

Discussion: 18.04. - 18.04.

## Exercise Sheet 1

### Exercise 1: Affine Independency

(4 Punkte)

Prove the following observations mentioned during the lecture:

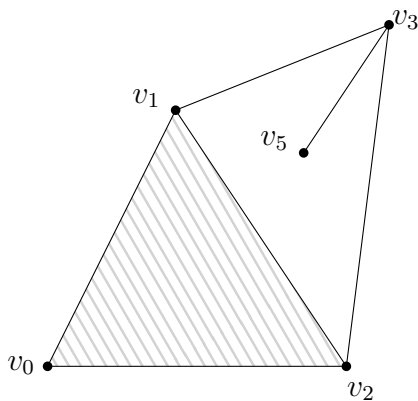
- (i)  $v_0, \dots, v_n$  affine independent  $\Leftrightarrow v_1 - v_0, v_2 - v_0, \dots, v_n - v_0$  linear independent
- (ii) An  $n$ -simplex can exist only in  $\mathbb{R}^d$ , where  $n \leq d$
- (iii)  $v_0, \dots, v_n$  affine independent  $\Rightarrow v_0, \dots, v_n$  are in convex position, i.e.  $ch(v_0, \dots, v_n)$  contains no  $v_i$  in its topological interior

### Exercise 2: Simplicial Complexes

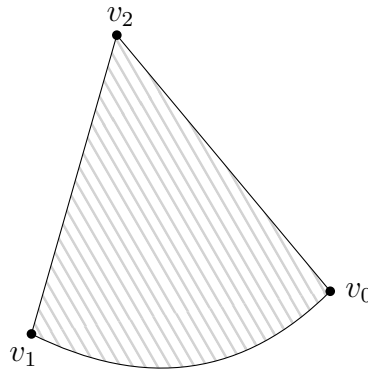
(4 Punkte)

Are the following objects in  $\mathbb{R}^2$  simplicial complexes? Argue why or why not!

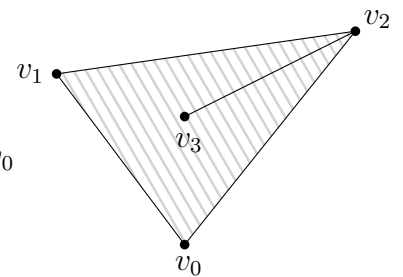
(i)



(ii)



(iii)



### Exercise 3: $\delta$ and permuted order

(4 Punkte)

Prove the following observation about  $\delta$  and any permutation  $\pi$ :

$$\delta\langle v_{\pi(0)} \dots v_{\pi(i)} \rangle = (-1)^{\text{sign}(\pi)} \delta\langle v_0 \dots v_i \rangle$$