

How is everything related?

General

Example

Question

Matrix eqn.

$$A\bar{x} = \bar{b}$$

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

Does matrix eqn. have a solution? (is it consistent?)

Vector eqn.

$$x_1 \bar{a}_1 + \dots + x_n \bar{a}_n = \bar{b}$$

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

Is  $\begin{bmatrix} 6 \\ 7 \end{bmatrix}$  in  $\text{span} \left\{ \begin{bmatrix} 1 \\ 3 \end{bmatrix}, \begin{bmatrix} 0 \\ 4 \end{bmatrix}, \begin{bmatrix} 2 \\ 5 \end{bmatrix} \right\}$ ?

system of eqns.

$$a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n = b_1$$

⋮

$$a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mn}x_n = b_m$$

$$\begin{aligned} x_1 + 2x_3 &= 6 \\ 3x_1 + 4x_2 + 5x_3 &= 7 \end{aligned}$$

alternatively

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

Is the system consistent?

Does the augmented matrix represent a consistent system?