$$Q^{T}Q = \begin{bmatrix} q_{1}^{T} \\ q_{2}^{T} \\ q_{3}^{T} \end{bmatrix} \begin{bmatrix} r_{1} & r_{2} & r_{3} \end{bmatrix}$$

8543

ATA=I

ET cols & A re.o.n.

AAT = I E7 rens at A are on.

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 & 1 \\ 1 & 2 & 3 & 4 & 5 \\ 0 & 0 & 1 & 2 & 3 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix}$$

X1, X3, X5 phot X2, X4 free

$$X_{1}\begin{bmatrix} 0\\ 0\\ 0 \end{bmatrix} + X_{2}\begin{bmatrix} 2\\ 0\\ 0 \end{bmatrix} + X_{3}\begin{bmatrix} 3\\ 1\\ 0 \end{bmatrix} + X_{4}\begin{bmatrix} 4\\ 2\\ 6 \end{bmatrix} + X_{5}\begin{bmatrix} 5\\ 3\\ 1 \end{bmatrix} = 0$$

$$x_{1} \begin{bmatrix} 0 \\ 0 \end{bmatrix} + x_{3} \begin{bmatrix} 3 \\ 1 \\ 0 \end{bmatrix} + x_{5} \begin{bmatrix} 5 \\ 3 \\ 1 \end{bmatrix} = -x_{2} \begin{bmatrix} 2 \\ 0 \\ 0 \end{bmatrix} - x_{4} \begin{bmatrix} 4 \\ 2 \\ 0 \end{bmatrix}$$

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 0 & 0 & 1 & 2 & 3 \\ 0 & 0 & 0 & 6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix}$$

$$V_1 = \begin{bmatrix} * \\ 1 \\ * \\ 0 \\ * \end{bmatrix}$$

$$V_2 = \begin{bmatrix} * \\ 0 \\ * \\ 1 \\ * \end{bmatrix}$$

$$C_1 V_1 + C_2 V_2 = \begin{pmatrix} * \\ C_1 \\ * \\ C_2 \\ * \end{pmatrix}$$

$$GV_1 + G_2V_2 = O$$

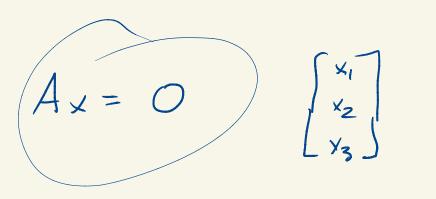
$$G = O, Oz = O$$

$$SY V_1 V_2 \text{ are law, well}$$

The Nullspuse NA) is efficiently described by

N(A)={ C,V,+C,V2! C,C,C,ER}

No extra insormation



$$x_1 + 2x_2 + 3x_3 = 0$$

$$4x_1 + 5x_2 + 6x_3 = 0$$

$$30 | u + nus od$$

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$$30 | u + nus od$$

$$50 | u + nus od$$

$$50 | u + nus od$$

$$X_1 + Z_{12} + 3_{13} = 0$$

$$0 \times -3_{12} - 6_{13} = 0$$

$$\begin{bmatrix} 1 & 237 & R_2 - 4R_1 \\ 456 \end{bmatrix} \xrightarrow{ } \begin{bmatrix} 1 & 237 \\ 0 & -3-6 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 6 & 9 & 12 \end{bmatrix} \xrightarrow{R_2 - 4R_1} \begin{bmatrix} 1 & 2 & 3 \\ 0 & -3 - 6 \\ 0 & -3 - 6 \end{bmatrix} \xrightarrow{R_3 - R_2} \begin{bmatrix} 1 & 2 & 3 \\ 0 & -3 - 6 \\ 0 & 0 & 0 \end{bmatrix}$$

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6 & -4 & 3 & & \\
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$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 6 & 9 & 12 \end{bmatrix} \xrightarrow{R_2 - 4R_1} \begin{bmatrix} 1 & 2 & 3 \\ 0 & -3 - 6 \\ 0 & -3 - 6 \end{bmatrix} \xrightarrow{R_3 - R_2} \begin{bmatrix} 1 & 2 & 3 \\ 0 & -3 - 6 \\ 0 & -3 - 6 \end{bmatrix}$$

$$\begin{bmatrix}
1 & 0 & 0 \\
4 & 1 & 0
\end{bmatrix}
\begin{bmatrix}
1 & 2 & 3 \\
0 & -3 & -6
\end{bmatrix} =
\begin{bmatrix}
1 & 2 & 3 \\
4 & 5 & 6 \\
6 & 9 & 12
\end{bmatrix}$$

$$L$$

$$U$$

$$A$$

2)
$$U_X = W$$
 back subs