Reminder V

flow

- For any $X \in \mathfrak{X}(M)$ and $p \in M$, $\exists\ \theta : (-\delta, \delta) \times V \to M$, $\delta > 0$, $V \in N_p$, with $\theta(0, q) = q$ and $\dot{\theta}(t, q) = X_{\theta(t,q)}$ $\forall\ t \in (-\delta, \delta)$, $q \in V$.
- Singular and regular points with respect to $X \in \mathfrak{X}(M)$.
- Complete flow (verified on compact manifold).
- Lie derivative of a function or of a vector field.

  defined by a vector field

- V finite dim real vector space, V^* its dual.

  (r, s) - tensors

- $\mathcal{T}^r_s(V) = \{$multilinear maps from $\underbrace{V \times \dots V}_{r \text{ copies}} \times \underbrace{V^* \times \dots V^*}_{s \text{ copies}} \to \mathbb{R}\}$

  symmetric — antisymmetric

- $\otimes$, $\Sigma^r(V)$, $\Sigma_s(V)$, $\Lambda^r(V)$, $\Lambda_s(V)$.
- Group of permutations, transpositions, $\mathrm{sgn}(\sigma)$.
- $\mathcal{S}$, $\mathcal{A}$: $\mathcal{T}^r(V) \to \mathcal{T}^r(V)$, symmetrization, anti-symmetrization
- some properties.
- Tensor algebra $\mathcal{T}(V) = \underbrace{\mathcal{T}^0(V)}_{\mathbb{R}} \oplus \mathcal{T}^1(V) \oplus \mathcal{T}^2(V) \oplus \dots$

  $\rightsquigarrow$ associative algebra with unit $1 \oplus 0 \oplus 0 \oplus 0 \oplus \dots$