The test lasts 15 minutes. No documents are allowed. The use of a calculator, cell phone or other equivalent electronic device is not allowed.

1) For a vector $u \in \mathbb{R}^N$, give the definitions of the norms $\|u\|_1$ and $\|u\|_\infty$.

**Solution.** The definitions are

$$\|u\|_1 = \sum_{i=1}^N |u_i|, \quad \|u\|_\infty = \max_{i=1...N} |u_i|.$$ 

2) For a square matrix $A \in M_N(\mathbb{R})$, give the formulas for $\|A\|_\infty$.

**Solution.** One has from class that

$$\|A\|_\infty = \max_{i=1...N} \sum_{j=1}^N |A_{ij}|.$$