



basis

Span

linearly
Independence

Example: $\overset{u}{(2,1)} \overset{v}{(3,0)}$

Span Check: $k_1 u + k_2 v = b$

$$k_1(2,1) + k_2(3,0) = (b_1, b_2)$$

$$(2k_1, k_1) + (3k_2, 0) = (b_1, b_2)$$

$$(2k_1 + 3k_2, k_1) = (b_1, b_2)$$

$$2k_1 + 3k_2 = b_1$$

$$k_1 = b_2$$

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

$$\det = -3$$

Consistent \Rightarrow Span ✓

linearly independence Check:

$$k_1 u + k_2 v = 0$$

$$k_1(2, 1) + k_2(3, 0) = (0, 0)$$

$$(2k_1, k_1) + (3k_2, 0) = (0, 0)$$

$$(2k_1 + 3k_2, k_1) = (0, 0)$$

$$2k_1 + 3k_2 = 0$$

$$k_1 = 0$$

$$\begin{bmatrix} 2 & 3 \\ 1 & 0 \end{bmatrix} \quad -3 \neq 0 \quad \boxed{LI} \quad \checkmark$$

basis ✓

الموازيات الي تخلي الي تنسب بيها الفكتورز من
البييسز اذا عطيتهم في فكتور لحالهم تنسب

Coordinate Vector

وتكتب كذا $(v)_S = (c_1, c_2, c_3)$
الساويات \leftarrow اسم الفكتور الاساسي \leftarrow دلالة انها

Example:

$v_1 = (1, 2, 1), v_2 = (2, 9, 0), v_3 = (3, 3, 4)$ basis
form a basis for R^3 . Find the coordinate vector of $v = (5, -1, 9)$ relative to the basis $S = \{v_1, v_2, v_3\}$.

$$v = c_1 v_1 + c_2 v_2 + c_3 v_3$$

$$(5, -1, 9) = c_1(1, 2, 1) + c_2(2, 9, 0) + c_3(3, 3, 4)$$

$$(5, -1, 9) = (c_1, 2c_1, c_1) + (2c_2, 9c_2, 0) + (3c_3, 3c_3, 4c_3)$$

$$(5, -1, 9) = (c_1 + 2c_2 + 3c_3, 2c_1 + 9c_2 + 3c_3, c_1 + 4c_3)$$

$$\begin{aligned} c_1 + 2c_2 + 3c_3 &= 5 \\ 2c_1 + 9c_2 + 3c_3 &= -1 \\ c_1 + 4c_3 &= 9 \end{aligned}$$

↓
Reduced Row echelon form
↓

$$c_1 = 1 \quad c_2 = -1 \quad c_3 = 2$$

$$(v)_S = (1, -1, 2) \rightarrow \text{final answer}$$