



Discrete Geometry I

Exercise Sheet 6

Exercise 1 - Polar polytope

Compute vertices and facet supporting hyperplanes of the polar of the following polytope:

$$P = \text{conv}\{(-1, 1), (-1, -1), (1, 3), (1, -2), (2, 0)\}$$

Exercise 2 - Simplicial and simple polytopes

Let P be an n -polytope with $0 \in \text{int}P$. Show that P is simplicial if and only if the polar polytope P° is simple. Deduce a statement for simple polytope analogue to Exercise 1 in Exercise Sheet 4.

Exercise 3 - Simplicial polytopes

Let P be a simplicial n -polytope. Show that

$$(n - k)f_k(P) \leq \binom{n}{k + 1} f_{n-1}(P) \text{ for } k \in \{-1, \dots, n\}.$$

Exercise 4 - Graph of a polytope

Let P be a polytope with vertex set V and edge set E . The graph $G(P)$ is the abstract graph (V, E) with natural incidences. Show that the graph $G(P)$ is connected.