Name: ______________________

VIP ID: ______________________

Problem	**Max. points**	**Your points**
1	25	
2	25	
3	25	
4	25	
Total	100	

Write down your birth-date in the form `mm/dd/YY`, and set m to be the value of the month, d the value of the day, and Y the value of those two last digits of the year you were born (for instance, today it would be $m = 11$, $d = 7$, $Y = 17$).

1. We want to find the **minimum** of the function $f(x, y) = Y(x - d)^2 + (y - m)^2$ over the half-disk that contains the point $(1, 4)$, and has as diameter the segment of endpoints $(1, 1)$ and $(3, 5)$.
   (a) Write the statement of this problem as a program.
   (b) Is the objective function pseudo-convex? Why or why not?
   (c) Are the inequality constraints quasi-convex? Why or why not?
   (d) Sketch the feasibility region. Label all relevant objects involved.
   (e) Use the techniques we have covered in Chapter 4 to find the optimal solution. Make sure to name the Theorems you use.

2. Find a non-diagonal positive definite matrix $\boldsymbol{Q}$ of the form

$$\boldsymbol{Q} = \begin{bmatrix} m & a_{12} & a_{13} \\ a_{12} & d & a_{23} \\ a_{13} & a_{23} & Y \end{bmatrix}$$

   (the coefficients a_{12}, a_{13} and a_{23} cannot be simultaneously equal to zero)

3. Find the **maximum** of the quadratic form $\mathcal{Q}_{\boldsymbol{Q}}$ over the unit ball

$$\mathbb{B}_3 = \{(x, y, z) \in \mathbb{R}^3 : x^2 + y^2 + z^2 \leq 1\}.$$

4. Find the **minimum** of the quadratic form $\mathcal{Q}_{\boldsymbol{Q}}$ over the ball

$$S = \{(x, y, z) \in \mathbb{R}^3 : x^2 + y^2 + z^2 \leq Y^2 + m^2 + d^4\}.$$