$m < n$

Reason: There will be free vars!

Independence

Vectors $x_1, x_2, \ldots, x_n$ are lineary independent if no combinations give zero vector (except the zero combination)

Vectors $v_1, \ldots, v_e$ span a space means: the space consists of all combs of those vectors

Basis for a space is a sequence of vectors $v_1, \ldots, v_d$ with props:

1. Independent
2. Span the space

$\mathbb{R}^n$ n vectors give basis if the $n \times n$ matrix with those cols is invertable

Given a space

every basis for the space has the same number of vectors

Def: Dimention of the space

Def: The rank of A is the number of pivots. This number r.

Recitation

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

$$\begin{bmatrix} \boxed{1} & 1 & -2 & 0 & -1 \\ 0 & \boxed{1} & 2 & -4 & 2 \\ 0 & 0 & \boxed{1} & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{matrix} \left.\begin{matrix} \\ \\ \\ \end{matrix}\right\} \text{independent rows} \\ \\ \end{matrix}$$

basis: $(1\ 1\ -2\ 0\ -1)$
$(0\ 1\ 2\ -4\ 2)$
$(0\ 0\ 1\ 1\ 0)$

Vectors span R^3

rank = 2 $\quad$ dimention of $C(A) = 3$