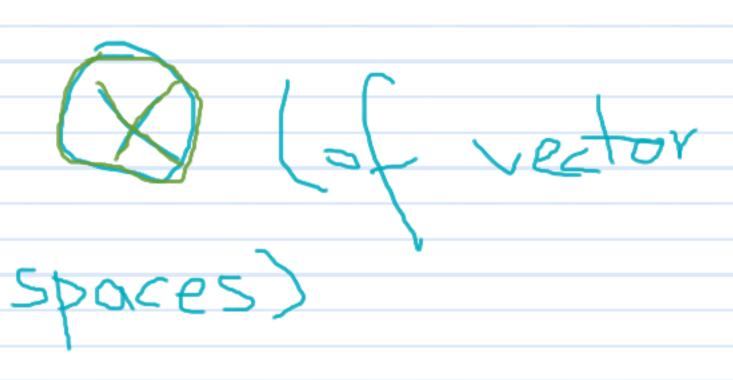
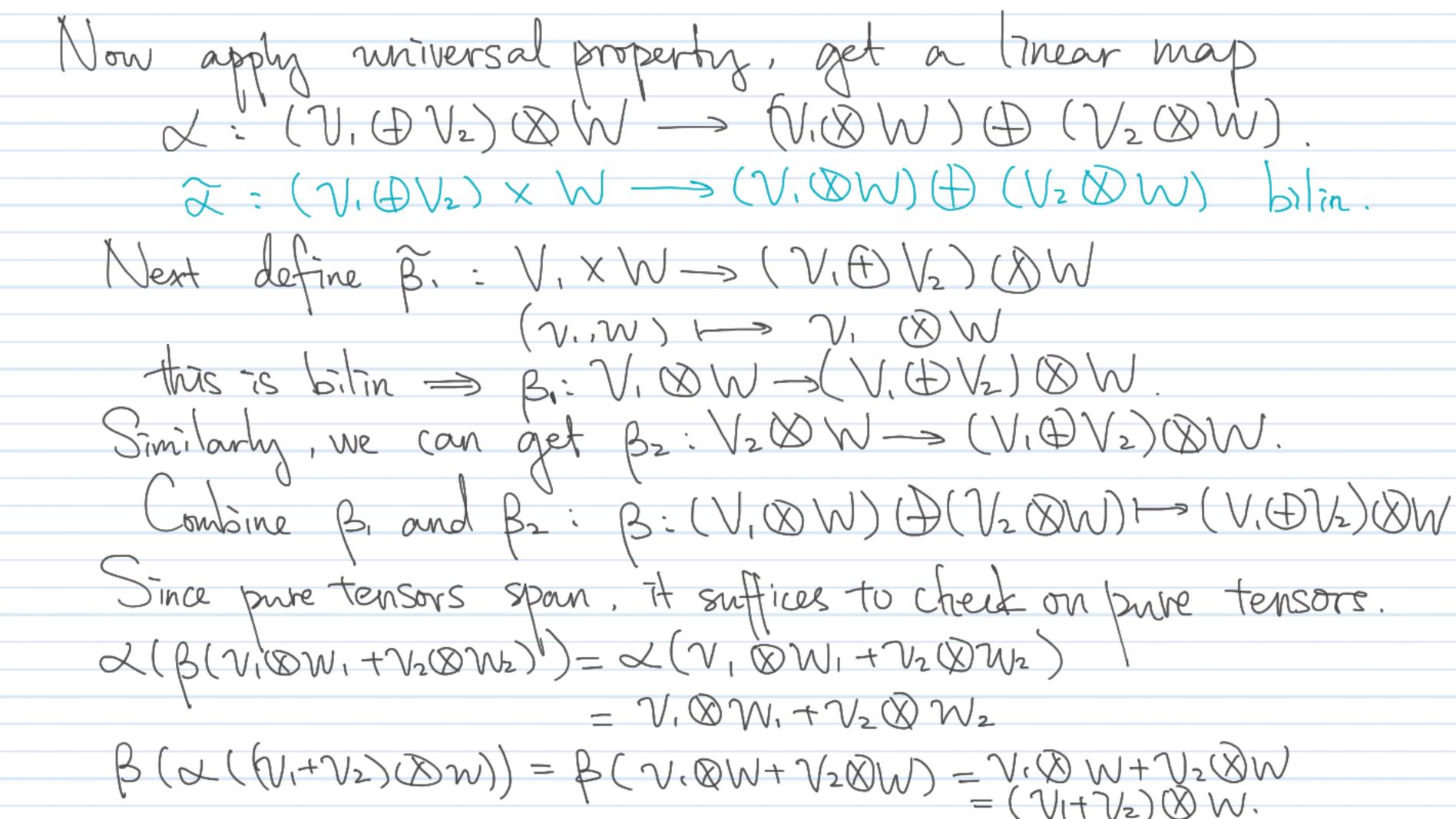
## Physics-Mathematics Dictionary by Hrvoje Nikolić

physical language	mathematical language
physics	applied mathematics
mathematics	applied mathematics
abstract nonsense	mathematics
conjecture	vague idea
theorem	conjecture
rigorous theorem	theorem
proof	sketch of the proof
basic operations $+, -, \cdot, :$	commutative field theory
classical field theory	multi-variable calculus
mathematical analysis	calculus
linear algebra	matrix calculus
group theory	representation theory
abstract group theory	group theory
quantum mechanics	mambo jumbo Dirac notation
fancy schmancy functional analysis	quantum mechanics
Hilbert space	rigged Hilbert space
Riemannian geometry	pseudo-Riemannian geometry
tensor	components of a tensor
contravariant vector	components of a vector
covariant vector	components of a one-form
fancy schmancy index-free notation	differential geometry



Istation. V.W vector spaces, then we write their tensor product as V&W. T([v|w]) = v&w. Remark. vow called pure tensors. Pure tensors span the tensor product but not every element is a prive tensor Prop.  $(V, \oplus V_2) \otimes W \cong (V, \otimes W) \oplus (V_2 \otimes W)$ .

Pf. Pefne  $\approx : (V, \oplus V_2) \times W \longrightarrow (V, \otimes W) \oplus (V_2 \otimes W)$ .  $(V, +V_2, W) \longmapsto V_1 \otimes W + V_2 \otimes W$ . ( aim & is bilinear. 2(a(v,+v2)+b(v,'+v2'),w) = 2 (av.+av2+bv,1+bv2,w) = 2 ((av,+bv,')+(av2+bv2'),w) = (av, +bv,') & W + (av2+bv2') &W = avion+bvion+avion+bvion = a (V,+V2) DW + b(V,'+V2') DW = a 2 (V,+V2, w) + b2 (V+V2', w)



doB=id, Bod=id => they are isom. Rmk: This actually works for infinite (D. (DV) &W = (DV) &W). Prop. K&K is one dimensional.

pf. a general elt of K & K looks like Zi ai & bi 2 aib: 1001 = (2 aibi) 1001. => 1001 spans KOOK >> KOK has dimension 1 or 0. Suppose KOK = O. Consider a bilin map KxK -> W

If we can construct any nonzero bilin map 4: KXK->W, then KOK \$0. 7.KxK -> K is a bilin map and nonzero!

(a,b) >> ab So Kook #0 => dim Kook = 1. Rock: the mult map induces an isom KOK Sisk

Prop. Let  $e_1, \dots, e_n$  be a basis for V,  $f_1, \dots, f_m$  be a basis for W. Then  $e_i \otimes f_j$  for  $1 \leq i \leq n$ ,  $1 \leq j \leq m$  forms a basis for  $V \otimes W$ .

Prop. Let  $e_1, \dots, e_n$  be a basis for V,  $f_1, \dots, f_m$  be a basis  $e_i \otimes f_j$  for  $i \leq j \leq n$ .

Prop. Let  $e_1, \dots, e_n$  be a basis  $e_i \otimes f_j$  for  $i \leq j \leq n$ . VOW = ( EKer) (8 (EKf)). = (#) (#) (Kei & Kfi) this is a & of 1-d = (1) (1) K ei&fj. din (VOW) = din (V) · din (W). Kn (x) Knm

Prop. II linear map  $V.\otimes W. \longrightarrow V_2 \otimes W_2$ , denoted  $f \otimes g$  with the property that  $V \otimes W \longmapsto f(v) \otimes g(w)$ .

If Have a map  $V. \times W. \longrightarrow V_2 \otimes W_2$ this is bitin wap, by universal prop, I linear wap V. OW, -> V2 OD W2 s.t. V. OW, -> f(v,) Og(W2). Rink: This says that @ is functorial.