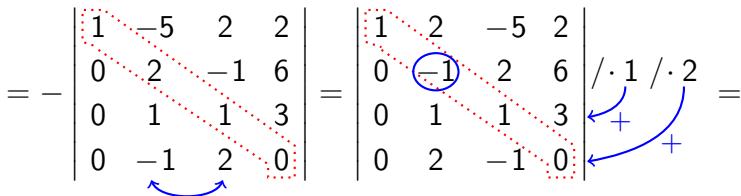
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ \leftarrow + \\ \leftarrow + \end{array} =$$

$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 0 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

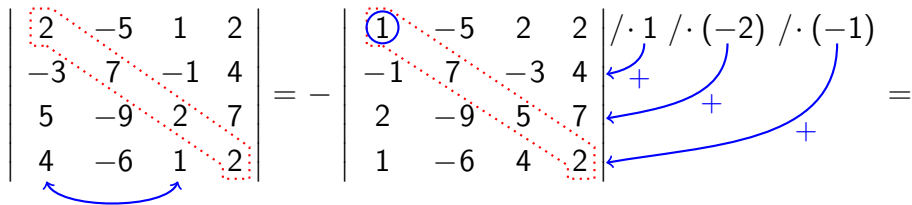
$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \quad + \quad + \end{array} =$$


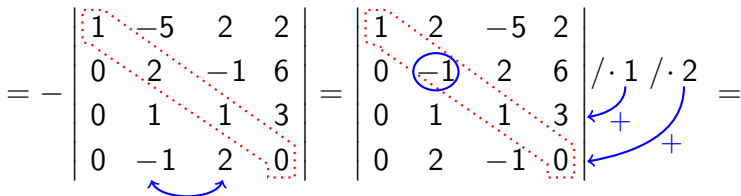
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \quad + \end{array} =$$


$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$


$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ \leftarrow + \\ \leftarrow + \end{array} =$$


$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & & & \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

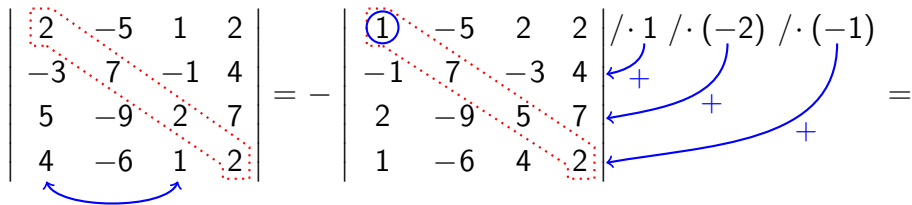
$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$

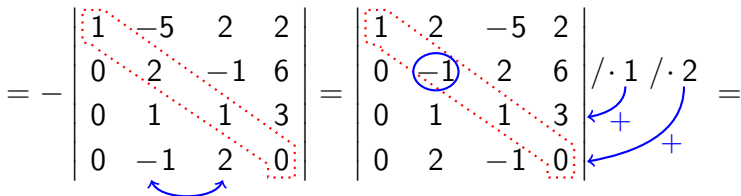
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ \leftarrow + \\ \leftarrow + \end{array} =$$

$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 0 & 0 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

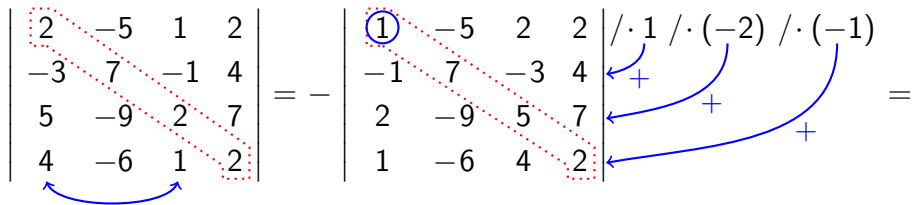
$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$


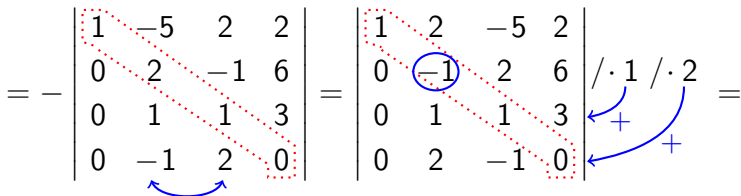
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ \leftarrow + \\ \leftarrow + \end{array} =$$


$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$


$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ \leftarrow + \\ \leftarrow + \end{array} =$$


$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$

$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ \leftarrow + \\ \leftarrow + \end{array} =$$

$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & 0 & 0 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$

$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ \leftarrow + \\ \leftarrow + \end{array} =$$

$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & 0 & 0 \end{vmatrix}$$



## Rješenje

### 1. način: svodenje na trokutastu matricu

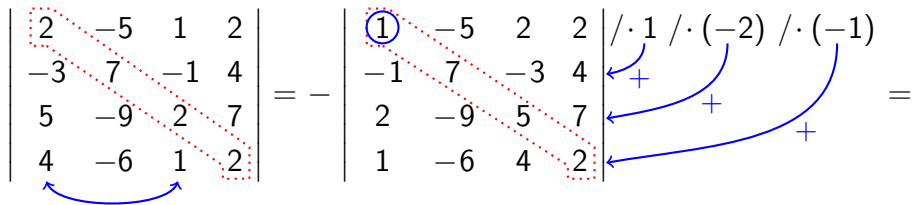
$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \quad + \quad + \end{array} =$$

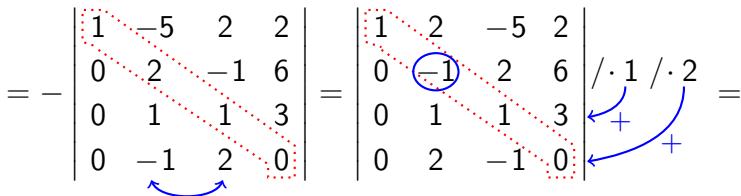
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \quad + \end{array} =$$

$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & 3 & \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$


$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ \leftarrow + \\ \leftarrow + \end{array} =$$


$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \quad + \quad + \end{array} =$$

$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \quad + \end{array} =$$

$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \quad + \quad + \end{array} =$$

$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \quad + \end{array} =$$

$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \leftarrow + \\ \leftarrow + \\ \leftarrow + \end{array} =$$

$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ \leftarrow + \\ \leftarrow + \end{array} =$$

$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix} / \cdot (-1)$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

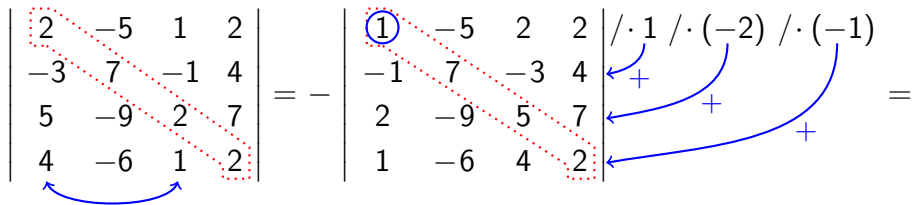
$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \\ + \\ + \end{array} =$$

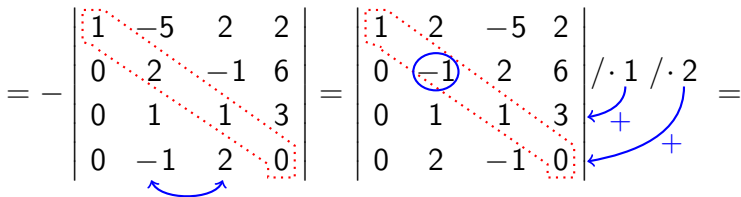
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \\ + \end{array} =$$

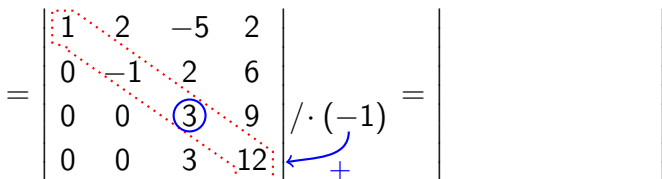
$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix} \begin{array}{l} / \cdot (-1) \\ + \end{array}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \quad + \quad + \end{array} =$$


$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \quad + \end{array} =$$


$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix} \begin{array}{l} / \cdot (-1) \\ + \end{array} =$$


## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \\ + \\ + \end{array} =$$

$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \\ + \end{array} =$$

$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix} \begin{array}{l} / \cdot (-1) \\ + \end{array} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & 1 & -2 & -6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix}$$



## Rješenje

### 1. način: svodenje na trokutastu matricu

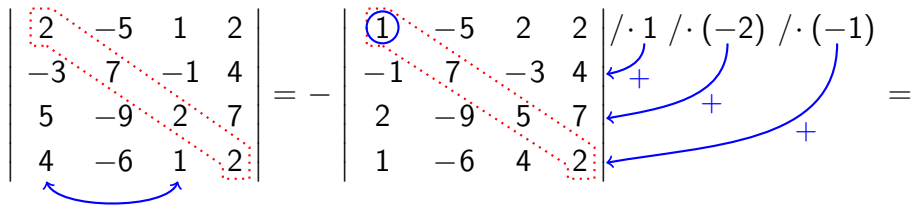
$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \quad + \quad + \end{array} =$$

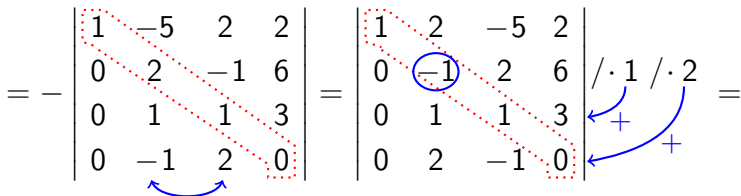
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \quad + \end{array} =$$

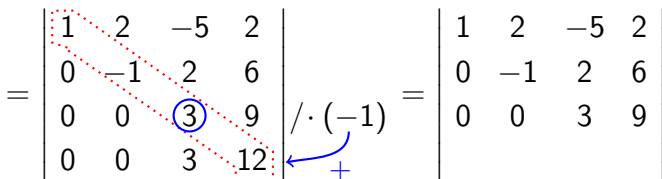
$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix} \begin{array}{l} / \cdot (-1) \\ + \end{array} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 12 \\ 0 & 0 & 3 & 12 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \quad + \quad + \end{array} =$$


$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \quad + \end{array} =$$


$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix} \begin{array}{l} / \cdot (-1) \\ + \end{array} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & 3 & 9 \end{vmatrix}$$


## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \quad + \quad + \end{array} =$$
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \quad + \end{array} =$$
$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix} \begin{array}{l} / \cdot (-1) \\ + \end{array} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & 3 & 9 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \quad + \quad + \end{array} =$$

$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \quad + \end{array} =$$

$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix} \begin{array}{l} / \cdot (-1) \\ + \end{array} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & & \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \\ + \\ + \end{array} =$$
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \\ + \end{array} =$$
$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix} \begin{array}{l} / \cdot (-1) \\ + \end{array} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & 0 & 0 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \quad + \quad + \end{array} =$$
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \quad + \end{array} =$$
$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix} \begin{array}{l} / \cdot (-1) \\ + \end{array} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & 0 & 3 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \\ + \\ + \end{array} =$$

$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \\ + \end{array} =$$

$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix} / \cdot (-1) \quad + = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & 0 & 3 \end{vmatrix}$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \quad + \quad + \end{array} =$$
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \quad + \end{array} =$$
$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix} \begin{array}{l} / \cdot (-1) \\ + \end{array} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & 0 & 3 \end{vmatrix} = 1 \cdot (-1) \cdot 3 \cdot 3$$



## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \quad + \quad + \end{array} =$$

$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \quad + \end{array} =$$

$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix} / \cdot (-1) = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & 0 & 3 \end{vmatrix} = 1 \cdot (-1) \cdot 3 \cdot 3 =$$

## Rješenje

### 1. način: svodenje na trokutastu matricu

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = - \begin{vmatrix} \textcircled{1} & -5 & 2 & 2 \\ -1 & 7 & -3 & 4 \\ 2 & -9 & 5 & 7 \\ 1 & -6 & 4 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ + \quad + \quad + \end{array} =$$
$$= - \begin{vmatrix} 1 & -5 & 2 & 2 \\ 0 & 2 & -1 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & -1 & 2 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & \textcircled{-1} & 2 & 6 \\ 0 & 1 & 1 & 3 \\ 0 & 2 & -1 & 0 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot 2 \\ + \quad + \end{array} =$$
$$= \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & \textcircled{3} & 9 \\ 0 & 0 & 3 & 12 \end{vmatrix} \begin{array}{l} / \cdot (-1) \\ + \end{array} = \begin{vmatrix} 1 & 2 & -5 & 2 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 3 & 9 \\ 0 & 0 & 0 & 3 \end{vmatrix} = 1 \cdot (-1) \cdot 3 \cdot 3 = -9$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} =$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} =$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} +$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} +$$



2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} +$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} \text{[thick blue vertical bar]} & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ \text{[thick blue horizontal bar]} & 9 & 2 & 7 \\ \text{[thick blue vertical bar]} & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} \text{blue bar} & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ \text{red dotted box} & 9 & 2 & 7 \\ \text{blue bar} & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix} + (-9) \cdot$$



$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix} + (-9) \cdot (-1)^{3+2}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & 9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix} + (-9) \cdot (-1)^{3+2}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & 9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix} + (-9) \cdot (-1)^{3+2} \begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix} + (-9) \cdot (-1)^{3+2} \begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix} +$$

+ 2 \cdot

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix} + (-9) \cdot (-1)^{3+2} \begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix} +$$

$$+ 2 \cdot (-1)^{3+3}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 2 \\ -3 & 7 & 4 \\ 5 & 9 & 7 \\ 4 & -6 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix} + (-9) \cdot (-1)^{3+2} \begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix} +$$

$$+ 2 \cdot (-1)^{3+3}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 2 \\ -3 & 7 & 4 \\ 5 & 9 & 7 \\ 4 & -6 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix} + (-9) \cdot (-1)^{3+2} \begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix} +$$

$$+ 2 \cdot (-1)^{3+3} \begin{vmatrix} 2 & -5 & 2 \\ -3 & 7 & 4 \\ 4 & -6 & 2 \end{vmatrix}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix} + (-9) \cdot (-1)^{3+2} \begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix} +$$

$$+ 2 \cdot (-1)^{3+3} \begin{vmatrix} 2 & -5 & 2 \\ -3 & 7 & 4 \\ 4 & -6 & 2 \end{vmatrix} + 7 \cdot$$



$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix} + (-9) \cdot (-1)^{3+2} \begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix} +$$

$$+ 2 \cdot (-1)^{3+3} \begin{vmatrix} 2 & -5 & 2 \\ -3 & 7 & 4 \\ 4 & -6 & 2 \end{vmatrix} + 7 \cdot (-1)^{3+4}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 \\ -3 & 7 & -1 \\ 5 & 9 & 2 \\ 4 & -6 & 1 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix} + (-9) \cdot (-1)^{3+2} \begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix} +$$

$$+ 2 \cdot (-1)^{3+3} \begin{vmatrix} 2 & -5 & 2 \\ -3 & 7 & 4 \\ 4 & -6 & 2 \end{vmatrix} + 7 \cdot (-1)^{3+4}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 \\ -3 & 7 & -1 \\ 5 & 9 & 2 \\ 4 & -6 & 1 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix} + (-9) \cdot (-1)^{3+2} \begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix} +$$

$$+ 2 \cdot (-1)^{3+3} \begin{vmatrix} 2 & -5 & 2 \\ -3 & 7 & 4 \\ 4 & -6 & 2 \end{vmatrix} + 7 \cdot (-1)^{3+4} \begin{vmatrix} 2 & -5 & 1 \\ -3 & 7 & -1 \\ 4 & -6 & 1 \end{vmatrix}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix} + (-9) \cdot (-1)^{3+2} \begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix} +$$

$$+ 2 \cdot (-1)^{3+3} \begin{vmatrix} 2 & -5 & 2 \\ -3 & 7 & 4 \\ 4 & -6 & 2 \end{vmatrix} + 7 \cdot (-1)^{3+4} \begin{vmatrix} 2 & -5 & 1 \\ -3 & 7 & -1 \\ 4 & -6 & 1 \end{vmatrix} =$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \underbrace{\begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix}}_{=-6} + (-9) \cdot (-1)^{3+2} \begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix} +$$

$$+ 2 \cdot (-1)^{3+3} \begin{vmatrix} 2 & -5 & 2 \\ -3 & 7 & 4 \\ 4 & -6 & 2 \end{vmatrix} + 7 \cdot (-1)^{3+4} \begin{vmatrix} 2 & -5 & 1 \\ -3 & 7 & -1 \\ 4 & -6 & 1 \end{vmatrix} =$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \underbrace{\begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix}}_{=-6} + (-9) \cdot (-1)^{3+2} \underbrace{\begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix}}_{=12} +$$

$$+ 2 \cdot (-1)^{3+3} \begin{vmatrix} 2 & -5 & 2 \\ -3 & 7 & 4 \\ 4 & -6 & 2 \end{vmatrix} + 7 \cdot (-1)^{3+4} \begin{vmatrix} 2 & -5 & 1 \\ -3 & 7 & -1 \\ 4 & -6 & 1 \end{vmatrix} =$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \underbrace{\begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix}}_{=-6} + (-9) \cdot (-1)^{3+2} \underbrace{\begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix}}_{=12} +$$

$$+ 2 \cdot (-1)^{3+3} \underbrace{\begin{vmatrix} 2 & -5 & 2 \\ -3 & 7 & 4 \\ 4 & -6 & 2 \end{vmatrix}}_{=-54} + 7 \cdot (-1)^{3+4} \begin{vmatrix} 2 & -5 & 1 \\ -3 & 7 & -1 \\ 4 & -6 & 1 \end{vmatrix} =$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \underbrace{\begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix}}_{=-6} + (-9) \cdot (-1)^{3+2} \underbrace{\begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix}}_{=12} +$$

$$+ 2 \cdot (-1)^{3+3} \underbrace{\begin{vmatrix} 2 & -5 & 2 \\ -3 & 7 & 4 \\ 4 & -6 & 2 \end{vmatrix}}_{=-54} + 7 \cdot (-1)^{3+4} \underbrace{\begin{vmatrix} 2 & -5 & 1 \\ -3 & 7 & -1 \\ 4 & -6 & 1 \end{vmatrix}}_{=-3} =$$



$$A_{ij} = (-1)^{i+j} M_{ij}$$

2. način: Laplaceov razvoj, npr. po 3. retku

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = 5 \cdot A_{31} + (-9) \cdot A_{32} + 2 \cdot A_{33} + 7 \cdot A_{34} =$$

$$= 5 \cdot (-1)^{3+1} \underbrace{\begin{vmatrix} -5 & 1 & 2 \\ 7 & -1 & 4 \\ -6 & 1 & 2 \end{vmatrix}}_{=-6} + (-9) \cdot (-1)^{3+2} \underbrace{\begin{vmatrix} 2 & 1 & 2 \\ -3 & -1 & 4 \\ 4 & 1 & 2 \end{vmatrix}}_{=12} +$$

$$+ 2 \cdot (-1)^{3+3} \underbrace{\begin{vmatrix} 2 & -5 & 2 \\ -3 & 7 & 4 \\ 4 & -6 & 2 \end{vmatrix}}_{=-54} + 7 \cdot (-1)^{3+4} \underbrace{\begin{vmatrix} 2 & -5 & 1 \\ -3 & 7 & -1 \\ 4 & -6 & 1 \end{vmatrix}}_{=-3} = \dots = -9$$

DZ

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} / \cdot 1$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \\ \leftarrow + \end{array}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \\ \swarrow + \\ \end{array}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \\ \leftarrow + \\ \leftarrow + \end{array}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \searrow + \end{array}$$



### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{array}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{matrix} / \cdot 1 & / \cdot (-2) & / \cdot (-1) \\ \swarrow + & \swarrow + & \swarrow + \\ & \swarrow + & \swarrow + \\ & & \swarrow + \end{matrix} = \begin{vmatrix} \phantom{2} & \phantom{-5} & \phantom{\textcircled{1}} & \phantom{2} \\ \phantom{-3} & \phantom{7} & \phantom{-1} & \phantom{4} \\ \phantom{5} & \phantom{-9} & \phantom{2} & \phantom{7} \\ \phantom{4} & \phantom{-6} & \phantom{1} & \phantom{2} \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{array} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{array} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & & & \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{array} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & & \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{array} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 0 \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\left| \begin{array}{ccc|ccc} 2 & -5 & \textcircled{1} & 2 & / \cdot 1 & / \cdot (-2) & / \cdot (-1) \\ -3 & 7 & -1 & 4 & \swarrow + & & \\ 5 & -9 & 2 & 7 & \swarrow + & & \\ 4 & -6 & 1 & 2 & \swarrow + & & \end{array} \right| = \left| \begin{array}{cccc} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \end{array} \right|$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\left| \begin{array}{ccc|ccc} 2 & -5 & \textcircled{1} & 2 & / \cdot 1 & / \cdot (-2) & / \cdot (-1) \\ -3 & 7 & -1 & 4 & \swarrow + & & \\ 5 & -9 & 2 & 7 & \swarrow + & & \\ 4 & -6 & 1 & 2 & \swarrow + & & \end{array} \right| = \left| \begin{array}{cccc} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & & & \end{array} \right|$$



### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{array} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & & \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{matrix} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{matrix} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \quad \quad \quad \swarrow + \\ \swarrow \quad \quad \quad \swarrow + \\ \swarrow \quad \quad \quad \swarrow + \end{array} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{array} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & & & \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \quad \quad \quad \swarrow + \\ \swarrow \quad \quad \quad \swarrow + \\ \swarrow \quad \quad \quad \swarrow + \end{array} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & & \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\left| \begin{array}{ccc|ccc} 2 & -5 & \textcircled{1} & 2 & / \cdot 1 & / \cdot (-2) & / \cdot (-1) \\ -3 & 7 & -1 & 4 & \swarrow + & & \\ 5 & -9 & 2 & 7 & \swarrow + & & \\ 4 & -6 & 1 & 2 & \swarrow + & & \end{array} \right| = \left| \begin{array}{ccc|ccc} 2 & -5 & 1 & 2 & & & \\ -1 & 2 & 0 & 6 & & & \\ 1 & 1 & 0 & 3 & & & \\ 2 & -1 & 0 & & & & \end{array} \right|$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{matrix} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{matrix} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{array} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix}$$



### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{array} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix} =$$

$$= 1 \cdot A_{13}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{matrix} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{matrix} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix} =$$

$$= 1 \cdot A_{13} +$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{matrix} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{matrix} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix} =$$

$$= 1 \cdot A_{13} + 0 \cdot A_{23}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\left| \begin{array}{cccc} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{array} \right| \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \quad \quad \quad \swarrow + \\ \swarrow + \quad \quad \quad \swarrow + \\ \swarrow + \quad \quad \quad \swarrow + \end{array} = \left| \begin{array}{cccc} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{array} \right| =$$

$$= 1 \cdot A_{13} + 0 \cdot A_{23} +$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{matrix} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{matrix} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix} =$$

$$= 1 \cdot A_{13} + 0 \cdot A_{23} + 0 \cdot A_{33}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{matrix} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{matrix} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix} =$$

$$= 1 \cdot A_{13} + 0 \cdot A_{23} + 0 \cdot A_{33} +$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{matrix} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{matrix} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix} =$$

$$= 1 \cdot A_{13} + 0 \cdot A_{23} + 0 \cdot A_{33} + 0 \cdot A_{43}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{matrix} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{matrix} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix} =$$

$$= 1 \cdot A_{13} + 0 \cdot A_{23} + 0 \cdot A_{33} + 0 \cdot A_{43} = 1 \cdot A_{13}$$



$$A_{ij} = (-1)^{i+j} M_{ij}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{array} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix} =$$

$$= 1 \cdot A_{13} + 0 \cdot A_{23} + 0 \cdot A_{33} + 0 \cdot A_{43} = 1 \cdot A_{13} =$$

$$= 1 \cdot$$



$$A_{ij} = (-1)^{i+j} M_{ij}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{array}{l} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{array} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix} =$$

$$= 1 \cdot A_{13} + 0 \cdot A_{23} + 0 \cdot A_{33} + 0 \cdot A_{43} = 1 \cdot A_{13} =$$

$$= 1 \cdot (-1)^{1+3}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{matrix} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{matrix} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix} =$$

$$= 1 \cdot A_{13} + 0 \cdot A_{23} + 0 \cdot A_{33} + 0 \cdot A_{43} = 1 \cdot A_{13} =$$

$$= 1 \cdot (-1)^{1+3} \begin{vmatrix} -1 & 2 & 6 \\ 1 & 1 & 3 \\ 2 & -1 & 0 \end{vmatrix}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{matrix} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{matrix} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix} =$$

$$= 1 \cdot A_{13} + 0 \cdot A_{23} + 0 \cdot A_{33} + 0 \cdot A_{43} = 1 \cdot A_{13} =$$

$$= 1 \cdot (-1)^{1+3} \begin{vmatrix} -1 & 2 & 6 \\ 1 & 1 & 3 \\ 2 & -1 & 0 \end{vmatrix} = 1 \cdot 1 \cdot (-9)$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \begin{matrix} / \cdot 1 \quad / \cdot (-2) \quad / \cdot (-1) \\ \swarrow + \\ \swarrow + \\ \swarrow + \end{matrix} = \begin{vmatrix} 2 & -5 & 1 & 2 \\ -1 & 2 & 0 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix} =$$

$$= 1 \cdot A_{13} + 0 \cdot A_{23} + 0 \cdot A_{33} + 0 \cdot A_{43} = 1 \cdot A_{13} =$$

$$= 1 \cdot (-1)^{1+3} \begin{vmatrix} -1 & 2 & 6 \\ 1 & 1 & 3 \\ 2 & -1 & 0 \end{vmatrix} = 1 \cdot 1 \cdot (-9) = -9$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & 1 & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix}$$




### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} \\ \quad \quad \quad / \cdot 5$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix}$$

  $+ / \cdot 5$

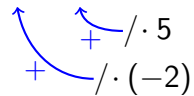
### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix}$$

$\begin{matrix} \nearrow + \\ \searrow \end{matrix} \begin{matrix} / \cdot 5 \\ / \cdot (-2) \end{matrix}$

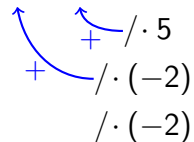
### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix}$$



### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix}$$



$+ \quad / \cdot (-2)$

$+ \quad / \cdot 5$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix}$$

Diagram illustrating row operations for simplification:

- Row 1:  $2$  (circled)
- Row 2:  $-3$
- Row 3:  $5$
- Row 4:  $4$

Operations indicated by arrows:

- From Row 1 to Row 2:  $+ / \cdot 5$
- From Row 1 to Row 3:  $+ / \cdot (-2)$
- From Row 1 to Row 4:  $+ / \cdot (-2)$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} & & & \\ & & & \\ & & & \\ & & & \end{vmatrix}$$

Diagram illustrating row operations for simplifying the determinant:

- Row 1:  $2 \rightarrow +$  (arrow from  $2$  to  $4$ )
- Row 2:  $-5 \rightarrow +$  (arrow from  $-5$  to  $-6$ )
- Row 3:  $2 \rightarrow +$  (arrow from  $2$  to  $1$ )
- Row 4:  $2 \rightarrow +$  (arrow from  $2$  to  $1$ )

Operations indicated by blue arrows and text:

- $+ \cdot 5$  (from  $2$  to  $1$ )
- $+ \cdot (-2)$  (from  $2$  to  $4$ )
- $+ \cdot (-2)$  (from  $2$  to  $1$ )

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 1 \\ -1 \\ 2 \\ 1 \end{vmatrix}$$

Diagram illustrating row operations to simplify the determinant:

- Row 1:  $2 \rightarrow 1$  (operation:  $/: 2$ )
- Row 2:  $-3 \rightarrow -1$  (operation:  $/: 3$ )
- Row 3:  $5 \rightarrow 2$  (operation:  $/: 3$ )
- Row 4:  $4 \rightarrow 1$  (operation:  $/: 4$ )

Blue arrows and plus signs indicate the operations performed on the rows.



### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 1 \\ & -1 \\ & 2 \\ & 1 \end{vmatrix}$$

Diagram illustrating row operations for simplification:

- Row 1:  $2 \xrightarrow{+} 4$  (arrow from column 3 to column 1)
- Row 2:  $-1 \xrightarrow{+} 1$  (arrow from column 3 to column 2)
- Row 3:  $2 \xrightarrow{+} 4$  (arrow from column 3 to column 1)
- Row 4:  $1 \xrightarrow{+} 2$  (arrow from column 3 to column 2)

Operations indicated by blue arrows and text:

- $\xrightarrow{+} / \cdot 5$  (from row 1, column 3 to row 1, column 2)
- $\xrightarrow{+} / \cdot (-2)$  (from row 1, column 3 to row 1, column 1)
- $\xrightarrow{+} / \cdot (-2)$  (from row 1, column 3 to row 1, column 4)

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 1 \\ 2 & -1 \\ & 2 \\ & 1 \end{vmatrix}$$

Diagram illustrating row operations for simplification:

- Row 1:  $2 \xrightarrow{+} 4$  (arrow from  $2$  to  $4$ )
- Row 2:  $-1 \xrightarrow{+} 1$  (arrow from  $-1$  to  $1$ )
- Row 3:  $2 \xrightarrow{+} 4$  (arrow from  $2$  to  $4$ )
- Row 4:  $1 \xrightarrow{+} 2$  (arrow from  $1$  to  $2$ )

Operations indicated by blue arrows and text:

- $\text{Row 2} \xrightarrow{+} \text{Row 1} \cdot 5$
- $\text{Row 3} \xrightarrow{+} \text{Row 1} \cdot (-2)$
- $\text{Row 4} \xrightarrow{+} \text{Row 1} \cdot (-2)$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 1 \\ 2 & -1 \\ 1 & 2 \\ & 1 \end{vmatrix}$$

Diagram illustrating row operations for simplification:

- Row 1:  $2 \rightarrow 0$  (operation:  $-\cdot 5$ )
- Row 2:  $-3 \rightarrow 2$  (operation:  $+\cdot (-2)$ )
- Row 3:  $5 \rightarrow 1$  (operation:  $+\cdot (-2)$ )
- Row 4:  $4 \rightarrow 0$  (operation:  $-\cdot 5$ )

### 3. način: svojstva determinanti i Laplaceov razvoj

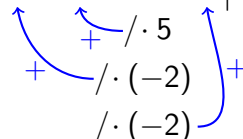
$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 1 \\ 2 & -1 \\ 1 & 2 \\ -1 & 1 \end{vmatrix}$$

Diagram illustrating row operations to simplify the determinant:

- Row 1:  $2 \rightarrow 0$  (operation:  $-\cdot 5$ )
- Row 2:  $-3 \rightarrow 2$  (operation:  $+\cdot (-2)$ )
- Row 3:  $5 \rightarrow 1$  (operation:  $+\cdot (-2)$ )
- Row 4:  $4 \rightarrow -1$  (operation:  $+\cdot (-2)$ )

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 \\ & 2 & -1 \\ & 1 & 2 \\ & -1 & 1 \end{vmatrix}$$



$+ \quad + \quad +$   
 $/ \cdot (-2) \quad / \cdot (-2) \quad / \cdot (-2)$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 \\ -1 & 2 & -1 \\ & 1 & 2 \\ & -1 & 1 \end{vmatrix}$$

Diagram illustrating row operations for simplification:

- Row 1:  $2 \xrightarrow{+} 0$  (operation:  $/.5$ )
- Row 2:  $-3 \xrightarrow{+} -1$  (operation:  $/.(-2)$ )
- Row 3:  $5 \xrightarrow{+} 1$  (operation:  $/.(-2)$ )
- Row 4:  $4 \xrightarrow{+} -1$  (operation:  $/.(-2)$ )

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 \\ -1 & 2 & -1 \\ 1 & 1 & 2 \\ & -1 & 1 \end{vmatrix}$$

Diagram illustrating row operations for simplification:

- Row 1:  $+ \cdot 5$  (indicated by a blue arrow from the circled 1 to the 5 in Row 3, Column 1)
- Row 2:  $+ \cdot (-2)$  (indicated by a blue arrow from the circled 1 to the 2 in Row 2, Column 4)
- Row 4:  $+ \cdot (-2)$  (indicated by a blue arrow from the circled 1 to the 2 in Row 4, Column 4)

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 \\ -1 & 2 & -1 \\ 1 & 1 & 2 \\ 2 & -1 & 1 \end{vmatrix}$$

Diagram illustrating row operations to simplify the determinant:

- Row 1:  $2 \xrightarrow{+} 0$  (operation:  $/.5$ )
- Row 2:  $-3 \xrightarrow{+} -1$  (operation:  $/.(-2)$ )
- Row 3:  $5 \xrightarrow{+} 1$  (operation:  $/.(-2)$ )
- Row 4:  $4 \xrightarrow{+} 2$  (operation:  $/.(-2)$ )



### 3. način: svojstva determinanti i Laplaceov razvoj

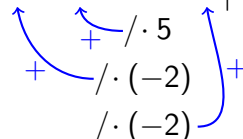
$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & \\ 1 & 1 & 2 & \\ 2 & -1 & 1 & \end{vmatrix}$$

Diagram illustrating row operations for the first determinant:

- Row 1:  $2$  (circled 1) and  $2$  are connected by a blue arrow labeled  $+$  and  $/ \cdot 5$ .
- Row 2:  $-3$  and  $4$  are connected by a blue arrow labeled  $+$  and  $/ \cdot (-2)$ .
- Row 4:  $4$  and  $2$  are connected by a blue arrow labeled  $+$  and  $/ \cdot (-2)$ .

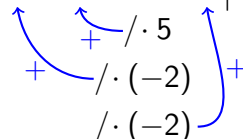
### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & \\ 2 & -1 & 1 & \end{vmatrix}$$



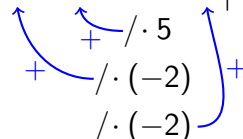
### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & \end{vmatrix}$$



### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & 0 \end{vmatrix}$$



### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & 0 \end{vmatrix}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & 0 \end{vmatrix} =$$

$$= 0 \cdot A_{11}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & 0 \end{vmatrix} =$$

$$= 0 \cdot A_{11} +$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & 0 \end{vmatrix} =$$

$$= 0 \cdot A_{11} + 0 \cdot A_{12}$$



### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & 0 \end{vmatrix} =$$

$$= 0 \cdot A_{11} + 0 \cdot A_{12} +$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & 0 \end{vmatrix} =$$

$$= 0 \cdot A_{11} + 0 \cdot A_{12} + 1 \cdot A_{13}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & 0 \end{vmatrix} =$$

$$= 0 \cdot A_{11} + 0 \cdot A_{12} + 1 \cdot A_{13} +$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & 0 \end{vmatrix} =$$

$$= 0 \cdot A_{11} + 0 \cdot A_{12} + 1 \cdot A_{13} + 0 \cdot A_{14}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

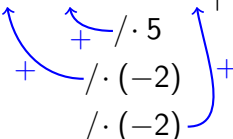
$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & 0 \end{vmatrix} =$$

$$= 0 \cdot A_{11} + 0 \cdot A_{12} + 1 \cdot A_{13} + 0 \cdot A_{14} = 1 \cdot A_{13}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & 0 \end{vmatrix} =$$



$$= 0 \cdot A_{11} + 0 \cdot A_{12} + 1 \cdot A_{13} + 0 \cdot A_{14} = 1 \cdot A_{13} =$$

$$= 1.$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & 0 \end{vmatrix} =$$

$$= 0 \cdot A_{11} + 0 \cdot A_{12} + 1 \cdot A_{13} + 0 \cdot A_{14} = 1 \cdot A_{13} =$$

$$= 1 \cdot (-1)^{1+3}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 0 & 3 \\ 2 & -1 & 0 & 0 \end{vmatrix} =$$

$$= 0 \cdot A_{11} + 0 \cdot A_{12} + 1 \cdot A_{13} + 0 \cdot A_{14} = 1 \cdot A_{13} =$$

$$= 1 \cdot (-1)^{1+3}$$



$$A_{ij} = (-1)^{i+j} M_{ij}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 3 & 0 \end{vmatrix} =$$

$$= 0 \cdot A_{11} + 0 \cdot A_{12} + 1 \cdot A_{13} + 0 \cdot A_{14} = 1 \cdot A_{13} =$$

$$= 1 \cdot (-1)^{1+3} \begin{vmatrix} -1 & 2 & 6 \\ 1 & 1 & 3 \\ 2 & -1 & 0 \end{vmatrix}$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & 0 \end{vmatrix} =$$

$\begin{matrix} \text{+} & \text{+} & \text{+} \\ \text{+} & \text{+} & \text{+} \\ \text{+} & \text{+} & \text{+} \end{matrix}$ 
  
 $\begin{matrix} \text{+} & \text{+} & \text{+} \\ \text{+} & \text{+} & \text{+} \\ \text{+} & \text{+} & \text{+} \end{matrix}$ 
  
 $\begin{matrix} \text{+} & \text{+} & \text{+} \\ \text{+} & \text{+} & \text{+} \\ \text{+} & \text{+} & \text{+} \end{matrix}$

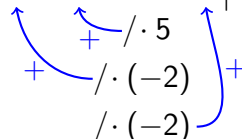
$$= 0 \cdot A_{11} + 0 \cdot A_{12} + 1 \cdot A_{13} + 0 \cdot A_{14} = 1 \cdot A_{13} =$$

$$= 1 \cdot (-1)^{1+3} \begin{vmatrix} -1 & 2 & 6 \\ 1 & 1 & 3 \\ 2 & -1 & 0 \end{vmatrix} = 1 \cdot 1 \cdot (-9)$$

$$A_{ij} = (-1)^{i+j} M_{ij}$$

### 3. način: svojstva determinanti i Laplaceov razvoj

$$\begin{vmatrix} 2 & -5 & \textcircled{1} & 2 \\ -3 & 7 & -1 & 4 \\ 5 & -9 & 2 & 7 \\ 4 & -6 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 0 & 0 & 1 & 0 \\ -1 & 2 & -1 & 6 \\ 1 & 1 & 2 & 3 \\ 2 & -1 & 1 & 0 \end{vmatrix} =$$



$$= 0 \cdot A_{11} + 0 \cdot A_{12} + 1 \cdot A_{13} + 0 \cdot A_{14} = 1 \cdot A_{13} =$$

$$= 1 \cdot (-1)^{1+3} \begin{vmatrix} -1 & 2 & 6 \\ 1 & 1 & 3 \\ 2 & -1 & 0 \end{vmatrix} = 1 \cdot 1 \cdot (-9) = -9$$

## čtvrti zadatak

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## Zadatak 4

Zadana je matrica

$$A = \begin{bmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{bmatrix}.$$

a) Odredite sve  $x \in \mathbb{R}$  za koje je  $\det A = 0$ .

b) Za  $x = -1$  izračunajte

$$\det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right).$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix}$$

## Rješenje

a)

$$\left| \begin{array}{ccc|c} 4+x & 2 & 2 & 4+x \\ 7 & x-1 & 2 & 7 \\ x+1 & 5 & 5 & x+1 \end{array} \right|$$

## Rješenje

a)

$$\left| \begin{array}{ccc} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{array} \right| \left| \begin{array}{cc} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{array} \right|$$



## Rješenje

a)

$$\left| \begin{array}{ccc} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{array} \right| \left| \begin{array}{cc} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{array} \right| =$$

## Rješenje

a)

$$\left| \begin{array}{ccc|c} 4+x & 2 & 2 & 4+x \\ 7 & x-1 & 2 & 7 \\ x+1 & 5 & 5 & x+1 \end{array} \right| =$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$= (4+x) \cdot (x-1) \cdot 5$$

## Rješenje

a)

$$\left| \begin{array}{ccc} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{array} \right| \left| \begin{array}{cc} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{array} \right| =$$

$$= (4+x) \cdot (x-1) \cdot 5$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1)$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1)$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5$$



## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$\begin{aligned} &= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ &\quad - (x+1) \cdot (x-1) \cdot 2 \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} - \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$\begin{aligned} &= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ &\quad - (x+1) \cdot (x-1) \cdot 2 \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$\begin{aligned} &= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ &\quad - (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) \end{aligned}$$

## Rješenje

a)

The diagram shows a 3x3 determinant with terms: top row (4+x, 2, 2), middle row (7, x-1, 2), and bottom row (x+1, 5, 5). Blue solid lines connect (4+x) to (x-1) to 5, (2) to 2 to (x+1), and (2) to 7 to 5. Red dashed lines connect (4+x) to 2 to (x+1), (2) to (x-1) to 2, and (7) to 5 to (x-1). The expression is followed by an equals sign.

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} =$$

$$\begin{aligned} &= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ &\quad - (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$\begin{aligned} &= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ &\quad - (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} = \begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix}$$

$$\begin{aligned} &= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ &\quad - (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 = \\ &= 20x \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} =$$

$$\begin{aligned} &= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ &\quad - (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 = \\ &= 20x - 20 \end{aligned}$$

## Rješenje

a)

The diagram shows a 3x3 determinant with terms  $4+x$ ,  $7$ ,  $x+1$  in the first column,  $2$ ,  $x-1$ ,  $5$  in the second column, and  $2$ ,  $7$ ,  $5$  in the third column. Blue solid lines connect  $4+x$  to  $x-1$ ,  $7$  to  $5$ , and  $x+1$  to  $2$ . Red dashed lines connect  $2$  to  $5$ ,  $x-1$  to  $2$ , and  $x+1$  to  $7$ . The determinant is followed by an equals sign.

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 7 \\ x+1 & 5 & 5 \end{vmatrix} =$$

$$\begin{aligned} &= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ &\quad - (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 = \\ &= 20x - 20 + 5x^2 \end{aligned}$$



## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} = \begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix}$$

$$\begin{aligned} &= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ &\quad - (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 = \\ &= 20x - 20 + 5x^2 - 5x \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} - \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$\begin{aligned} &= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ &\quad - (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 = \\ &= 20x - 20 + 5x^2 - 5x + 4x \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} = \begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix}$$

$$\begin{aligned} &= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ &\quad - (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 = \\ &= 20x - 20 + 5x^2 - 5x + 4x + 4 \end{aligned}$$

## Rješenje

a)

The diagram shows a 3x3 determinant with elements  $\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix}$ . Blue solid lines represent the positive terms of Sarrus' rule:  $(4+x) \cdot (x-1) \cdot 5$ ,  $2 \cdot 2 \cdot (x+1)$ , and  $2 \cdot 7 \cdot 5$ . Red dashed lines represent the negative terms:  $(x+1) \cdot (x-1) \cdot 2$ ,  $5 \cdot 2 \cdot (4+x)$ , and  $5 \cdot 7 \cdot 2$ .

$$\begin{aligned} &= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ &\quad - (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 = \\ &= 20x - 20 + 5x^2 - 5x + 4x + 4 + 70 \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} = \begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix}$$

$$\begin{aligned} &= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ &\quad - (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 = \\ &= 20x - 20 + 5x^2 - 5x + 4x + 4 + 70 - 2x^2 \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$\begin{aligned} &= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ &\quad - (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 = \\ &= 20x - 20 + 5x^2 - 5x + 4x + 4 + 70 - 2x^2 + 2 \end{aligned}$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 -$$

$$- (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 =$$

$$= 20x - 20 + 5x^2 - 5x + 4x + 4 + 70 - 2x^2 + 2 - 40$$

## Rješenje

a)

The diagram shows a 3x3 determinant with terms: top row (4+x, 2, 2), middle row (7, x-1, 2), and bottom row (x+1, 5, 5). Blue solid lines connect (4+x) to (x-1) to 5, (2) to 2 to (x+1), and (2) to 7 to 5. Red dashed lines connect (4+x) to 2 to (x+1), (2) to (x-1) to 2, and (7) to 5 to (x-1). The expression is followed by an equals sign.

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} =$$

$$= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 -$$

$$- (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 =$$

$$= 20x - 20 + 5x^2 - 5x + 4x + 4 + 70 - 2x^2 + 2 - 40 - 10x$$



## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 - \\ - (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 =$$

$$= 20x - 20 + 5x^2 - 5x + 4x + 4 + 70 - 2x^2 + 2 - 40 - 10x - 70$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 -$$

$$- (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 =$$

$$= 20x - 20 + \underline{5x^2} - 5x + 4x + 4 + 70 - \underline{2x^2} + 2 - 40 - 10x - 70 =$$

$$=$$

## Rješenje

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$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

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$$= 3x^2$$

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## Rješenje

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$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

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$$= 3x^2 + 9x$$

## Rješenje

a)

$$\begin{vmatrix} 4+x & 2 & 2 \\ 7 & x-1 & 2 \\ x+1 & 5 & 5 \end{vmatrix} \begin{vmatrix} 4+x & 2 \\ 7 & x-1 \\ x+1 & 5 \end{vmatrix} =$$

$$= (4+x) \cdot (x-1) \cdot 5 + 2 \cdot 2 \cdot (x+1) + 2 \cdot 7 \cdot 5 -$$

$$- (x+1) \cdot (x-1) \cdot 2 - 5 \cdot 2 \cdot (4+x) - 5 \cdot 7 \cdot 2 =$$

$$= \underline{20x} - 20 + \underline{5x^2} - \underline{5x} + \underline{4x} + 4 + 70 - \underline{2x^2} + 2 - 40 - \underline{10x} - 70 =$$

$$= 3x^2 + 9x - 54$$

$$3x^2 + 9x - 54 = 0$$

$$3x^2 + 9x - 54 = 0 \quad / : 3$$

$$x^2 + 3x - 18 = 0$$

$$ax^2 + bx + c = 0$$

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



$$3x^2 + 9x - 54 = 0 \quad / : 3$$

$$x^2 + 3x - 18 = 0$$

$$x_{1,2} = \frac{-3 \pm \sqrt{3^2 - 4 \cdot 1 \cdot (-18)}}{2 \cdot 1}$$

$$ax^2 + bx + c = 0$$

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$3x^2 + 9x - 54 = 0 \quad / : 3$$

$$x^2 + 3x - 18 = 0$$

$$x_{1,2} = \frac{-3 \pm \sqrt{3^2 - 4 \cdot 1 \cdot (-18)}}{2 \cdot 1}$$

$$x_{1,2} = \frac{-3 \pm \sqrt{9 + 72}}{2}$$

$$ax^2 + bx + c = 0$$

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$3x^2 + 9x - 54 = 0 \quad / : 3$$

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$$x_{1,2} = \frac{-3 \pm \sqrt{9 + 72}}{2}$$

$$x_{1,2} = \frac{-3 \pm 9}{2}$$

$$ax^2 + bx + c = 0$$
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$$x_{1,2} = \frac{-3 \pm \sqrt{9 + 72}}{2}$$

$$x_{1,2} = \frac{-3 \pm 9}{2}$$

$$x_1 = 3, \quad x_2 = -6$$

$$ax^2 + bx + c = 0$$

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$3x^2 + 9x - 54 = 0 \quad / : 3$$

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$$x_{1,2} = \frac{-3 \pm \sqrt{3^2 - 4 \cdot 1 \cdot (-18)}}{2 \cdot 1}$$

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$$x_{1,2} = \frac{-3 \pm 9}{2}$$

$$x_1 = 3, \quad x_2 = -6$$

b)  $x = -1$ ,

$$\det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) =$$

b)  $x = -1$ ,  $\det A = 3x^2 + 9x - 54$

$$\det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) =$$

$$\text{b) } x = -1, \quad \det A = 3x^2 + 9x - 54$$

$$\det A =$$

$$\det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) =$$



$$\text{b) } x = -1, \quad \det A = 3x^2 + 9x - 54$$

$$\det A = 3 \cdot (-1)^2 + 9 \cdot (-1) - 54$$

$$\det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) =$$

$$\text{b) } x = -1, \quad \det A = 3x^2 + 9x - 54$$

$$\det A = 3 \cdot (-1)^2 + 9 \cdot (-1) - 54 = -60$$

$$\det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) =$$

$$\text{b) } x = -1, \quad \det A = 3x^2 + 9x - 54$$

$$\det A = 3 \cdot (-1)^2 + 9 \cdot (-1) - 54 = -60$$

$$\det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) =$$

$$= \det A$$

$$\det(A^m) = (\det A)^m$$

$$\text{b) } x = -1, \quad \det A = 3x^2 + 9x - 54$$

$$\det A = 3 \cdot (-1)^2 + 9 \cdot (-1) - 54 = -60$$

$$\det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) =$$

$$= \det A + 5 \cdot$$

$$\det(A^m) = (\det A)^m$$

$$\text{b) } x = -1, \quad \det A = 3x^2 + 9x - 54$$

$$\det A = 3 \cdot (-1)^2 + 9 \cdot (-1) - 54 = -60$$

$$\det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) =$$

$$= \det A + 5 \cdot (\det A)^3$$

$$\det(A^m) = (\det A)^m$$

b)  $x = -1$ ,  $\det A = 3x^2 + 9x - 54$

$$\det A = 3 \cdot (-1)^2 + 9 \cdot (-1) - 54 = -60$$

$$\begin{aligned} &\det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) = \\ &= \det A + 5 \cdot (\det A)^3 - 2 \cdot \end{aligned}$$

$$\det(kA) = k^n \det A$$

$n$  je red kvadratne matrice  $A$

$$\det(A^m) = (\det A)^m$$

$$\text{b) } x = -1, \quad \det A = 3x^2 + 9x - 54$$

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$$\begin{aligned} & \det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) = \\ &= \det A + 5 \cdot (\det A)^3 - 2 \cdot \left(\frac{1}{2}\right)^3 \end{aligned}$$

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$$\begin{aligned} & \det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) = \\ &= \det A + 5 \cdot (\det A)^3 - 2 \cdot \left(\frac{1}{2}\right)^3 \det A \end{aligned}$$

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$$\det(A^m) = (\det A)^m$$

$$\text{b) } x = -1, \quad \det A = 3x^2 + 9x - 54$$

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$$\det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) =$$

$$= \det A + 5 \cdot (\det A)^3 - 2 \cdot \left(\frac{1}{2}\right)^3 \det A =$$

$$= -60$$

$$\det(kA) = k^n \det A$$

$n$  je red kvadratne matrice  $A$

$$\det(A^m) = (\det A)^m$$

$$\text{b) } x = -1, \quad \det A = 3x^2 + 9x - 54$$

$$\det A = 3 \cdot (-1)^2 + 9 \cdot (-1) - 54 = -60$$

$$\det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) =$$

$$= \det A + 5 \cdot (\det A)^3 - 2 \cdot \left(\frac{1}{2}\right)^3 \det A =$$

$$= -60 + 5 \cdot (-60)^3$$

$$\det(kA) = k^n \det A$$

$n$  je red kvadratne matrice  $A$

$$\det(A^m) = (\det A)^m$$

$$\text{b) } x = -1, \quad \det A = 3x^2 + 9x - 54$$

$$\det A = 3 \cdot (-1)^2 + 9 \cdot (-1) - 54 = -60$$

$$\begin{aligned} \det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) &= \\ &= \det A + 5 \cdot (\det A)^3 - 2 \cdot \left(\frac{1}{2}\right)^3 \det A = \\ &= -60 + 5 \cdot (-60)^3 - 2 \cdot \frac{1}{8} \cdot (-60) \end{aligned}$$

$$\det(kA) = k^n \det A$$

$n$  je red kvadratne matrice  $A$

$$\det(A^m) = (\det A)^m$$

$$\text{b) } x = -1, \quad \det A = 3x^2 + 9x - 54$$

$$\det A = 3 \cdot (-1)^2 + 9 \cdot (-1) - 54 = -60$$

$$\det(A^T) + 5 \det(A^3) - 2 \det\left(\frac{1}{2}A\right) =$$

$$= \det A + 5 \cdot (\det A)^3 - 2 \cdot \left(\frac{1}{2}\right)^3 \det A =$$

$$= -60 + 5 \cdot (-60)^3 - 2 \cdot \frac{1}{8} \cdot (-60) = -1\,080\,045$$

$$\det(kA) = k^n \det A$$

$n$  je red kvadratne matrice  $A$

**peti zadatak**

---

## Zadatak 5

Neka su  $A$  i  $B$  kvadratne matrice reda 4 pri čemu je  $\det A = \frac{1}{2}$  i  $\det B = -1$ . Odredite:

a)  $\det(A^5 A^T)$

b)  $\det(B^T \cdot 2A)^T$

c)  $\det(2AB)^3$

## Rješenje

a)  $\det(A^5 A^T) =$

## Rješenje

$$\det(AB) = \det A \det B$$

a)

$$\det(A^5 A^T) =$$



## Rješenje

$$\det(AB) = \det A \det B$$

a)

$$\det(A^5 A^T) = \det(A^5)$$

## Rješenje

$$\det(AB) = \det A \det B$$

a)

$$\det(A^5 A^T) = \det(A^5) \cdot$$

## Rješenje

$$\det(AB) = \det A \det B$$

a)

$$\det(A^5 A^T) = \det(A^5) \cdot \det(A^T)$$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\det(A^5 A^T) = \det(A^5) \cdot \det(A^T) =$$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\det(A^5 A^T) = \det(A^5) \cdot \det(A^T) = (\det A)^5$$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\det(A^5 A^T) = \det(A^5) \cdot \det(A^T) = (\det A)^5.$$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\det(A^5 A^T) = \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A$$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6\end{aligned}$$



## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6\end{aligned}$$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$

b)

$$\det(B^T \cdot 2A)^T =$$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$

b)

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## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$

b)

$$\det(B^T \cdot 2A)^T = \det(B^T \cdot 2A) =$$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$

b)

$$\det(B^T \cdot 2A)^T = \det(B^T \cdot 2A) = \det(B^T)$$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$

b)

$$\det(B^T \cdot 2A)^T = \det(B^T \cdot 2A) = \det(B^T) \cdot$$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$

b)

$$\det(B^T \cdot 2A)^T = \det(B^T \cdot 2A) = \det(B^T) \cdot \det(2A)$$



## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$

b)

$$\begin{aligned}\det(B^T \cdot 2A)^T &= \det(B^T \cdot 2A) = \det(B^T) \cdot \det(2A) = \\ &= \det B \cdot\end{aligned}$$

$$\det(kA) = k^n \det A$$

$n$  je red kvadratne matrice  $A$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$

b)

$$\begin{aligned}\det(B^T \cdot 2A)^T &= \det(B^T \cdot 2A) = \det(B^T) \cdot \det(2A) = \\ &= \det B \cdot 2^4\end{aligned}$$

$$\det(kA) = k^n \det A$$

$n$  je red kvadratne matrice  $A$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$

b)

$$\begin{aligned}\det(B^T \cdot 2A)^T &= \det(B^T \cdot 2A) = \det(B^T) \cdot \det(2A) = \\ &= \det B \cdot 2^4 \det A\end{aligned}$$

$$\det(kA) = k^n \det A$$

$n$  je red kvadratne matrice  $A$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$

b)

$$\begin{aligned}\det(B^T \cdot 2A)^T &= \det(B^T \cdot 2A) = \det(B^T) \cdot \det(2A) = \\ &= \det B \cdot 2^4 \det A = 16 \det A \det B\end{aligned}$$

$$\det(kA) = k^n \det A$$

$n$  je red kvadratne matrice  $A$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$

b)

$$\begin{aligned}\det(B^T \cdot 2A)^T &= \det(B^T \cdot 2A) = \det(B^T) \cdot \det(2A) = \\ &= \det B \cdot 2^4 \det A = 16 \det A \det B = 16 \cdot \frac{1}{2} \cdot (-1)\end{aligned}$$

$$\det(kA) = k^n \det A$$

$n$  je red kvadratne matrice  $A$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

a)

$$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$

b)

$$\begin{aligned}\det(B^T \cdot 2A)^T &= \det(B^T \cdot 2A) = \det(B^T) \cdot \det(2A) = \\ &= \det B \cdot 2^4 \det A = 16 \det A \det B = 16 \cdot \frac{1}{2} \cdot (-1) = -8\end{aligned}$$

$$\det(kA) = k^n \det A$$

$n$  je red kvadratne matrice  $A$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

- a)
- $$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$
- b)
- $$\begin{aligned}\det(B^T \cdot 2A)^T &= \det(B^T \cdot 2A) = \det(B^T) \cdot \det(2A) = \\ &= \det B \cdot 2^4 \det A = 16 \det A \det B = 16 \cdot \frac{1}{2} \cdot (-1) = -8\end{aligned}$$
- c)
- $$\det(2AB)^3 =$$

$$\det(kA) = k^n \det A$$

$n$  je red kvadratne matrice  $A$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

- a)
- $$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$
- b)
- $$\begin{aligned}\det(B^T \cdot 2A)^T &= \det(B^T \cdot 2A) = \det(B^T) \cdot \det(2A) = \\ &= \det B \cdot 2^4 \det A = 16 \det A \det B = 16 \cdot \frac{1}{2} \cdot (-1) = -8\end{aligned}$$
- c)
- $$\det(2AB)^3 = (\det(2AB))^3$$

$$\det(kA) = k^n \det A$$

$n$  je red kvadratne matrice  $A$



## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

- a)
- $$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$
- b)
- $$\begin{aligned}\det(B^T \cdot 2A)^T &= \det(B^T \cdot 2A) = \det(B^T) \cdot \det(2A) = \\ &= \det B \cdot 2^4 \det A = 16 \det A \det B = 16 \cdot \frac{1}{2} \cdot (-1) = -8\end{aligned}$$
- c)
- $$\det(2AB)^3 = (\det(2AB))^3 = (\quad)^3$$

$$\det(kA) = k^n \det A$$

$n$  je red kvadratne matrice  $A$

## Rješenje

$$\det(AB) = \det A \det B$$

$$\det(A^m) = (\det A)^m$$

- a)
- $$\begin{aligned}\det(A^5 A^T) &= \det(A^5) \cdot \det(A^T) = (\det A)^5 \cdot \det A = \\ &= (\det A)^6 = \left(\frac{1}{2}\right)^6 = \frac{1}{64}\end{aligned}$$
- b)
- $$\begin{aligned}\det(B^T \cdot 2A)^T &= \det(B^T \cdot 2A) = \det(B^T) \cdot \det(2A) = \\ &= \det B \cdot 2^4 \det A = 16 \det A \det B = 16 \cdot \frac{1}{2} \cdot (-1) = -8\end{aligned}$$
- c)
- $$\det(2AB)^3 = (\det(2AB))^3 = (2^4 \quad \quad \quad)^3$$

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- $$\begin{aligned}\det(2AB)^3 &= (\det(2AB))^3 = (2^4 \det(AB))^3 = \\ &= (16 \det A \det B)^3\end{aligned}$$

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c)

$$\begin{aligned}\det(2AB)^3 &= (\det(2AB))^3 = (2^4 \det(AB))^3 = \\ &= (16 \det A \det B)^3 = \left(16 \cdot \frac{1}{2} \cdot (-1)\right)^3 = (-8)^3 = -512\end{aligned}$$

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$n$  je red kvadratne matrice  $A$