This assignment is due on June 10/11 in your tutorial session. You are allowed (even encouraged) to discuss these problems with your fellow classmates. All submitted work, however, must be written individually without consulting someone else’s solutions or any other source like the web.

**Problem 1**  
(6 points)  
Let $s \in \mathbb{N}$ and 

$A := \begin{pmatrix} -1 & 0 \\ 0 & -1 \\ 2s & 1 \end{pmatrix}$ and $b := \begin{pmatrix} -1 \\ -1 \\ 1 \end{pmatrix}$. 

Furthermore, let $P := \{x \in \mathbb{R}^2 \mid Ax \leq b\}$. Find a feasible solution with the ellipsoid method for $s = 0$ and $s = 1$.

**Problem 2**  
(4 points)  
Consider the polyhedron $P = \{(x, y) \in \mathbb{R}^2 \mid y \leq \sqrt{2}x\}$. Show that its integer hull $P_I = \text{conv.hull}(P \cap \mathbb{Z}^2)$ is not a polyhedron, that is, it cannot be described by a finite number of inequalities.

**Problem 3**  
(4 points)  
Let $P := \text{conv.hull}\{(0, 3), (2, 2), (0, 0), (3, 0)\}$ and consider the following two linear representations:

$x + 2y \leq 6$

$2x + y \leq 6$

$2x + y \leq 6$

$x + y \leq 4$

$x \geq 0$

$y \geq 0$

They clearly define the same polyhedron. Prove that one is TDI but the other one is not.

**Problem 4**  
(4 points)  
Prove that adding a feasible constraint does not destroy TDI-ness: If $Ax \leq b$ is TDI and $a^T x \leq \beta$ is a valid inequality for $\{x \mid Ax \leq b\}$, then $Ax \leq b, a^T x \leq \beta$ is also TDI.