Calculus 2 — AY 2025/26, Exam Program

- All notation refers to the Course Lecture Notes (LN) available on Moodle.
- All definitions included in this syllabus must be known very well; that is, you should be able to state each definition and apply it to concrete examples.
- All statements of theorems, propositions, corollaries, etc. must be known very well. You should be able to apply them correctly.
- Simple and significant proofs marked by (P) must be known, and you should be able to adapt these arguments to obtain more general statements using a similar proof strategy.

1. Euclidean space $\mathbb{R}^d$. 1.1 Euclidean norm (prop. 1.1.4 (P)). 1.2 Limit of a sequence. 1.3 Limit of a function. 1.4 Computing limits. 1.5 Basic topological concepts (prop. 1.5.6 Cantor (P), 1.5.7 (P)). 1.6 Weiestrass theorem. 1.7 Intermediate values theorem.

2. Differential Calculus. 2.1 Directional derivative. 2.2 Differentiability (prop 2.2.3 (P)). 2.3 Extrema (thm. 2.3.2 Fermat (P)). 2.4 Taylor formula. 2.5 Classification of stationary points. 2.6 Convexity (cor. 2.6.4 (P)).2.7 Constrained optimization. 2.8 General Lagrange multipliers theorem.

3. Vector fields 3.1 Definitions. 3.2 Irrotational fields. 3.3 Line integral (prop 3.3.3. (P)).

4. Differential equations 4.1 First order scalar equations. 4.2 Global and local existence and uniqueness. 4.3 Qualitative study of scalar equations.

5. Multiple Integrals 5.1 Measure of a trapezoid. 5.2 Integral. 5.3 Reduction formula. 5.4 Change of variable. 5.5 Barycenter, center of mass, inertia moments. 5.6 Green formula.

7. Holomorphic functions. 7.2 Elementary functions (prop 7.2.5 (P)). 7.3 $\mathbb{C}-$differentiability. 7.4 Cauchy-Riemann equations (thm 7.4.2 (P)).