# Sustavi linearnih jednadžbi. Kronecker-Capellijev teorem

Matematika za ekonomiste 1

Damir Horvat

FOI, Varaždin

# Sadržaj

prvi zadatak

drugi zadatak

treći zadatak

četvrti zadatak

prvi zadatak

Odredite rang matrice

$$A = \begin{bmatrix} -4 & -3 & -4 & -1 & 0 \\ 1 & 1 & 1 & 1 & 3 \\ 14 & 11 & 14 & 5 & 2 \\ 11 & 9 & 11 & 5 & 4 \end{bmatrix}.$$

Odredite rang matrice

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$$\begin{array}{c} & & & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & \\ & & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & \\ & & & \\ & & \\ & & & \\ & & \\ & & & \\ & & \\ & & & \\ & & \\ & & & \\ & &$$

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# subdeterminanta reda 3

Odredite rang matrice

$$A = \begin{bmatrix} -4 & -3 & -4 & -1 & 0 \\ 1 & 1 & 1 & 1 & 3 \\ 14 & 11 & 14 & 5 & 2 \\ 11 & 9 & 11 & 5 & 4 \end{bmatrix}.$$

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Odredite rang matrice

$$A = \begin{bmatrix} -4 & -3 & -4 & -1 & 0 \\ 1 & 1 & 1 & 1 & 3 \\ 14 & 11 & 14 & 5 & 2 \\ 11 & 9 & 11 & 5 & 4 \end{bmatrix}$$

$$\begin{array}{c} \longleftarrow 1. \\ \longleftarrow 2. \\ \longleftarrow 3. \\ \hline \end{array}$$

$$\begin{array}{c} \downarrow \\ \downarrow \\ 1. \\ \hline \end{array}$$

### Odredite rang matrice

$$A = \begin{bmatrix} -4 & -3 & -4 & -1 & 0 \\ 1 & 1 & 1 & 1 & 3 \\ 14 & 11 & 14 & 5 & 2 \\ 11 & 9 & 11 & 5 & 4 \end{bmatrix}$$

#### subdeterminanta reda 3

$$\begin{vmatrix} -4 & -4 & -1 \\ 1 & 1 & 1 \\ 14 & 14 & 5 \end{vmatrix}$$

### Odredite rang matrice

$$A = \begin{bmatrix} -4 & -3 & -4 & -1 & 0 \\ 1 & 1 & 1 & 1 & 3 \\ 4 & 11 & 14 & 5 & 2 \\ 11 & 9 & 11 & 5 & 4 \end{bmatrix} \xrightarrow{\longleftarrow 2} \xrightarrow{\longleftarrow 3}$$

#### subdeterminanta reda 3

$$\begin{vmatrix} -4 & -4 & -1 \\ 1 & 1 & 1 \\ 14 & 14 & 5 \\ \hline 1. & 3. & 4. \end{vmatrix}$$

Odredite rang matrice

$$A = \begin{bmatrix} -4 & -3 & -4 & -1 & 0 \\ 1 & 1 & 1 & 1 & 3 \\ 14 & 11 & 14 & 5 & 2 \\ 11 & 9 & 11 & 5 & 4 \end{bmatrix}.$$

subdeterminanta reda 3

$$\begin{vmatrix} -4 & -4 & -1 \\ 1 & 1 & 1 \\ 14 & 14 & 5 \\ \hline 1. & 3. & 4. \end{vmatrix}$$

subdeterminanta reda 4

#### Odredite rang matrice

#### subdeterminanta reda 3

$$\begin{vmatrix} -4 & -4 & -1 \\ 1 & 1 & 1 \\ 14 & 14 & 5 \\ \hline 1. & 3. & 4. \end{vmatrix}$$

subdeterminanta reda 4

### Odredite rang matrice

$$A = \begin{bmatrix} -4 & -3 & -4 & -1 & 0 \\ 1 & 1 & 1 & 1 & 3 \\ 4 & 11 & 14 & 5 & 2 \\ 1 & 9 & 11 & 5 & 4 \end{bmatrix}$$

$$\begin{array}{c} -4 & -1 & 0 \\ -4 & -1 & 0 \\ -4 & -1 & 3 \\ -4 & -2 & 3 \\ \hline \end{array}$$

### subdeterminanta reda 2

### subdeterminanta reda 3

$$\begin{vmatrix} -4 & -4 & -1 \\ 1 & 1 & 1 \\ 14 & 14 & 5 \\ \hline 1. & 3. & 4. \end{vmatrix}$$

$$\begin{vmatrix} -4 & -3 & -4 & 0 \\ 1 & 1 & 1 & 3 \\ 14 & 11 & 14 & 2 \\ 11 & 9 & 11 & 4 \end{vmatrix}$$

Odredite rang matrice

# subdeterminanta reda 2

$$\begin{vmatrix} 1 & 3 & & & \\ 11 & 4 & & & \\ & & & & 4 \end{vmatrix}$$

### subdeterminanta reda 3

$$\begin{vmatrix} -4 & -4 & -1 \\ 1 & 1 & 1 \\ 14 & 14 & 5 \\ \hline 1. & 3. & 4. \end{vmatrix}$$
 \times\_{\text{\cdots}} \tag{\cdots}\_1

Odredite rang matrice

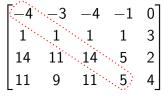
$$A = \begin{bmatrix} -4 & -3 & -4 & -1 & 0 \\ 1 & 1 & 1 & 1 & 3 \\ 14 & 11 & 14 & 5 & 2 \\ 11 & 9 & 11 & 5 & 4 \end{bmatrix}$$

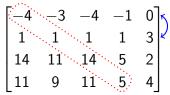
$$\begin{array}{c} & & & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & \\ & & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & & \\ & & & & \\ & & & \\ & & & & \\ & & & \\ & & & & \\ & & & \\ & & & & \\ & & &$$

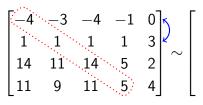
# subdeterminanta reda 2

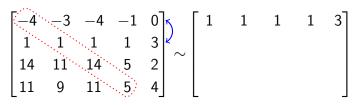
### subdeterminanta reda 3

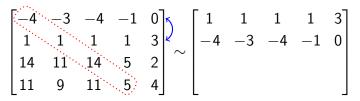
$$\begin{vmatrix} -4 & -4 & -1 \\ 1 & 1 & 1 \\ 14 & 14 & 5 \\ \hline 1 & 3 & 4 \end{vmatrix}$$

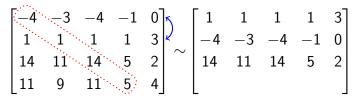


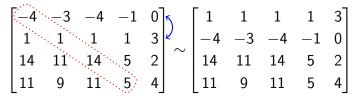


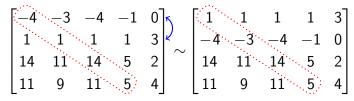


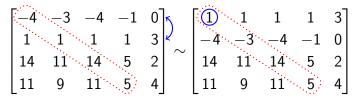


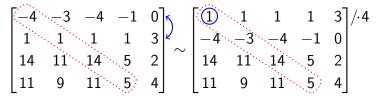


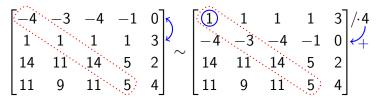


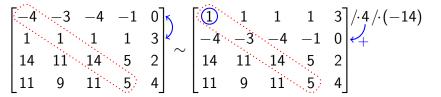


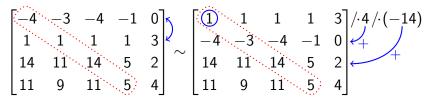


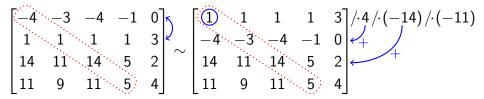


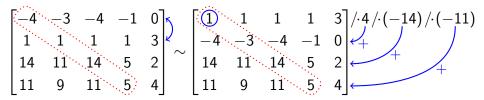


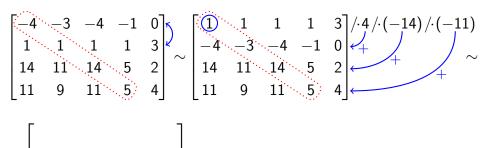


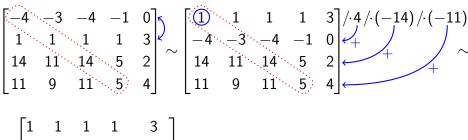


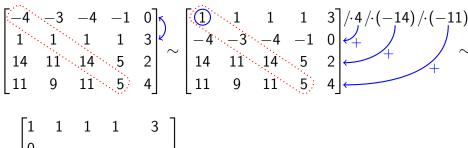


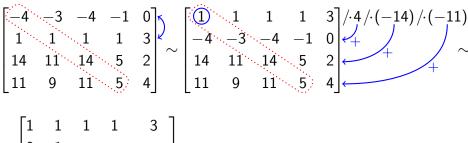


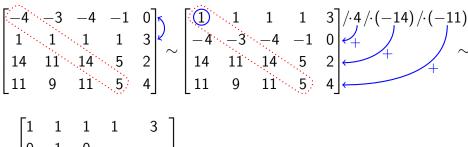


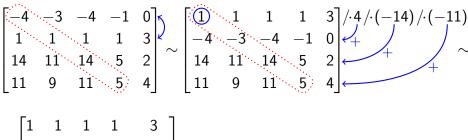




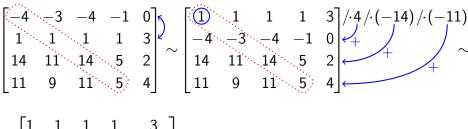




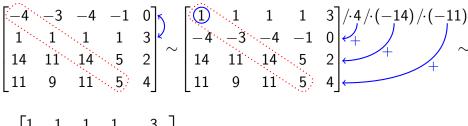




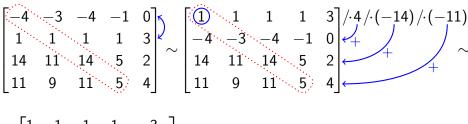
$$\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3
\end{bmatrix}$$



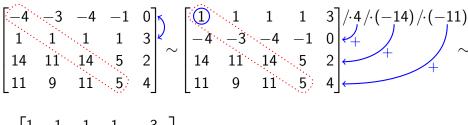
$$\sim egin{bmatrix} 1 & 1 & 1 & 1 & 3 \ 0 & 1 & 0 & 3 & 12 \ \end{bmatrix}$$



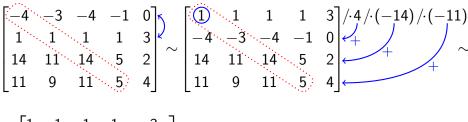
$$\sim \begin{bmatrix} 1 & 1 & 1 & 1 & 3 \\ 0 & 1 & 0 & 3 & 12 \\ 0 & & & & & \end{bmatrix}$$



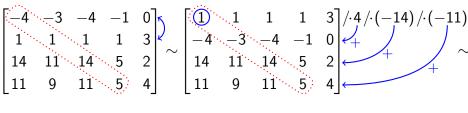
$$\sim \begin{bmatrix} 1 & 1 & 1 & 1 & 3 \\ 0 & 1 & 0 & 3 & 12 \\ 0 & -3 & & & & \end{bmatrix}$$



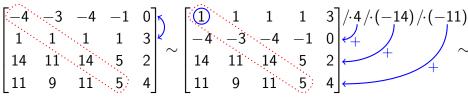
$$\sim \begin{bmatrix} 1 & 1 & 1 & 1 & 3 \\ 0 & 1 & 0 & 3 & 12 \\ 0 & -3 & 0 & & & \end{bmatrix}$$



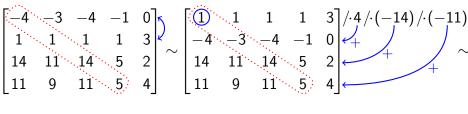
$$\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & -3 & 0 & -9
\end{bmatrix}$$



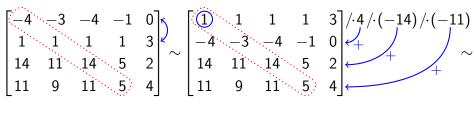
$$\sim \begin{bmatrix} 1 & 1 & 1 & 1 & 3 \\ 0 & 1 & 0 & 3 & 12 \\ 0 & -3 & 0 & -9 & -40 \end{bmatrix}$$



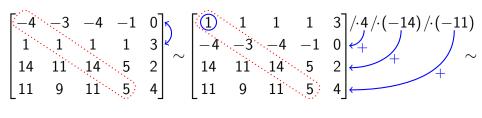
$$\sim
\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & -3 & 0 & -9 & -40 \\
0
\end{bmatrix}$$



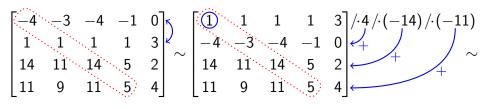
$$\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & -3 & 0 & -9 & -40 \\
0 & -2
\end{bmatrix}$$



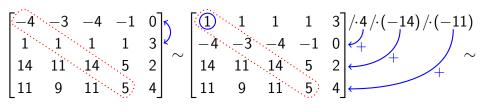
$$\sim \begin{bmatrix} 1 & 1 & 1 & 1 & 3 \\ 0 & 1 & 0 & 3 & 12 \\ 0 & -3 & 0 & -9 & -40 \\ 0 & -2 & 0 & & \end{bmatrix}$$



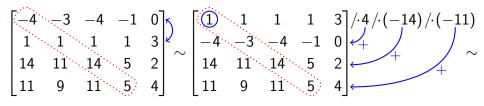
$$\sim \begin{bmatrix} 1 & 1 & 1 & 1 & 3 \\ 0 & 1 & 0 & 3 & 12 \\ 0 & -3 & 0 & -9 & -40 \\ 0 & -2 & 0 & -6 \end{bmatrix}$$



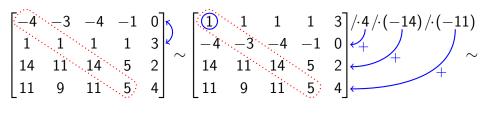
$$\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & -3 & 0 & -9 & -40 \\
0 & -2 & 0 & -6 & -29
\end{bmatrix}$$



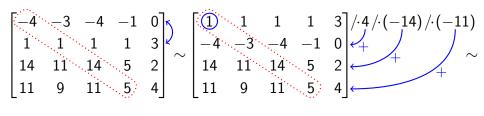
$$\begin{bmatrix}
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0 & -3 & 0 & -9 & -40 \\
0 & -2 & 0 & -6 & -29
\end{bmatrix}$$



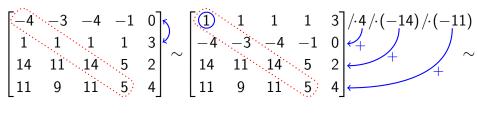
$$\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & -3 & 0 & -9 & -40 \\
0 & -2 & 0 & -6 & -29
\end{bmatrix}$$



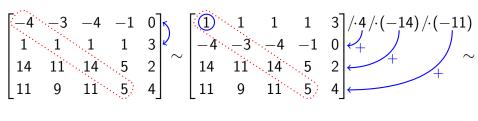
$$\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & -3 & 0 & -9 & -40 \\
0 & -2 & 0 & -6 & -29
\end{bmatrix} / \cdot 3$$



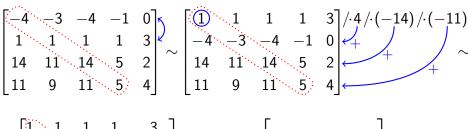
$$\begin{bmatrix}
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0 & 1 & 0 & 3 & 12 \\
0 & -3 & 0 & -9 & -40 \\
0 & -2 & 0 & -6 & -29
\end{bmatrix} / \cdot 3$$

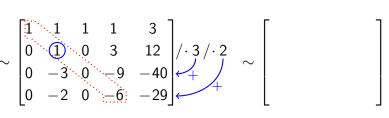


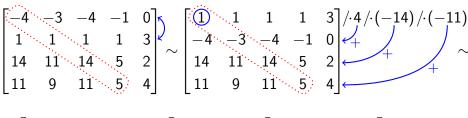
$$\begin{bmatrix} 1 & 1 & 1 & 1 & 3 \\ 0 & 1 & 0 & 3 & 12 \\ 0 & -3 & 0 & -9 & -40 \\ 0 & -2 & 0 & -6 & -29 \end{bmatrix} / \cdot \frac{3}{2} / \cdot \frac{3}{2}$$

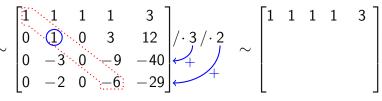


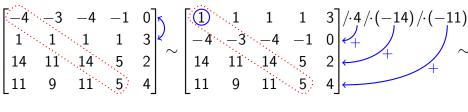
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0 & 1 & 0 & 3 & 12 \\
0 & -3 & 0 & -9 & -40 \\
0 & -2 & 0 & -6 & -29
\end{bmatrix}$$





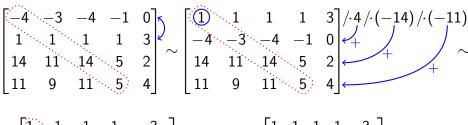


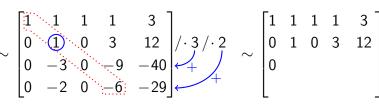


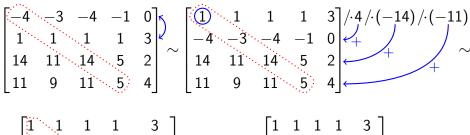


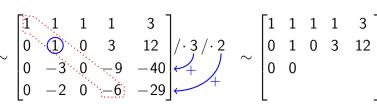
$$\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & -3 & 0 & -9 & -40 \\
0 & -2 & 0 & -6 & -29
\end{bmatrix}$$

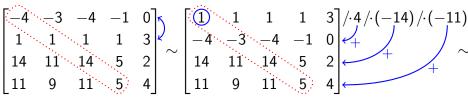
$$\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & -2 & 0 & -6 & -29
\end{bmatrix}$$



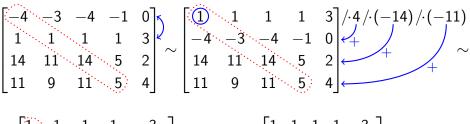


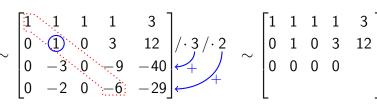


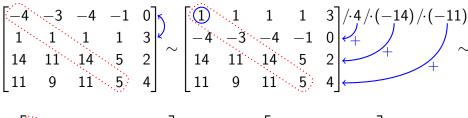


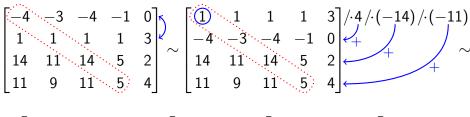


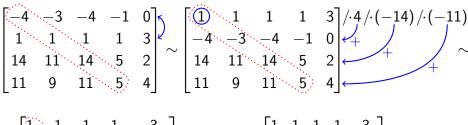
$$\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & -3 & 0 & -9 & -40 \\
0 & -2 & 0 & -6 & -29
\end{bmatrix}
\xrightarrow{/\cdot 3/\cdot 2} \sim
\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & 0 & 0
\end{bmatrix}$$



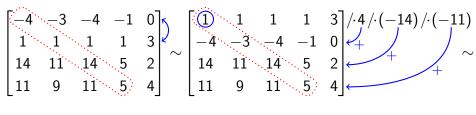






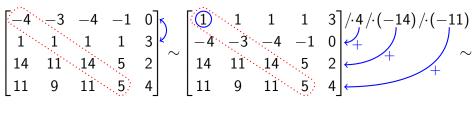


$$\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & -3 & 0 & -9 & -40 \\
0 & -2 & 0 & -6 & -29
\end{bmatrix}
\xrightarrow{/\cdot 3/\cdot 2} \sim
\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & 0 & 0 & 0 & -4 \\
0 & 0
\end{bmatrix}$$



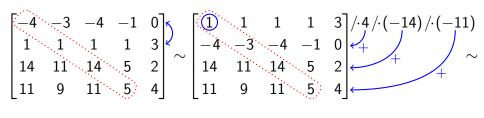
$$\sim \begin{bmatrix}
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0 & 1 & 0 & 3 & 12 \\
0 & -3 & 0 & -9 & -40 \\
0 & -2 & 0 & -6 & -29
\end{bmatrix}$$

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

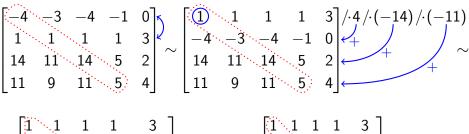


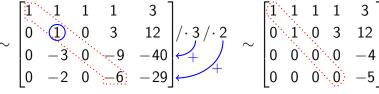
$$\sim \begin{bmatrix}
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\end{bmatrix}$$

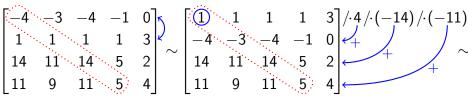
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- \times \begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & 0 & 0 & 0 & -4 \\
0 & 0 & 0 & 0
\end{bmatrix}$$

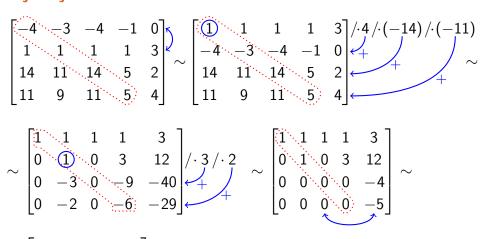


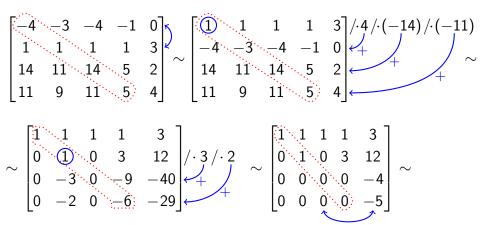
$$\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & -3 & 0 & -9 & -40 \\
0 & -2 & 0 & -6 & -29
\end{bmatrix}
\xrightarrow{/\cdot 3/\cdot 2} \sim
\begin{bmatrix}
1 & 1 & 1 & 1 & 3 \\
0 & 1 & 0 & 3 & 12 \\
0 & 0 & 0 & 0 & -4 \\
0 & 0 & 0 & 0 & -5
\end{bmatrix}$$



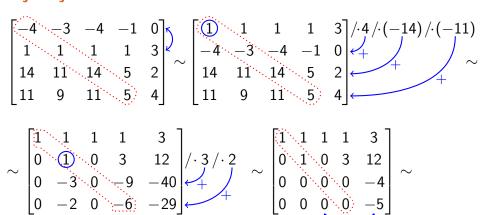




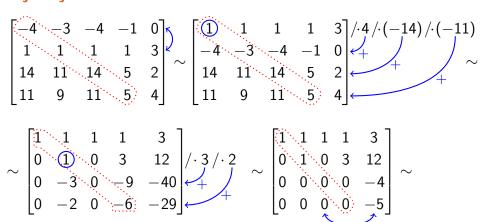




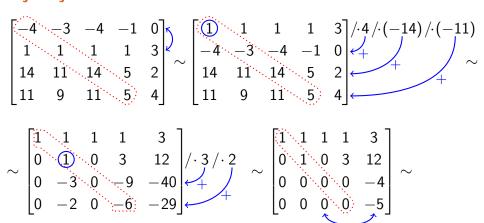
$$\sim \left[ egin{array}{ccc} 3 & & & & \ & 12 & & \ & -4 & & \ & -5 & & \end{array} 
ight.$$



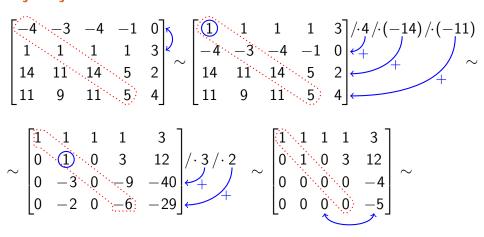
$$\sim \left[ egin{array}{cccc} 3 & 1 \ 12 & 0 \ -4 & 0 \ -5 & 0 \ \end{array} 
ight]$$

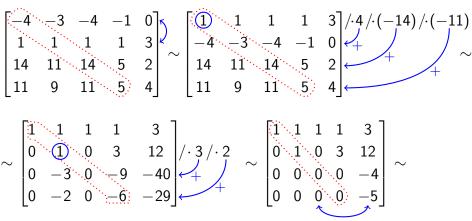


$$\sim egin{bmatrix} 1 & 3 & 1 \ 0 & 12 & 0 \ 0 & -4 & 0 \ 0 & -5 & 0 \end{bmatrix}$$

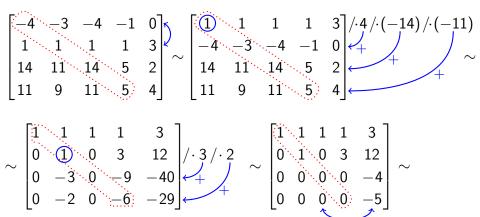


$$\sim egin{bmatrix} 1 & 1 & 3 & 1 \ 0 & 1 & 12 & 0 \ 0 & 0 & -4 & 0 \ 0 & 0 & -5 & 0 \end{bmatrix}$$

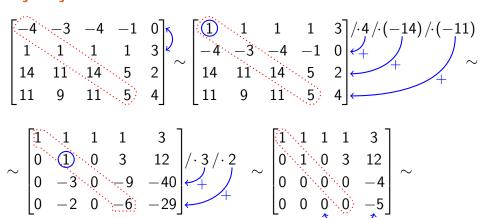


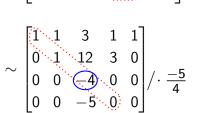


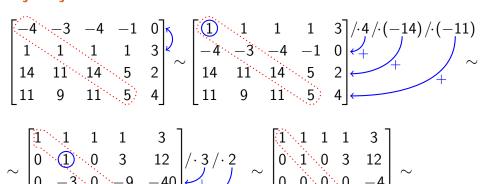
$$\sim egin{bmatrix} 1 & 1 & 3 & 1 & 1 \ 0 & 1 & 12 & 3 & 0 \ 0 & 0 & -4 & 0 & 0 \ 0 & 0 & -5 & 0 & 0 \ \end{pmatrix}$$

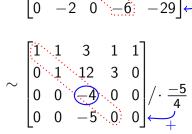


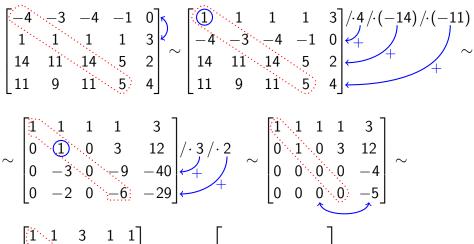
$$\sim egin{bmatrix} 1 & 1 & 3 & 1 & 1 \ 0 & 1 & 12 & 3 & 0 \ 0 & 0 & -4 & 0 & 0 \ 0 & 0 & -5 & 0 & 0 \ \end{pmatrix}$$



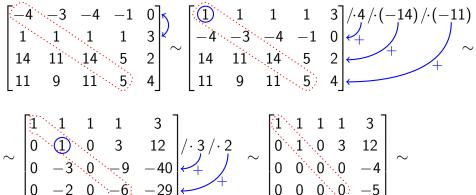




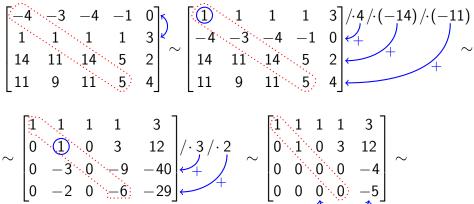




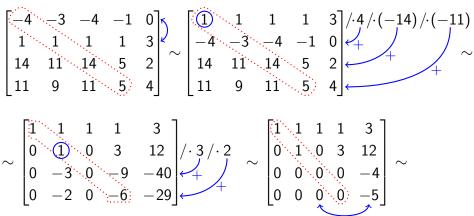
$$\sim \begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -5 & 0 & 0 \end{bmatrix} / \cdot \frac{-5}{4} \sim \begin{bmatrix} \\ \\ \\ \end{bmatrix}$$



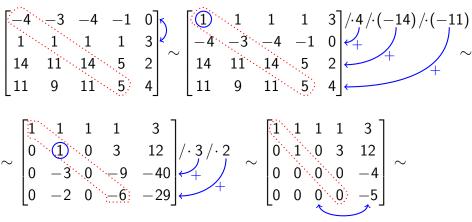
$$\begin{bmatrix} 0 & -2 & 0 & -6 & -29 \end{bmatrix} \leftarrow \begin{bmatrix} 0 & 0 & 0 \\ 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -5 & 0 & 0 \end{bmatrix} / \cdot \frac{-5}{4} \sim \begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ & & & & \\ & & & & \\ & & & & \end{bmatrix}$$



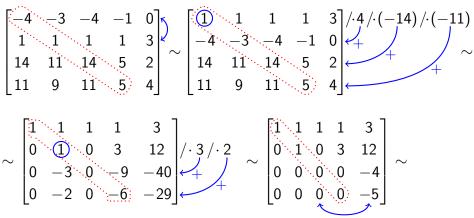
$$\begin{bmatrix} 0 & -2 & 0 & -6 & -29 \end{bmatrix} \longrightarrow \begin{bmatrix} 0 & 0 & 0 \\ 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -5 & 0 & 0 \end{bmatrix} / \underbrace{-\frac{5}{4}}_{+} \sim \begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -5 & 0 & 0 \end{bmatrix}$$



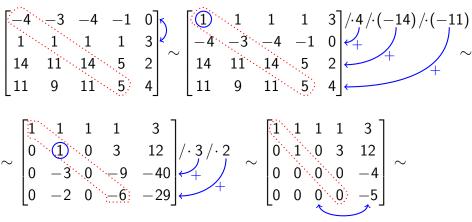
$$\begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -5 & 0 & 0 \\ 0 & 0 & -5 & 0 & 0 \end{bmatrix} / \cdot \frac{-5}{4} \sim \begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -4 & 0 & 0 \\ 0 & 0 & -4 & 0 & 0 \end{bmatrix}$$



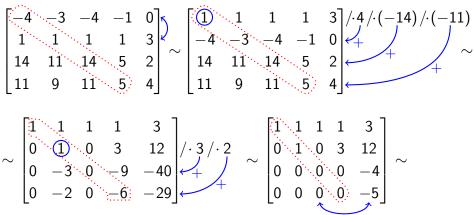
$$\begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -5 & 0 & 0 \\ 0 & 0 & -5 & 0 & 0 \end{bmatrix} / \cdot \frac{-5}{4} \sim \begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -4 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$



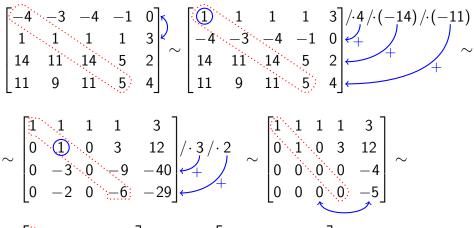
$$\begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -4 & 0 & 0 \\ 0 & 0 & -5 & 0 & 0 \end{bmatrix} / \cdot \frac{-5}{4} \sim \begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -4 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$



$$\begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -5 & 0 & 0 \\ 0 & 0 & -5 & 0 & 0 \end{bmatrix} / \cdot \frac{-5}{4} \sim \begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -4 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

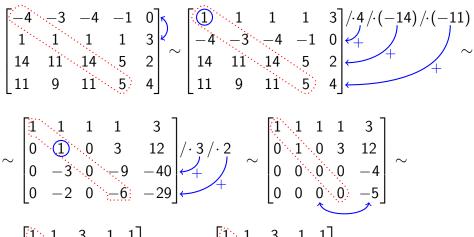


$$\begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -4 & 0 & 0 \\ 0 & 0 & -5 & 0 & 0 \end{bmatrix} / \cdot \frac{-5}{4} \sim \begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -4 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

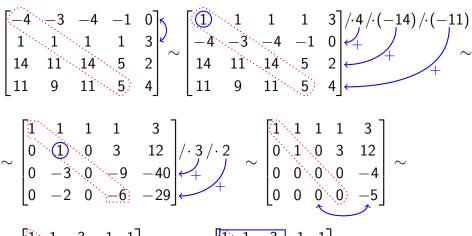


$$\begin{bmatrix}
1 & 1 & 3 & 1 & 1 \\
0 & 1 & 12 & 3 & 0 \\
0 & 0 & 4 & 0 & 0 \\
0 & 0 & -5 & 0 & 0
\end{bmatrix}$$

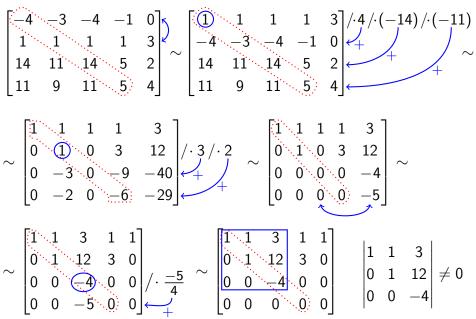
$$\begin{bmatrix}
1 & 1 & 3 & 1 & 1 \\
0 & 1 & 12 & 3 & 0 \\
0 & 0 & -4 & 0 & 0 \\
0 & 0 & 0 & 0 & 0
\end{bmatrix}$$



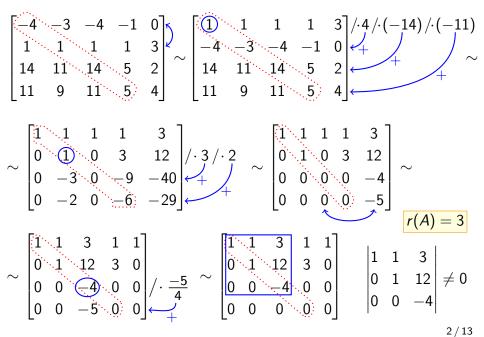
$$\begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -4 & 0 & 0 \\ 0 & 0 & -5 & 0 & 0 \end{bmatrix} / \frac{-5}{4} \sim \begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -4 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$



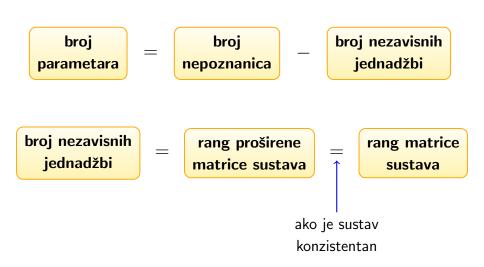
$$\begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -4 & 0 & 0 \\ 0 & 0 & -5 & 0 & 0 \end{bmatrix} / \cdot \frac{-5}{4} \sim \begin{bmatrix} 1 & 1 & 3 & 1 & 1 \\ 0 & 1 & 12 & 3 & 0 \\ 0 & 0 & -4 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$



/ 13



## Broj parametara u rješivom sustavu



# \_\_\_\_

drugi zadatak

#### Zadatak 2

Zadan je sustav linearnih jednadžbi

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19.$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

- a) Pomoću Kronecker-Capellijevog teorema ispitajte koliko rješenja ima zadani sustav.
- b) Riješite zadani sustav Gaussovim postupkom.

a)

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$

$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$

$$2x_1 + 6x_2 + 15x_4 = -8$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

a) 
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ & & & \end{bmatrix}$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

a) 
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \end{bmatrix}$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

a) 
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix}$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

a)  $A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} \\ \\ \end{bmatrix}$ 

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix}$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

a)  $A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix}$ 

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$

$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$

$$2x_1 + 6x_2 + 15x_4 = -8$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$A_p = \begin{vmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{vmatrix}$$

$$\begin{bmatrix}
2 & 3 & 2 & 6 & 1 \\
-2 & 3 & -6 & 12 & -19 \\
2 & 6 & 0 & 15 & -8
\end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$A_p = \begin{vmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{vmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} / \cdot 1$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} / \cdot 1$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} / \cdot \frac{1}{\cdot} \cdot (-1)$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1 / \cdot (-1)} +$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/\cdot 1/\cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ & & & & \\ & & & & \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{\text{$/$-$}} \xrightarrow{\text{$/$-$}} \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & & & & & \\ & & & & & \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/\cdot 1/\cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & & & & \\ & & & & & & \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{\text{$/$-$}} \leftarrow \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & & & \\ & & & & & \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{\text{$/$-$}} \xrightarrow{\text{$/$-$}} \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & 1 \\ & & & & & & \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1/ \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ & & & & & \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1/ \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & & & & \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1 / \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & & & \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1/\cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -18 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

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$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{\text{$/$-1/$}} (-1) \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

(a) 
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_{i}$$

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$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1/\cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix}$$

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$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1/ \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ & & & & \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/\cdot 1/\cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \xrightarrow{\sim}$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ & & & & & \\ & & & & & \end{bmatrix}$$

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$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

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$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1 / \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix}$$

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$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

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$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1 / \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

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$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$A_{p} = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix}$$

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$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

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$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1 / \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2)$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

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2 & 3 & 2 & 6 & 1 \\
0 & 3 & -2 & 9 & -9 \\
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\end{bmatrix} / \cdot (-2)$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

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$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

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$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ & & & & & & \end{bmatrix}$$

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$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1/ \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & & & & \end{bmatrix}$$

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$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{\text{$/$-$}} \xrightarrow{\text{$/$-$}} \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \xrightarrow{\text{$/$-$}} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 0 & & & \end{bmatrix}$$

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$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/\cdot 1/\cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

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$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1/ \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1/ \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1/ \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1/ \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 \\ 0 & 3 & -2 & 9 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$A_{p} = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{\text{$/$-1/$}} \leftarrow \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \xrightarrow{\text{$/$-2/$}} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 \\ 0 & 3 & -2 & 9 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$r(A) =$$

$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1/ \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 \\ 0 & 3 & -2 & 9 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$r(A) =$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$A_{p} = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{\text{$/$-1/$}} \leftarrow \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \xrightarrow{\text{$/$-2/$}} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 \\ 0 & 3 & -2 & 9 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$r(A) = 2$$

$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1/ \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 \\ 0 & 3 & -2 & 9 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$r(A) = 2$$

$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{\text{+}} \leftarrow \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$r(A) = 2$$
  $r(A_p) =$ 

$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{\text{$/$-1/$}} \begin{pmatrix} 1 \\ -1 \\ -1 \end{pmatrix} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$r(A) = 2$$
  $r(A_p) =$ 

(a) 
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 19 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1/ \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$r(A)=2 \qquad r(A_p)=2$$

$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix}$$

a)
$$A = \begin{bmatrix} 2 & 3 & 2 & 6 \\ -2 & 3 & -6 & 12 \\ 2 & 6 & 0 & 15 \end{bmatrix} \qquad A_p = \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ -2 & 3 & -6 & 12 & -19 \\ 2 & 6 & 0 & 15 & -8 \end{bmatrix} \xrightarrow{/ \cdot 1/ \cdot (-1)} \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 6 & -4 & 18 & -18 \\ 0 & 3 & -2 & 9 & -9 \end{bmatrix} \sim$$

$$\sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 6 & -4 & 18 & -18 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 2 & 3 & 2 & 6 & 1 \\ 0 & 3 & -2 & 9 & -9 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$r(A)=2 \qquad r(A_p)=2$$

$$r(A)=r(A_p)=2$$

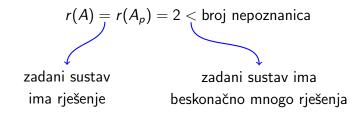
$$r(A) = r(A_p) = 2$$

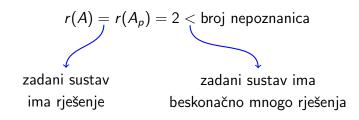
zadani sustav ima rješenje

$$r(A) = r(A_p) = 2 < \text{broj nepoznanica}$$

zadani sustav ima rješenje

$$r(A) = r(A_p) = 2$$
   
broj nepoznanica zadani sustav ima ima rješenje beskonačno mnogo rješenja





broj parametara = broj nepoznanica - r(A)

$$r(A) = r(A_p) = 2$$
   
broj nepoznanica zadani sustav ima ima rješenje beskonačno mnogo rješenja

broj parametara = broj nepoznanica 
$$- r(A)$$
  
broj parametara =  $4 - 2$ 

$$r(A) = r(A_p) = 2$$
 < broj nepoznanica zadani sustav zadani sustav ima ima rješenje beskonačno mnogo rješenja

broj parametara = broj nepoznanica - r(A)broj parametara = 4 - 2broj parametara = 2

$$x_1$$
  $x_2$   $x_3$   $x_4$ 

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$

$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$

$$2x_1 + 6x_2 + 15x_4 = -8$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
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$x_1$	$x_2$	<i>X</i> <sub>3</sub>	$X_4$	
2	3	2	6	1
-2	3	-6	12	-19
2	6	0	15	-8

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

$x_1$	$x_2$	<i>X</i> <sub>3</sub>	$X_4$	
2	3	2	6	1
-2	3	-6	12	-19
2	6	0	15	-8

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
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$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
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$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
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$$2x_1 + 6x_2 + 15x_4 = -8$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

 $-3x_{2}$ 

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

$$-3x_2 + 2x_3$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

$$-3x_2 + 2x_3 - 9x_4$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_1$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$
$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_1 + 6x_2$$

$$2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$$

$$-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$$

$$2x_1 + 6x_2 + 15x_4 = -8$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_1 + 6x_2 + 15x_4$$

 $2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$   $-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$   $2x_1 + 6x_2 + 15x_4 = -8$ 

$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

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2x_1 + 6x_2 + 15x_4 = -8$$

 $2x_1 + 3x_2 + 2x_3 + 6x_4 = 1$  $-2x_1 + 3x_2 - 6x_3 + 12x_4 = -19$  $2x_1 + 6x_2 + 15x_4 = -8$ 

$$-3x_2 + 2x_3 - 9x_4 = 9$$

$$\begin{array}{c}
-3x_2 + 2x_3 - 9x_4 = 9 \\
2x_1 + 6x_2 + 15x_4 = -8
\end{array}$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_3 =$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_3 = 9 + 3x_2 + 9x_4$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_3 = 9 + 3x_2 + 9x_4$$
$$x_3 =$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_3 = 9 + 3x_2 + 9x_4$$
$$x_3 = \frac{9}{2} + \frac{3}{2}x_2 + \frac{9}{2}x_4$$

 $-3x_2 + 2x_3 - 9x_4 = 9$  $2x_3 = 9 + 3x_2 + 9x_4$  $x_3 = \frac{9}{2} + \frac{3}{2}x_2 + \frac{9}{2}x_4$ 

$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_3 = 9 + 3x_2 + 9x_4$$
$$x_3 = \frac{9}{2} + \frac{3}{2}x_2 + \frac{9}{2}x_4$$

 $2x_1 + 6x_2 + 15x_4 = -8$ 

 $2x_1 + 6x_2 + 15x_4 = -8$ 

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$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$

$$2x_3 = 9 + 3x_2 + 9x_4$$

$$x_3 = \frac{9}{2} + \frac{3}{2}x_2 + \frac{9}{2}x_4$$

$$2x_1 + 6x_2 + 15x_4 = -8$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_3 = 9 + 3x_2 + 9x_4$$
$$x_3 = \frac{9}{2} + \frac{3}{2}x_2 + \frac{9}{2}x_4$$

$$2x_1 + 6x_2 + 15x_4 = -8$$
$$2x_1 = -8 - 6x_2 - 15x_4$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$
  $\begin{cases} 2x_1 + 6x_2 + 15x_4 = -8 \end{cases}$ 

$$x_1$$
  $x_2$   $x_3$   $x_4$ 
 $x_2$   $x_3$   $x_4$ 
 $x_4$ 
 $x_5$   $x_6$   $x_6$ 
 $x_7$ 
 $x_8$   $x_8$   $x_8$ 
 $x_8$ 
 $x_8$ 
 $x_8$ 
 $x_8$ 
 $x_9$ 
 $x_9$ 

$$\begin{vmatrix} 0 & -3 & 2 & -9 & 9 \\ 2 & 6 & 0 & 15 & -8 \end{vmatrix}$$
$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$

$$2x_3 = 9 + 3x_2 + 9x_4$$

$$x_3 = \frac{9}{2} + \frac{3}{2}x_2 + \frac{9}{2}x_4$$

$$2x_1 + 6x_2 + 15x_4 = -8$$
$$2x_1 = -8 - 6x_2 - 15x_4$$
$$x_1 = -8$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$

$$2x_3 = 9 + 3x_2 + 9x_4$$

$$x_3 = \frac{9}{2} + \frac{3}{2}x_2 + \frac{9}{2}x_4$$

$$2x_1 + 6x_2 + 15x_4 = -8$$

$$2x_1 = -8 - 6x_2 - 15x_4$$

$$x_1 = -4 - 3x_2 - \frac{15}{2}x_4$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

$$\begin{array}{c|ccccc}
2 & 6 & 0 & 15 & -8 \\
\hline
0 & -3 & 2 & -9 & 9 \\
2 & 6 & 0 & 15 & -8 \\
\hline
-3x_2 + 2x_3 - 9x_4 = 9 \\
2x_1 + 6x_2 + 15x_4 = -8
\end{array}$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_3 = 9 + 3x_2 + 9x_4$$

$$x_3 = \frac{9}{2} + \frac{3}{2}x_2 + \frac{9}{2}x_4$$

$$2x_1 + 6x_2 + 15x_4 = -8$$

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$$2x_3 = 9 + 3x_2 + 9x_4$$

$$x_3 = \frac{9}{2} + \frac{3}{2}x_2 + \frac{9}{2}x_4$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

$$2x_1 = -8 - 6x_2 - 15x_4$$
$$x_1 = -4 - 3x_2 - \frac{15}{2}x_4$$

Opće rješenje sustava

$$-3x_2 + 2x_3 - 9x_4 = 9 
2x_1 + 6x_2 + 15x_4 = -8$$

$$-3x_{2} + 2x_{3} - 9x_{4} = 9$$

$$2x_{3} = 9 + 3x_{2} + 9x_{4}$$

$$x_{3} = \frac{9}{2} + \frac{3}{2}x_{2} + \frac{9}{2}x_{4}$$

$$2x_{1} + 6x_{2} + 15x_{4} = -8$$

$$2x_{1} = -8 - 6x_{2} - 15x_{4}$$

$$x_{1} = -4 - 3x_{2} - \frac{15}{2}x_{4}$$

$$x_1 = -4 - 3u - \frac{15}{2}v$$

$$a = 1$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_1 + 6x_2 + 15x_4 = -8$$

$$-3x_2 + 2x_3 - 9x_4 = 9$$
$$2x_3 = 9 + 3x_2 + 9x_4$$

$$x_3 = \frac{9}{2} + \frac{3}{2}x_2 + \frac{9}{2}x_4$$

$$2x_1 + 6x_2 + 15x_4 = -8$$
$$2x_1 = -8 - 6x_2 - 15x_4$$

$$x_1 = -4 - 3x_2 - \frac{15}{2}x_4$$

# Opće rješenje sustava

$$x_1 = -4 - 3u - \frac{15}{2}v$$
  
$$x_2 = u$$

$$x_3 = \frac{9}{2} + \frac{3}{2}u + \frac{9}{2}v$$

$$x_4 = v$$

$$x_{3} = \frac{9}{2} + \frac{3}{2}x_{2} + \frac{9}{2}x_{4}$$

$$2x_{1} + 6x_{2} + 15x_{4} = -8$$

$$2x_{1} = -8 - 6x_{2} - 15x_{4}$$

$$x_{1} = -4 - 3x_{2} - \frac{15}{2}x_{4}$$
Opće rješenje sustava
$$x_{1} = -4 - 3u - \frac{15}{2}v$$

$$x_{2} = u$$

 $x_3 = \frac{9}{2} + \frac{3}{2}u + \frac{9}{2}v$ 

 $x_4 = v$ 

 $-3x_2 + 2x_3 - 9x_4 = 9$ 

 $2x_3 = 9 + 3x_2 + 9x_4$ 

 $u, v \in \mathbb{R}$ 

$$x_{1} = -4 - 3u - \frac{15}{2}v$$

$$x_{2} = u$$

$$x_{3} = \frac{9}{2} + \frac{3}{2}u + \frac{9}{2}v$$

$$x_{4} = v$$

• bazično rješenje: u = 0, v = 0

$$x_1 = -4, \ x_2 = 0, \ x_3 = \frac{9}{2}, \ x_4 = 0$$

$$x_{1} = -4 - 3u - \frac{15}{2}v$$

$$x_{2} = u$$

$$x_{3} = \frac{9}{2} + \frac{3}{2}u + \frac{9}{2}v$$

$$x_{4} = v$$

• bazično rješenje: u = 0, v = 0

$$x_1 = -4$$
,  $x_2 = 0$ ,  $x_3 = \frac{9}{2}$ ,  $x_4 = 0$ 

• u = 0, v = 1

$$x_1 = -\frac{23}{2}, \ x_2 = 0, \ x_3 = 9, \ x_4 = 1$$

 $x_{1} = -4 - 3u - \frac{15}{2}v$   $x_{2} = u$   $x_{3} = \frac{9}{2} + \frac{3}{2}u + \frac{9}{2}v$   $x_{4} = v$ 

• bazično rješenje: u = 0, v = 0

$$x_1 = -4, \ x_2 = 0, \ x_3 = \frac{9}{2}, \ x_4 = 0$$

• 
$$u = 0, v = 1$$

$$x_1 = -\frac{23}{2}, \ x_2 = 0, \ x_3 = 9, \ x_4 = 1$$

• 
$$u = \sqrt{2}, v = \pi$$

$$x_1 = -4 - 3\sqrt{2} - \frac{15}{2}\pi$$
,  $x_2 = \sqrt{2}$ ,  $x_3 = \frac{9}{2} + \frac{3}{2}\sqrt{2} + \frac{9}{2}\pi$ ,  $x_4 = \pi$ 

$$x_{1} = -4 - 3u - \frac{15}{2}v$$

$$x_{2} = u$$

$$x_{3} = \frac{9}{2} + \frac{3}{2}u + \frac{9}{2}v$$

$$x_{4} = v$$

treći zadatak

Pomoću Kronecker-Capellijevog teorema ispitajte koliko rješenja ima sustav linearnih jednadžbi

$$x_1 - 4x_2 + 5x_3 = 6$$
  
 $-3x_2 + 2x_3 = -12$ .  
 $2x_1 + 7x_2 = 35$ 

Pomoću Kronecker-Capellijevog teorema ispitajte koliko rješenja ima sustav linearnih jednadžbi

$$x_1 - 4x_2 + 5x_3 = 6$$
  
 $-3x_2 + 2x_3 = -12.$   
 $2x_1 + 7x_2 = 35$ 

$$A = \begin{bmatrix} & & \\ & & \end{bmatrix}$$

Pomoću Kronecker-Capellijevog teorema ispitajte koliko rješenja ima sustav linearnih jednadžbi

$$x_1 - 4x_2 + 5x_3 = 6$$
  
 $-3x_2 + 2x_3 = -12$ .  
 $2x_1 + 7x_2 = 35$ 

$$A = \begin{bmatrix} 1 & -4 & 5 \\ & & \end{bmatrix}$$

Pomoću Kronecker-Capellijevog teorema ispitajte koliko rješenja ima sustav linearnih jednadžbi

$$x_1 - 4x_2 + 5x_3 = 6$$
  
 $-3x_2 + 2x_3 = -12$ .  
 $2x_1 + 7x_2 = 35$ 

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

Pomoću Kronecker-Capellijevog teorema ispitajte koliko rješenja ima sustav linearnih jednadžbi

$$x_1 - 4x_2 + 5x_3 = 6$$
  
 $-3x_2 + 2x_3 = -12.$   
 $2x_1 + 7x_2 = 35$ 

$$A = \begin{bmatrix} 1 & -4 & 5 \\ 0 & -3 & 2 \\ 2 & 7 & 0 \end{bmatrix}$$

Pomoću Kronecker-Capellijevog teorema ispitajte koliko rješenja ima sustav linearnih jednadžbi

$$x_1 - 4x_2 + 5x_3 = 6$$
  
 $-3x_2 + 2x_3 = -12.$   
 $2x_1 + 7x_2 = 35$ 

$$A = \begin{bmatrix} 1 & -4 & 5 \\ 0 & -3 & 2 \\ 2 & 7 & 0 \end{bmatrix} \qquad A_p = \begin{bmatrix} 1 & -4 & 5 \\ 0 & -3 & 2 \\ 0 & 7 & 0 \end{bmatrix}$$

Pomoću Kronecker-Capellijevog teorema ispitajte koliko rješenja ima sustav linearnih jednadžbi

$$x_1 - 4x_2 + 5x_3 = 6$$
  
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$$A = \begin{bmatrix} 1 & -4 & 5 \\ 0 & -3 & 2 \\ 2 & 7 & 0 \end{bmatrix} \qquad A_p = \begin{bmatrix} 1 & -4 & 5 \\ 0 & -3 & 2 \\ 2 & 7 & 0 \end{bmatrix}$$

Pomoću Kronecker-Capellijevog teorema ispitajte koliko rješenja ima sustav linearnih jednadžbi

$$x_1 - 4x_2 + 5x_3 = 6$$
  
 $-3x_2 + 2x_3 = -12$ .  
 $2x_1 + 7x_2 = 35$ 

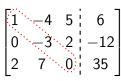
$$A = \begin{bmatrix} 1 & -4 & 5 \\ 0 & -3 & 2 \\ 2 & 7 & 0 \end{bmatrix} \qquad A_p = \begin{bmatrix} 1 & -4 & 5 \\ 0 & -3 & 2 \\ 2 & 7 & 0 \end{bmatrix}$$

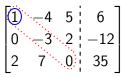
Pomoću Kronecker-Capellijevog teorema ispitajte koliko rješenja ima sustav linearnih jednadžbi

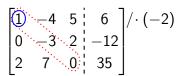
$$x_1 - 4x_2 + 5x_3 = 6$$
  
 $-3x_2 + 2x_3 = -12$ .  
 $2x_1 + 7x_2 = 35$ 

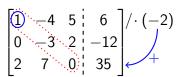
$$A = \begin{bmatrix} 1 & -4 & 5 \\ 0 & -3 & 2 \\ 2 & 7 & 0 \end{bmatrix} \qquad A_p = \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 2 & 7 & 0 & 35 \end{bmatrix}$$

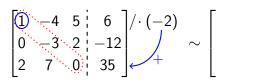
1	<b>-4</b>	5 ¦	6
0	-3	2 ¦	-12
2	7	0 ¦	35

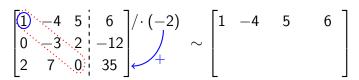


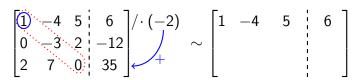


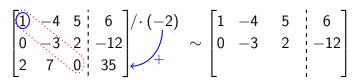


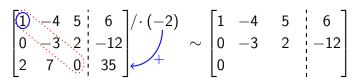


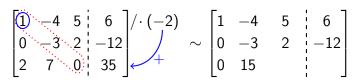


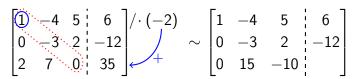


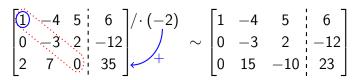


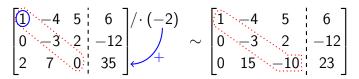


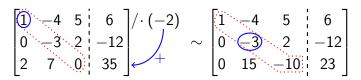


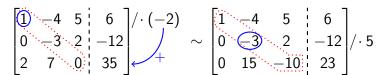


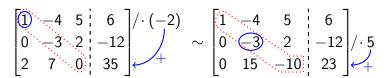


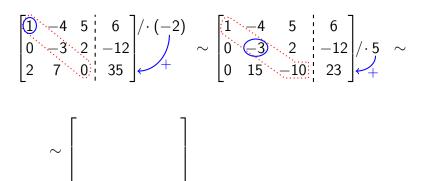






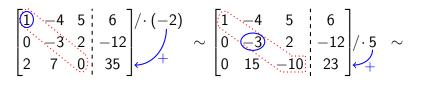






$$\begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 2 & 7 & 0 & 35 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 0 & 15 & -10 & 23 \end{bmatrix} / \cdot \underbrace{5}_{+} \sim$$

$$\sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ & & & \end{bmatrix}$$



$$\begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 2 & 7 & 0 & 35 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & 3 & 2 & -12 \\ 0 & 15 & -10 & 23 \end{bmatrix} / \cdot \underbrace{5}_{+} \sim$$

$$\sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \end{bmatrix}$$

$$\begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 2 & 7 & 0 & 35 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & 3 & 2 & -12 \\ 0 & 15 & -10 & 23 \end{bmatrix} / \cdot \underbrace{5}_{+} \sim$$

$$\sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 0 & & & \end{bmatrix}$$

$$\begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 2 & 7 & 0 & 35 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & 3 & 2 & -12 \\ 0 & 15 & -10 & 23 \end{bmatrix} / \cdot \underbrace{5}_{+} \sim$$

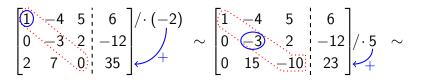
$$\sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 0 & 0 & & \end{bmatrix}$$

$$\begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 2 & 7 & 0 & 35 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & 3 & 2 & -12 \\ 0 & 15 & -10 & 23 \end{bmatrix} / \cdot \underbrace{5}_{+} \sim$$

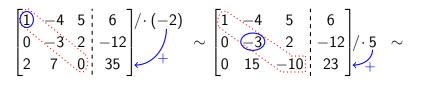
$$\sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 0 & 0 & 0 \end{bmatrix}$$

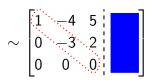
$$\begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 2 & 7 & 0 & 35 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & 3 & 2 & -12 \\ 0 & 15 & -10 & 23 \end{bmatrix} / \cdot \underbrace{5}_{+} \sim$$

$$\sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 0 & 0 & 0 & -37 \end{bmatrix}$$



$$\sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 0 & 0 & 0 & -37 \end{bmatrix}$$





$$\begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 2 & 7 & 0 & 35 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & 3 & 2 & -12 \\ 0 & 15 & -10 & 23 \end{bmatrix} / \cdot \underbrace{5}_{+} \sim$$

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

$$r(A) =$$

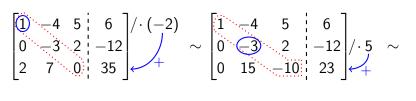
$$\begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & -3 & 2 & -12 \\ 2 & 7 & 0 & 35 \end{bmatrix} / \cdot (-2) \sim \begin{bmatrix} 1 & -4 & 5 & 6 \\ 0 & 3 & 2 & -12 \\ 0 & 15 & -10 & 23 \end{bmatrix} / \cdot \underbrace{5}_{+} \sim$$

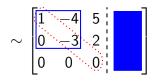
$$\sim \begin{bmatrix} 1 & -4 & 5 \\ 0 & -3 & 2 \\ 0 & 0 & 0 \end{bmatrix}$$

$$r(A) =$$

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

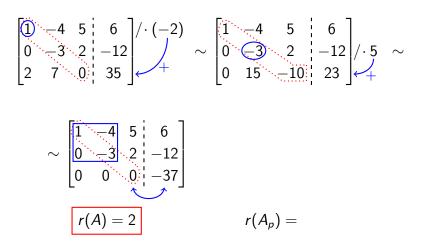
$$r(A) = 2$$





$$r(A) = 2$$

$$r(A) = 2 \qquad r(A_p) =$$



$$\begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
2 & 7 & 0 & 35
\end{bmatrix} / \cdot (-2) \sim \begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
0 & 15 & -10 & 23
\end{bmatrix} / \cdot 5 \sim \begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
0 & 0 & 0 & -37
\end{bmatrix} \sim \begin{bmatrix}
r(A) = 2
\end{bmatrix} r(A_p) =$$

$$\begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
2 & 7 & 0 & 35
\end{bmatrix} / \cdot (-2) \sim \begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
0 & 15 & -10 & 23
\end{bmatrix} / \cdot 5 \sim \begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
0 & 0 & 0 & -37
\end{bmatrix} \sim \begin{bmatrix}
r(A) = 2
\end{bmatrix} r(A_p) =$$

$$\begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
2 & 7 & 0 & 35
\end{bmatrix} / \cdot (-2) \sim \begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
0 & 15 & -10 & 23
\end{bmatrix} / \cdot 5 \sim \begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
0 & 0 & 0 & -37
\end{bmatrix} \sim \begin{bmatrix}
6 \\
-12 \\
-37
\end{bmatrix}$$

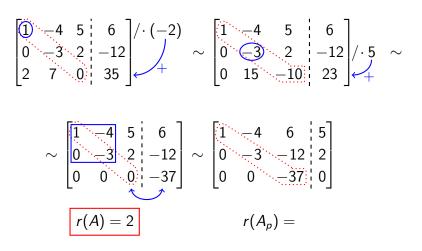
$$r(A) = 2 \qquad r(A_p) =$$

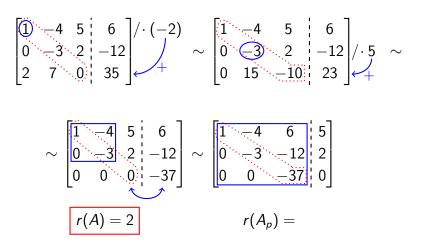
$$\begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
2 & 7 & 0 & 35
\end{bmatrix} / \cdot (-2) \sim \begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
0 & 15 & -10 & 23
\end{bmatrix} / \cdot 5 \sim \\
\sim \begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
0 & 0 & 0 & -37
\end{bmatrix} \sim \begin{bmatrix}
1 & 6 & 5 \\
0 & -12 & 2 \\
0 & -37 & 0
\end{bmatrix} \\
r(A) = 2$$

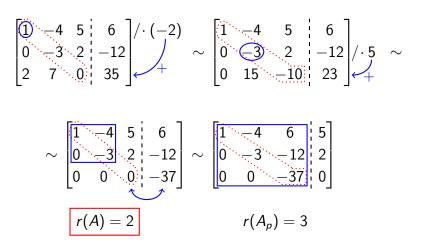
$$r(A_p) =$$

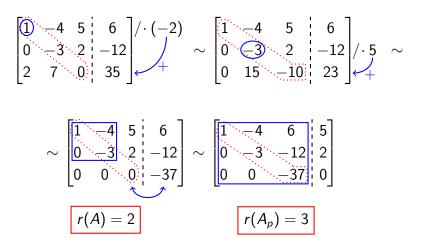
$$\begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
2 & 7 & 0 & 35
\end{bmatrix} / \cdot (-2) \sim \begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
0 & 15 & -10 & 23
\end{bmatrix} / \cdot 5 \sim \\
\sim \begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
0 & 0 & -37
\end{bmatrix} \sim \begin{bmatrix}
1 & -4 & 6 & 5 \\
0 & -3 & -12 & 2 \\
0 & 0 & -37 & 0
\end{bmatrix}$$

$$r(A) = 2 \qquad r(A_p) =$$









$$r(A) \neq r(A_p)$$

$$\begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
2 & 7 & 0 & 35
\end{bmatrix}$$

$$\sim
\begin{bmatrix}
1 & -4 & 5 & 6 \\
0 & -3 & 2 & -12 \\
0 & 0 & 3 & 2 & -12 \\
0 & 15 & -10 & 23
\end{bmatrix}$$

$$\sim
\begin{bmatrix}
1 & -4 & 6 & 5 \\
0 & -3 & 2 & -12 \\
0 & 0 & -37
\end{bmatrix}$$

$$\sim
\begin{bmatrix}
1 & -4 & 6 & 5 \\
0 & -3 & -12 \\
0 & 0 & -37
\end{bmatrix}$$

$$r(A) = 2$$

$$r(A_p) = 3$$

$$r(A) \neq r(A_p) \longrightarrow$$
 zadani sustav je kontradiktoran

četvrti zadatak

#### Zadatak 4

Zadan je homogeni sustav linearnih jednadžbi

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

- a) Odredite sve vrijednosti parametra  $a \in \mathbb{R}$  za koje sustav ima i netrivijalnih rješenja.
- b) Za sve pronađene vrijednosti parametra  $a \in \mathbb{R}$  iz a) dijela zadatka riješite pripadni sustav jednadžbi.

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$\begin{vmatrix}
6 & -4 & 1 & 6 \\
-1 & 1 & 4 & -1 \\
4 & -2 & a & 4
\end{vmatrix}$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 & = \\ 4 & -2 & a & 4 & -2 & = \end{vmatrix}$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 & = \\ 4 & -2 & a & 4 & -2 & = \end{vmatrix}$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 & = \\ 4 & -2 & a & 4 & -2 & = \end{vmatrix}$$

$$= 6 \cdot 1 \cdot a$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 & = \\ 4 & -2 & a & 4 & -2 & = \end{vmatrix}$$

$$= 6 \cdot 1 \cdot a$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 & = \\ 4 & -2 & a & 4 & -2 & = \end{vmatrix}$$

$$=6\cdot 1\cdot a+(-4)\cdot 4\cdot 4$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 \\ 4 & -2 & a & 4 & -2 \end{vmatrix} =$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 \\ 4 & -2 & a & 4 & -2 \end{vmatrix} =$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2)$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

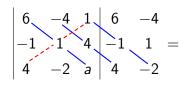
$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 \\ 4 & -2 & a & 4 & -2 \end{vmatrix} =$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2)$$

$$6x_1 - 4x_2 + x_3 = 0$$

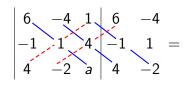
$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$



$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$
 $- 4 \cdot 1 \cdot 1$ 

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$



$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$

$$- 4 \cdot 1 \cdot 1$$

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 \\ 4 & -2 & a & 4 & -2 \end{vmatrix} =$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$

$$- 4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 \\ 4 & -2 & a & 4 & -2 \end{vmatrix} =$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$

$$- 4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 \\ 4 & -2 & a & 4 & -2 \end{vmatrix} =$$

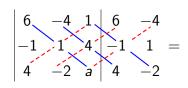
$$6x_1 - 4x_2 + x_3 = 0$$

$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$

$$- 4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6 - a \cdot (-1) \cdot (-4)$$



$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$

$$- 4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6 - a \cdot (-1) \cdot (-4) =$$

$$= 6a$$

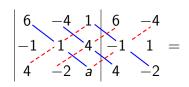
$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 \\ 4 & -2 & a & 4 & -2 \end{vmatrix} =$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$

$$- 4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6 - a \cdot (-1) \cdot (-4) =$$

$$= 6a - 64$$



$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$

$$- 4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6 - a \cdot (-1) \cdot (-4) =$$

$$= 6a - 64 + 2$$

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 \\ 4 & -2 & a & 4 & -2 \end{vmatrix} =$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$

$$- 4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6 - a \cdot (-1) \cdot (-4) =$$

$$= 6a - 64 + 2 - 4$$

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 \\ 4 & -2 & a & 4 & -2 \end{vmatrix} =$$

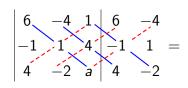
$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$

$$- 4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6 - a \cdot (-1) \cdot (-4) =$$

$$= 6a - 64 + 2 - 4 + 48$$

a) Roucheov teorem

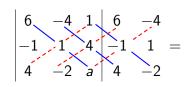


$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$-4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6 - a \cdot (-1) \cdot (-4) =$$

$$= 6a - 64 + 2 - 4 + 48 - 4a$$

 $= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$ 

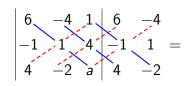


$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$

$$- 4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6 - a \cdot (-1) \cdot (-4) =$$

$$= 6a - 64 + 2 - 4 + 48 - 4a =$$



$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$

$$- 4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6 - a \cdot (-1) \cdot (-4) =$$

$$= 6a - 64 + 2 - 4 + 48 - 4a = 2a - 18$$

Roucheov teorem

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 \\ 4 & -2 & 4 & -2 \end{vmatrix} =$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

2a - 18 = 0

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$

$$- 4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6 - a \cdot (-1) \cdot (-4) =$$

$$=6a-64+2-4+48-4a=2a-18$$

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 \\ 4 & -2 & a & 4 & -2 \end{vmatrix} =$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$

$$- 4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6 - a \cdot (-1) \cdot (-4) =$$

$$=6a-64+2-4+48-4a=2a-18$$

$$2a - 18 \stackrel{\checkmark}{=} 0$$
$$a = 9$$

Roucheov teorem

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 \\ 4 & -2 & a & 4 & -2 \end{vmatrix} =$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$-4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6 - a \cdot (-1) \cdot (-4) =$$

 $= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$ 

$$=6a-64+2-4+48-4a=2a-18$$

$$2a - 18 \stackrel{\checkmark}{=} 0$$

$$a = 9$$

a) Roucheov teorem

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$-4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6 - a \cdot (-1) \cdot (-4) =$$

= 6a - 64 + 2 - 4 + 48 - 4a = 2a - 18

 $= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$ 

$$2a - 18 \stackrel{\downarrow}{=} 0$$

$$a = 9$$

ullet Za a=9 pripadni homogeni sustav ima i netrivijalnih rješenja.

a) Roucheov teorem

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

2a - 18 = 0

a=9

$$\begin{vmatrix} 6 & -4 & 1 & 6 & -4 \\ -1 & 1 & 4 & -1 & 1 \\ 4 & -2 & a & 4 & -2 \end{vmatrix} =$$

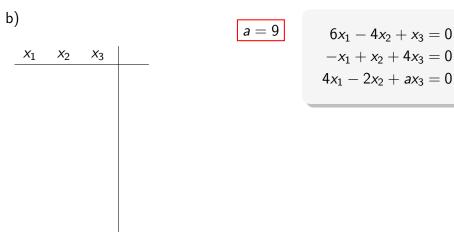
$$= 6 \cdot 1 \cdot a + (-4) \cdot 4 \cdot 4 + 1 \cdot (-1) \cdot (-2) -$$

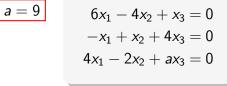
$$- 4 \cdot 1 \cdot 1 - (-2) \cdot 4 \cdot 6 - a \cdot (-1) \cdot (-4) =$$

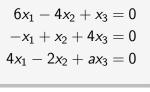
$$= 6a - 64 + 2 - 4 + 48 - 4a = 2a - 18$$

$$ullet$$
 Za  $a=9$  pripadni homogeni sustav ima i netrivijalnih rješenja.

• Za  $a \in \mathbb{R} \setminus \{9\}$  pripadni homogeni sustav ima samo trivijalno rješenje.







$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$6x_1 - 4x_2 + x_3 = 0$$

$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$

<i>x</i> <sub>1</sub>	<i>x</i> <sub>2</sub>	<i>X</i> <sub>3</sub>	
6	<b>-4</b>	1	0
-1	1	4	0
4	-2	9	0



$$6x_1 - 4x_2 + x_3 = 0$$

$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$

$x_1$	$X_2$	<i>X</i> <sub>3</sub>	
6	<b>-4</b>	1	0
$\bigcirc$ 1	1	4	0
4	-2	9	0

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$6x_1 - 4x_2 + x_3 = 0$$

$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$

$$6x_1 - 4x_2 + x_3 = 0$$

$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$

$$6x_1 - 4x_2 + x_3 = 0$$

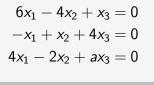
$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$

$$6x_1 - 4x_2 + x_3 = 0$$

$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$

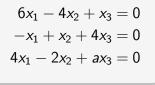


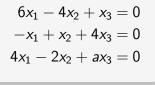
0

$$6x_1 - 4x_2 + x_3 = 0$$

$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$





$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$x_1$	$X_2$	<i>X</i> <sub>3</sub>		
6	<b>-4</b>	1	0	
$\bigcirc$ 1	1	4	0	/ · 6 / · 4
4	-2	9	0	+
0	2	25	0	_
-1	1	4	0	
0	2			

$$6x_1 - 4x_2 + x_3 = 0$$

$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$

			1	
$X_1$	$X_2$	<i>X</i> <sub>3</sub>		
6	<b>-4</b>	1	0	
$\bigcirc$ 1	1	4	0	/ · 6 / · 4
4	-2	9	0	+
0	2	25	0	
-1	1	4	0	
0	2	25		

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$x_1$	$x_2$	<i>X</i> <sub>3</sub>		
6	<b>-4</b>	1	0	
$\bigcirc$ 1	1	4	0	/· 6 /· 4
4	-2	9	0	+
0	2	25	0	_
-1	1	4	0	
0	2	25	0	
			1	

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$x_1$	$X_2$	<i>X</i> <sub>3</sub>		
6	-4	1	0	
$\bigcirc$ 1	1	4	0	/· 6 /· 4
4	-2	9	0	+
0	2	25	0	_
-1	1	4	0	
0	2	25	0	
				_

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

<i>X</i> <sub>1</sub>	<i>X</i> <sub>2</sub>	<i>X</i> <sub>3</sub>		_
6	<b>-4</b>	1	0	+
$\bigcirc$ 1	1	4	0	/ · 6 / · 4
4	-2	9	0	+
0	2	25	0	_
-1	1	4	0	
0	2	25	0	
0	2	25	0	_

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$x_1$	$x_2$	<i>X</i> <sub>3</sub>		
6	<b>-4</b>	1	0	
$\bigcirc$ 1	1	4	0	/· 6 /· 4
4	-2	9	0	+
0	2	25	0	_
-1	1	4	0	
0	2	25	0	
0	2	25	0	_
-1	1	4	0	
			1	

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$x_1$	$x_2$	<i>X</i> <sub>3</sub>		
6	<b>-4</b>	1	0	+
$\bigcirc$ 1	1	4	0	/· 6 /· 4
4	-2	9	0	+
0	2	25	0	_
-1	1	4	0	
0	2	25	0	
0	2	25	0	_
-1	1	4	0	
				_

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$x_1$	$x_2$	<i>X</i> <sub>3</sub>		
6	<b>-4</b>	1	0	+
$\bigcirc$ 1	1	4	0	/ · 6 / · 4
4	-2	9	0	+
0	2	25	0	_
-1	1	4	0	
0	2	25	0	
0	2	25	0	_
-1	1	4	0	
				_

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$x_1$	$x_2$	<i>X</i> <sub>3</sub>		
6	<b>-4</b>	1	0	+
$\bigcirc$ 1	1	4	0	/ · 6 / · 4
4	-2	9	0	+
0	2	25	0	_
-1	1	4	0	
0	2	25	0	
0	2	25	0	$-/\cdot \frac{-1}{2}$
-1	1	4	0	۷
				_
			1	

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$x_1$	$x_2$	<i>X</i> <sub>3</sub>		
6	<b>-4</b>	1	0	+
$\bigcirc$ 1	1	4	0	/ · 6 / · 4
4	-2	9	0	+
0	2	25	0	_
-1	1	4	0	
0	2	25	0	
0	2	25	0	$-/\cdot\frac{-1}{2}$
-1	1	4	0	$\leftarrow$
				_ '

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

<i>X</i> <sub>1</sub>	<i>X</i> <sub>2</sub>	<i>X</i> <sub>3</sub>		_
6	<b>-4</b>	1	0	+
$\bigcirc$ 1	1	4	0	/ · 6 / · 4
4	-2	9	0	+
0	2	25	0	_
-1	1	4	0	
0	2	25	0	
0	2	25	0	$-/\cdot \frac{-1}{2}$
-1	1	4	0	$\leftarrow$
0	2	25	0	_ '
-1				

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

<i>X</i> <sub>1</sub>	$X_2$	<i>X</i> <sub>3</sub>		_
6	<b>-4</b>	1	0	+
$\bigcirc$ 1	1	4	0	/ · 6 / · 4
4	-2	9	0	+
0	2	25	0	_
-1	1	4	0	
0	2	25	0	
0	2	25	0	$-/\cdot \frac{-1}{2}$
-1	1	4	0	<b>←</b>
0	2	25	0	_ 1
-1	0			

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

<i>X</i> <sub>1</sub>	$X_2$	<i>X</i> <sub>3</sub>		_
6	<b>-4</b>	1	0	+
$\bigcirc$ 1	1	4	0	/ · 6 / · 4
4	-2	9	0	+
0	2	25	0	_
-1	1	4	0	
0	2	25	0	
0	2	25	0	$-/\cdot \frac{-1}{2}$
-1	1	4	0	$\leftarrow$
0	2	25	0	_
-1	0	$-\frac{17}{2}$		
		,	l	

$$6x_1 - 4x_2 + x_3 = 0$$

$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$

<i>X</i> <sub>1</sub>	$X_2$	<i>X</i> <sub>3</sub>		_
6	<b>-4</b>	1	0	+
$\bigcirc$ 1	1	4	0	/ · 6 / · 4
4	-2	9	0	+
0	2	25	0	_
-1	1	4	0	
0	2	25	0	
0	2	25	0	$-/\cdot \frac{-1}{2}$
-1	1	4	0	$\leftarrow$
0	2	25	0	_
-1	0	$-\frac{17}{2}$	0	

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$6x_1 - 4x_2 + x_3 = 0$$

$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$

$$2x_2 + 25x_3 = 0$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$2x_2 + 25x_3 = 0$$
$$-x_1 - \frac{17}{2}x_3 = 0$$

$$6x_1 - 4x_2 + x_3 = 0$$

$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$

$$2x_2 + 25x_3 = 0$$
$$-x_1 - \frac{17}{2}x_3 = 0$$

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$

$$2x_2 + 25x_3 = 0 
-x_1 - \frac{17}{2}x_3 = 0$$

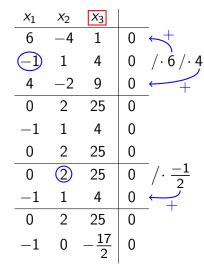
$$6x_1 - 4x_2 + x_3 = 0$$

$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$

$$\begin{array}{c}
-2x_2 + 23x_3 - 0 \\
-x_1 - \frac{17}{2}x_3 = 0
\end{array}$$

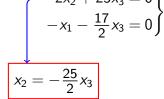
$$x_2 = -\frac{25}{2}x_3$$



$$6x_1 - 4x_2 + x_3 = 0$$

$$-x_1 + x_2 + 4x_3 = 0$$

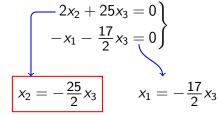
$$4x_1 - 2x_2 + ax_3 = 0$$

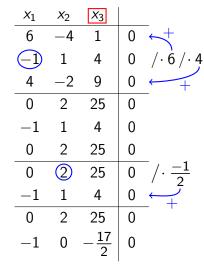


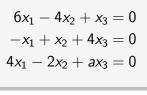
$$6x_1 - 4x_2 + x_3 = 0$$

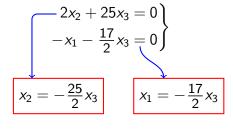
$$-x_1 + x_2 + 4x_3 = 0$$

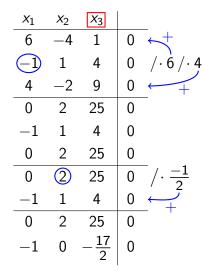
$$4x_1 - 2x_2 + ax_3 = 0$$





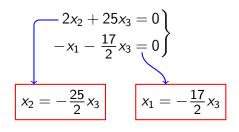




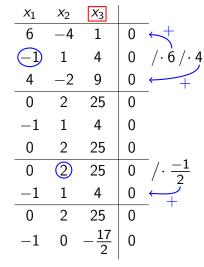


*a* = 9

$$6x_1 - 4x_2 + x_3 = 0$$
$$-x_1 + x_2 + 4x_3 = 0$$
$$4x_1 - 2x_2 + ax_3 = 0$$



Opće rješenje sustava

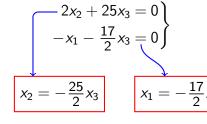




$$6x_1 - 4x_2 + x_3 = 0$$

$$-x_1 + x_2 + 4x_3 = 0$$

$$4x_1 - 2x_2 + ax_3 = 0$$



Opće rješenje sustava

$$\left(-\frac{17}{2}t, -\frac{25}{2}t, t\right), \quad t \in \mathbb{R}$$