Sample test questions for Exam #1

This provides samples of problems that might be on Exam 1.

Exercise 1: *(You need to know all the definitions precisely. You want to give a definition containing all their* assumptions. *Example for $co(D)$:*
For a set $D \subseteq \mathbb{R}^n$ the $co(D)$ is the intersection of all convex sets in R^n containing D.
)

Sate definitions of the following terms:
- open set
- gradient
- coercive function
- geometric program (GP)
- $co(D)$

Exercise 2: *(You should remember theorems (statements only). But do not forget their assumptions!)*

- What is the relation between convexity of f and Hf? *(I ask for Theorem 22)*
- Is there any connection between $co(D)$ and set of all convex combinations of vectors from D? $(D \subseteq \mathbb{R}^n)$
- How eigenvalues of A correspond to positive(negative) (semi)definity of A?

Exercise 3: *(You want me to show that you know how to do computations.)*

Determine whether the function is convex, concave, strictly convex or strictly concave on the specified set:
$f(x_1, x_2) = 5x_1^2 + 2x_1x_2 + x_2^2 - x_1 + 2x_2 + 3$ for $(x_1, x_2) \in \mathbb{R}^2$

Exercise 4: *(There will be more than one computing excercise.)*

Find (local, global) minimizers and maximizers of the following function:
$f(x_1, x_2) = e^{-(x_1^2+x_2^2)}$

Exercise 5: *(You may want to check previous HW and exercises from the book (in particular those we have not done yet))*

Solve using $(A - G)$ inequality the following problem:
Minimize $3x + 4y + 12z$ subject to $xyz = 1$ and $x, y, z > 0$

Exercise 6: *(**D14 only** need to know also proves that were done during the lecture (or as homeworks))*

State and prove the theorem relating if x strict local minimizer of f and $Hf(x)$. *(I ask for the statement and sketch of the proof of Theorem 9.)*
