# Test 3

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January 23, 2025

- **Please submit a pdf with your answers on blackboard by Thursday 30th of January at 13:00. Please state name, surname and CID.**

  **Use the handouts to reply to these questions. Do not use generative AI tools. Note that each answer is in the handouts.**

  **You cannot answer using screenshots. You need to reply by typing or in your own writing. This promotes subconscious retention.**

  **This is an individual test. You cannot collaborate with other students or any other individual. This must be your work.**

  **You should be able to complete this in 1 page. Do not write, nor spend too much time on this.**

1. Define the minimum element of a set $S$ (according to Section 3.5).
2. Define the minimal element of a set $S$ (according to Section 3.5).
3. (2 points) Consider a circle and the cone $K = \mathbb{R}^2_+$. Sketch the circle and indicate all minimum and minimal elements in the figure, if any.
4. (2 points) Give now the definitions of minimum and minimal elements of $S$ with respect to a cone $K$ using the dual cone $K^*$ (according to Section 3.7).
5. (3 points) Define a convex function in three different ways (1) Jensen's inequality, 2) the first order characterization, 3) the second order characterization).
6. Explain the meaning and importance of the statement: "the first-order Taylor expansion at a point of a convex function is a global underestimator".