HØ1

S1 EGYENESEK S2) 3 DIMENZIÓS

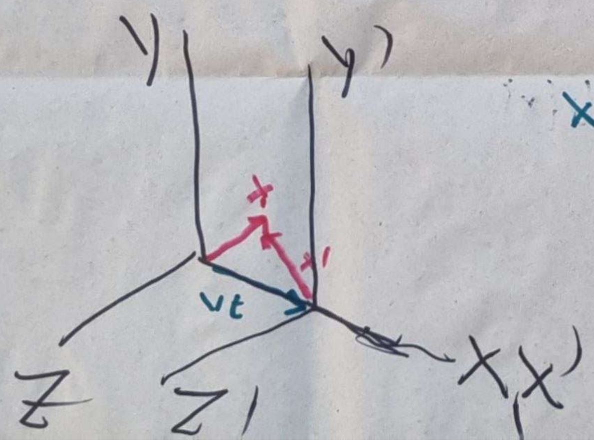
S3 IRÁNYÍTOTT S4) EUKLIDESZI

T1 EGY DIMENZIÓS T2 IRÁNYÍTOTT

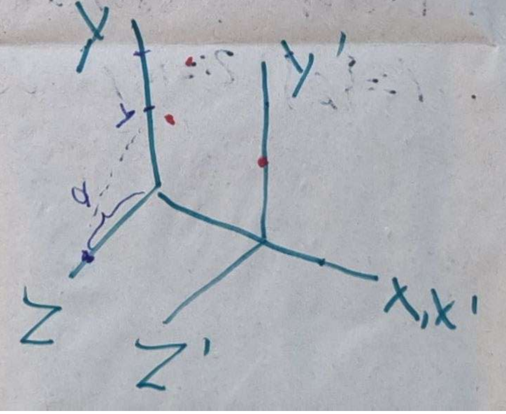
M1 EGYENES: PÁLYA M2 TEHETLEN PÁLYA EGYENES

U (TRÜKK)

M3 VAN GYORSABB M4 MINDEN LASSABB



$x' = x - vt$



$\sqrt{y^2 + d^2}$

HØ2

NØH

- standard logika: Objektumok, kijelentések, logikai fv. → $\neg, \wedge, \vee, \Rightarrow, \Leftrightarrow$, $\forall, \exists$
- ZFC: halmaz $\in$

  $A := \_\_\_ \quad =$

  $(a, b) := \{\{a\}, \{a, b\}\}$

  $A \times B$

- Zorn-lemma: $(S, \leq)$

  kivál. ax. $\quad \exists$ Descartes-szorzat

- term: $0 := \emptyset$, $1 := \{\emptyset\}$, $2 := \{0, 1\}$ ... $\quad x^{++} := x \cup \{x\}$

  $\exists \mathbb{N}$

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03

N $(V, \mathbb{R}, +, \cdot)$ vektortér

$\|\cdot\| : V \to \mathbb{R}_0^+$ $\quad \|c \cdot\| = |c| \, \|\cdot\|$, $\quad \|x+y\| \leq \|x\| + \|y\|$, $\quad \|x\| = 0 \Rightarrow x = 0$

$\|\cdot\|_1 \leq C \|\cdot\|_2$

H $\check{v} + A := \{\check{v} + x \mid \ldots\}$

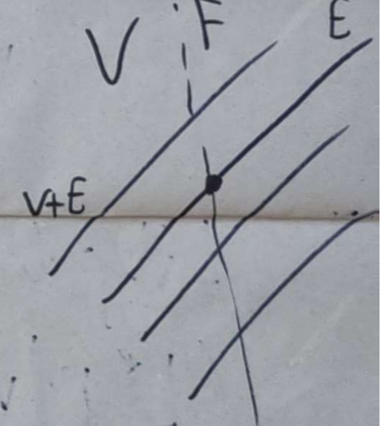
A

K $E, F \subset V$: $\quad E \cap F = \{0\}$

$E + F = V$ $\qquad \dim V = \dim E + \dim F$

F $E \subset V$: $\; v + E$: $\qquad v + E = u + E \Leftrightarrow v - u \in E$

V/E $\qquad (v+E) + (u+E) := (v+u) + E$, $\quad \alpha \cdot (v+E) := (\alpha v) + E$.



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HØ4

(I) $(V, \mathcal{B}_0)$

$A \quad A^+$

$\vec{a}$

$\vec{b}$

(D) $\cancel{\text{xx}}\ \{V \to \mathbb{K}\}_{lin.} =: V^*$ $\quad \dim V^* = \dim V$ $\quad (\cdot\text{—}) \begin{pmatrix} \cdot \\ \vdots \end{pmatrix}$

$p(v) =: (p|v)$

vektor

kovektor

$\{V^* \to \mathbb{K}\}_{lin.} =: V^{**}, \quad v \equiv (p \mapsto (p|v)), \quad V^{**} \cong V$

(T) $L: V \to U \quad L^*: U^* \to V^*, \ p \mapsto p \circ L \qquad \mathbb{K}^* \cong \mathbb{K}$

$(L^* p|v)_V = (p|Lv)_U \qquad L^{**} = L \qquad (LM)^* = M^* L^*$

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H05

(T) V, U, W. $\quad Lin(V,U) := \{L : V \to U \mid L \text{ lin}\}$

$Bilin(V \times U, W) := \{B : V \times U \to W \mid \text{bilineáris}\}$

$V^* = Lin(V, \mathbb{R})$.

$B \in Bilin(U \times V, \mathbb{R}) \qquad v \mapsto B(\cdot, v) \quad Lin(V, U^*)$

$L \in Lin(V, U^*) \qquad (u,v) \mapsto \underbrace{(u \mid Lv)}_{= u(Lv)}$

$$Bilin(U \times V, \mathbb{R}) \equiv Lin(V, U^*) =: U^* \otimes V^*$$

$$\boxed{U \otimes V := Bilin(U^* \times V^*, \mathbb{R})}$$

$\underset{r}{\Psi} \quad \underset{p}{\Psi} \qquad r \otimes p : U \times V \to \mathbb{R},$

$(u,v) \mapsto (u \mid r)(p \mid v)$

$$\boxed{\begin{aligned} &r \otimes p : V \to U^* \\ &r \otimes p(v) = r(p \mid v) \end{aligned}}$$

HØ6

$V \otimes V$, $V^* \otimes V$, $V \otimes V^*$, $V^* \otimes V^*$

$\sum_i v_i \otimes u_i$ $\quad \sum_i p^i \otimes v_i$

$V \vee V$ $\quad Tr \quad Tr$ $\quad V^* \vee V^*$

$V \wedge V$ $\quad \sum_i (p_i | v_i)$ $\quad V^* \wedge V^*$

K $\quad V \quad (e_1, \ldots, e_N)$ $\quad v = \sum_{i=1}^{N} v^i e_i$

$V^* \quad (p^1, \ldots, p^N)$ $\quad v = \sum_{i=1}^{N} (p^i | v) e_i$

$(p^i | e_j) \doteq \delta^i_j$

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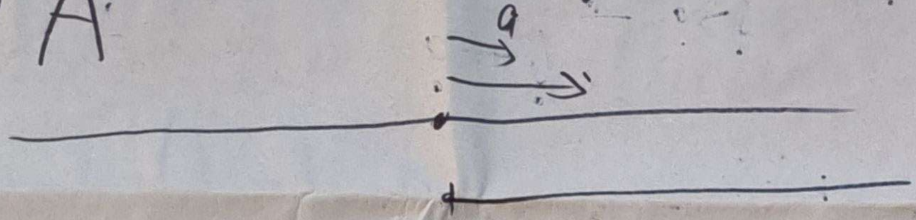
H07

M A V, $V \otimes A$



(A, a)

$A \rightarrow A \otimes B$

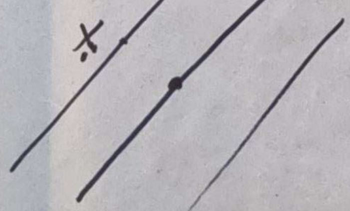
$B \rightarrow$

A^* $\quad B \otimes A^* =: \frac{B}{A}$

$A^+ \rightarrow (A \otimes A)^+, \quad a \mapsto a \otimes a$

$(V, V, -)$ $\quad E \subset V$,

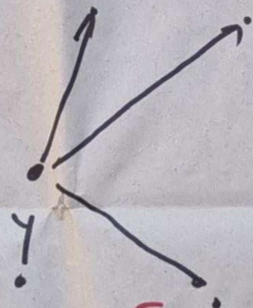
$x + E$

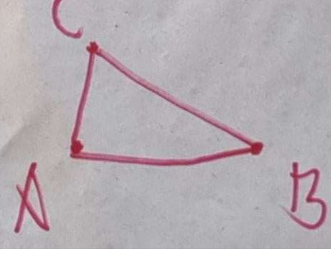


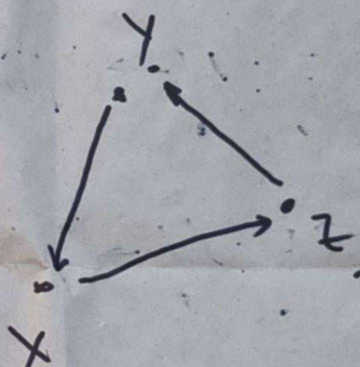
AH $\cancel{(V, V, +)}$ $(V, V, -)$ $\quad - : V \times V \to V$, $(x, y) \mapsto x - y$

1. $\forall y \in V: \; O_y : V \to V, \; x \mapsto x - y$ bij.

2. $\forall x, y, z \in V: \quad (x - y) + (y - z) + (z - x) = 0$







$O_y^{-1} x =: y + x$

H08

(D) $V, A, f: A \to V,$ $\quad f'(a) := \lim_{b \to a} \frac{f(b) - f(a)}{b - a} \in \frac{V}{A}$

$U, V \quad \text{ordo}: U \to V \quad \lim_{x \to 0} \frac{\text{ordo}(x)}{\|x\|} = 0.$

$F: U \to V, \quad \exists\ DF[x]: \underset{\text{lin}}{U \to V}: \quad F(y) - F(x) = DF[x]$ [illegible] $+ \text{ordo}(y - x)$ $\quad y \neq x$

$\left(\in \text{Lin}(U, V) = V \otimes U^* \right)$

$DF: U \to V \otimes U^*$

$D^2F: U \to V \otimes U^* \otimes U^*$

$x + y :=$ [illegible] x

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