


Recall:How to solve a system of linear equations

system of equations

$$\begin{cases} -x_1 + 2x_2 + 3x_3 = 4 \\ 2x_1 + 6x_3 = 9 \\ 4x_1 - x_2 - 3x_3 = 0 \end{cases}$$

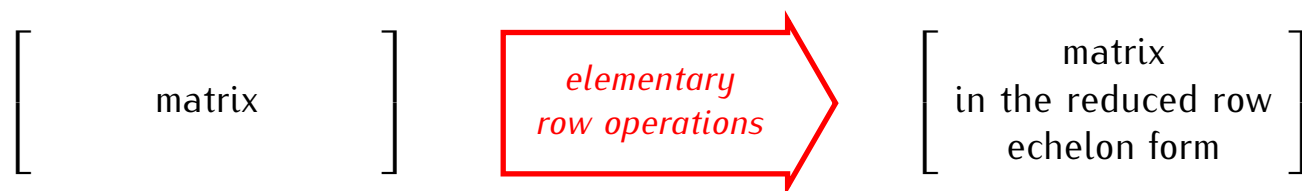
*make  
a matrix*augmented  
matrix*Gauss-Jordan  
elimination*

solutions

$$\begin{cases} x_1 = \dots \\ x_2 = \dots \\ x_3 = \dots \end{cases}$$

*read off  
solutions*matrix in reduced  
row echelon form

## Gauss-Jordan elimination process (= row reduction)



- ① Interchange rows, if necessary, to bring a non-zero element to the top of the first non-zero column of the matrix.
- ② Multiply the first row so that its first non-zero entry becomes 1.
- ③ Add multiples of the first row to eliminate non-zero entries below the leading one.
- ④ Ignore the first row; apply steps 1-3 to the rest of the matrix.
- ⑤ Eliminate non-zero entries above all leading ones.

**Example.**

$$\begin{bmatrix} 0 & 4 & -8 & 0 & 4 \\ 2 & 6 & -6 & -2 & -4 \\ 2 & 7 & -8 & 0 & -1 \end{bmatrix}$$

## How to solve systems of linear equations: example

$$\begin{cases} 4x_2 - 8x_3 = 4 \\ 2x_1 + 6x_2 - 6x_3 - 2x_4 = -4 \\ 2x_1 + 7x_2 - 8x_3 = -1 \end{cases}$$