- SET = collection of objects whose name is "element"

  $\mathcal{X}$ = generic set

  $\mathbb{R}$ = set of real numbers

  $\mathbb{C}$ = complex

  $\mathbb{N}$ = natural

$\mathcal{X} \underbrace{:=}_{\text{defined}} \underline{\mathbb{R}} \times \underline{\mathbb{R}}$

$: \; \rightarrow$ $:$ "such that"

$\rightarrow$ "to"

$> \; \geq$ "greater than", "greater than or equal to"

$\in$ "belongs"

$x \in \mathcal{X}$

- MATRIX $a_{ij} \in \mathbb{R}$ $i,j \in \mathbb{N}$ $i = 1, \dots, n$ $n, m \in \mathbb{N}$
  $j = 1, \dots, m$

$$A := \begin{bmatrix} a_{11} & \cdots & a_{1m} \\ \vdots & & \\ a_{n1} & \cdots & a_{nm} \end{bmatrix}$$

n = # rows

m = # columns

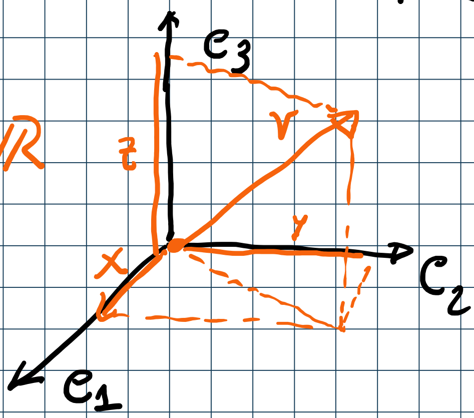
- VECTOR IS A MATRIX WITH $m = 1$

$e_1 := [1]$ $e_2 := [0]$ $e_3 := [0]$

• VECTOR IS A MATRIX WITH $m = 1$

$$e_1 := \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \qquad e_2 := \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \qquad e_3 := \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

$$v := \begin{bmatrix} x \\ y \\ z \end{bmatrix} \qquad x, y, z \in \mathbb{R}$$



• FUNCTION $\mathcal{X}, \mathcal{Y}$ $\quad f : \mathcal{X} \to \mathcal{Y}$

• NORM "$\|\cdot\|$" : $\begin{cases} \|v\| > 0 & \forall v \in \mathbb{R}^n : v \neq 0 \\ \|v\| = 0 & v = 0 \end{cases}$

$$\|\cdot\| : \mathbb{R}^n \to [0, +\infty)$$

• DOT PRODUT BETWEEN MATRICES

$$A \in \mathbb{R}^{m \times n}, \quad B \in \mathbb{R}^{n \times p}, \quad C \in \mathbb{R}^{m \times p}$$

$n, m, p \in \mathbb{N}$

$$C = A \cdot B \Rightarrow \text{row-by-column product}$$

$$\begin{array}{cc} & \\ 1 & \begin{bmatrix} \boxed{a_{11} \;\cdots\; a_{1n}} \\ \vdots \\ a_{m1} \quad\quad a_{mn} \end{bmatrix} \end{array} \cdot \begin{array}{c} 1 \\ \begin{bmatrix} b_{11} & \cdots & b_{1p} \\ \vdots & & \\ b_{n1} & & b_{np} \end{bmatrix} \end{array}$$

$$C = \begin{bmatrix} c_{11} & \cdots \\ & \end{bmatrix} \qquad \underline{c_{11}} = a_{11} b_{11} + \cdots + a_{1n} b_{n1}$$

• EUCLIDEAN NORM $\qquad v \in \mathbb{R}^n$

$$\|v\| := \sqrt{v^T \cdot v}$$

AB

Av

$v^T v$

• CONTINUOUS FUNCTION

$f : \mathcal{X} \to \mathcal{Y}$ $\qquad \exists$ "there exists"

$\Rightarrow$ "implies"

if $\forall \, \varepsilon > 0 \quad \exists \quad \delta > 0 \; :$

$$\forall s \in \mathcal{X} : \|s - x\| < \delta \Rightarrow \|f(s) - f(x)\| < \varepsilon$$

for all $x \in \mathcal{X}$