Problem sheet 6
Problems will be discussed at the problem class on December 7, 2016.

Problem 12.
Consider a convex polygon $P$ in the plane and a number $t$ strictly greater than the area of $P$. For each point $q \notin P$ let $P(q)$ be the polygon $\text{conv}(P \cup \{q\})$.

a) Prove that the locus $L_t$ of all points $q$ for which the area of $P(q)$ equals $t$ is the boundary of a convex polygon enclosing $P$.

b) Prove that if $P$ has $n$ corners, then $L_t$ has between $n$ and $2n$ corners. When does $L_t$ have less than $2n$ corners?

Problem 13.
For every $d$ and $r$ provide a set of $(d+1)(r-1)$ points in $\mathbb{R}^d$ that cannot be partitioned into $r$ subsets with mutually intersecting convex hulls.

Puzzle 6.
What is the smallest $k$ such that there is a room with $k$ straight walls and a light source that leaves either part or all of every wall in shadow?