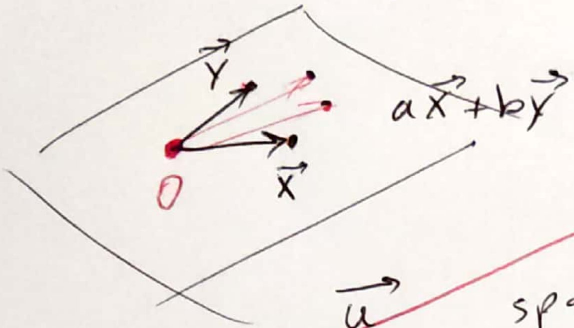
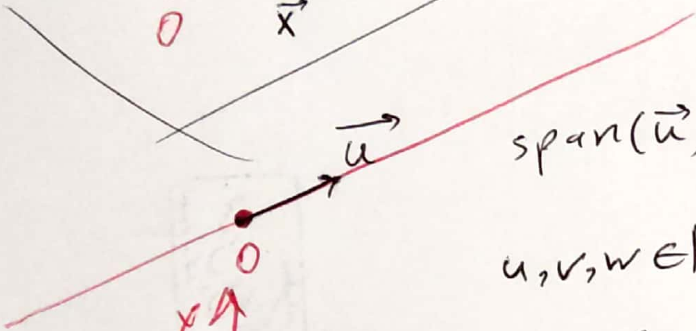
$a\vec{x} + b\vec{y}$

x_i $\quad \overset{a_1}{\vec{x}_1}, \overset{a_2}{\vec{x}_2}, \dots, \overset{a_n}{\vec{x}_n}$

$\sum a_i \cdot \vec{x}_i$

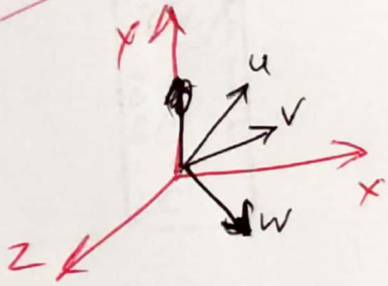




$span(\vec{u})$

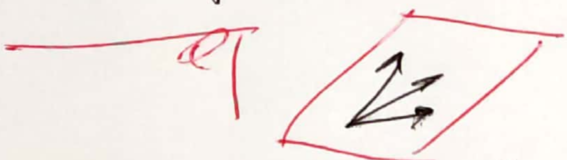
$u, v, w \in \mathbb{R}^3$

$span(u, v, w) = ?$

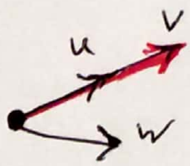


if x, y, z are not co-planar $\quad span(u, v, w) = \mathbb{R}^3$

if x, y, z are coplanar but not collinear صفحه

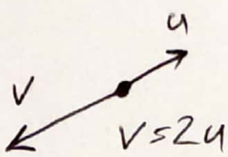


if x, y, z are collinear



$u \in span(v, w)$ ✓

$w \in span(u, v)$ ✗



$au + bv = 0$
$\Updownarrow$
$a = b = 0$

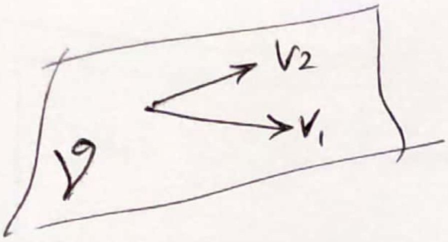
$au + bv = 0$
$2u + 1v = 0$

$a_0 x + by + cz = 0$

$\boxed{b \neq 0}$

$by = -ax - cz$

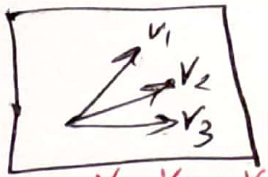
$y = \left(\frac{-a}{b}\right)x + \left(\frac{-c}{b}\right)z$



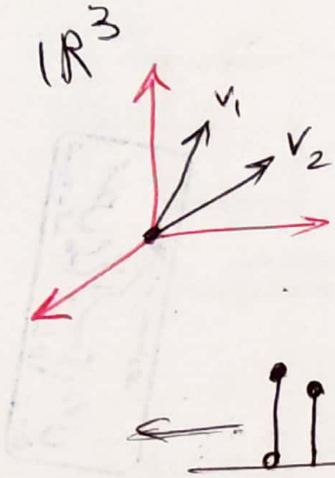
v_1, v_2 forms a basis for V

v_1, v_2 do not form a basis for V

span



v_1, v_2, v_3 not a basis



$v_1, v_2, \ldots, v_n$ form a basis for V

$x \in V$

$$\vec{x} = a_1 \vec{v}_1 + a_2 \vec{v}_2 + \cdots + a_n \vec{v}_n$$

$$\vec{x} = b_1 \vec{v}_1 + b_2 \vec{v}_2 + \cdots + b_n \vec{v}_n$$

$\Rightarrow a_1 = b_1, \ a_2 = b_2, \ \ldots, \ a_n = b_n$

$\Rightarrow (a_1, a_2, \ldots, a_n)$ is unique

$x \equiv (a_1, a_2, \ldots, a_n)$ array of real numbers

representation

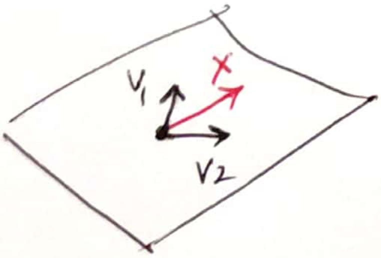
We can

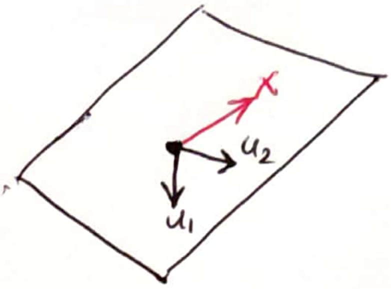
$$\vec{x} = \begin{bmatrix} a_1 \\ a_2 \\ \vdots \\ a_n \end{bmatrix}$$

$\rightarrow$ coordinates of $\vec{x}$

$\downarrow$

depend on basis vectors.





$$x = a_1 v_1 + a_2 v_2 \qquad x = a'_1 u_1 + a'_2 u_2$$

$$\begin{pmatrix} a_1 \\ a_2 \end{pmatrix} \neq \begin{pmatrix} a'_1 \\ a'_2 \end{pmatrix}$$

بردار

$$\begin{pmatrix} v_1 \\ v_2 \\ \vdots \\ v_n \end{pmatrix} \quad \begin{pmatrix} a_1 \\ a_2 \\ \vdots \\ a_n \end{pmatrix} \in \mathbb{R}^n$$

ماتریس

$$\begin{bmatrix} a_1 \\ a_2 \\ \vdots \\ a_n \end{bmatrix} \in \mathbb{R}^{n \times 1}$$

بردار ستونی

column-vector representation

$$[a_1 \ a_2 \cdots a_n] \in \mathbb{R}^{1 \times n}$$

row-vector representation

بردار سطری