Calculus 2 - Topics for the exam

In the first part of the final exam, you are expected to be able to state the following definitions and theorems and also the proofs where it is indicated.

Improper integrals

- 1. Definitions of the improper integrals
- 2. Comparison test for improper integrals
- 3. Integral test (proof)

Basic topological concepts

- 4. Norm of a vector, and the triangle inequality in R^{p} (pg. 2).
- 5. Scalar product and orthogonality of vectors in R^{p} (pg. 3).
- 6. The Cauchy-Schwartz inequality in R^{p} (pg. 2).
- 4. Convergence of a sequence of points in R^{p} (pg. 5).
- 5. Cauchy's criterion for convergence of sequences in R^{p} (pg. 6).
- 6. Bolzano-Weierstrass theorem in R^{p} (proof) (pg. 7).
- 7. Interior, exterior and boundary points of a set (pg. 8).
- 8. Limit points and isolated points of a set (pg. 11).
- 9. Definition of open sets, and their fundamental properties (pg. 11, Theorem 1.14).
- 10. Definition of closed sets and characterizing properties (pg. 12-13, Theorem 1.17, Theorem 1.18).
- 11. Cantor's theorem (proof) (pg. 15, Theorem 1.25).

Limit and continuity

- 12. Definition of the limit of functions (pg. 21, Def. 1.33, Def. 1.35).
- 13. Transference principle (pg. 22, Theorem 1.38).
- 14. Definition of continuity and its characterization (pg. 24, Def. 1.42, Theorem 1.44).
- 15. Weierstrass min-max theorem (proof) (pg. 26, Theorem 1.51).

Partial derivatives

- 16. Definition of partial derivatives (pg. 31, Def. 1.56).
- 17. Definition of local maximum and minimum (pg. 32, Def. 1.59).
- 18. Local extrema and partial derivatives (pg. 32, Theorem 1.60).
- 19. Extrema of functions on a closed and bounded set (pg. 32, Theorem 1.61).

Differentiability

- 20. Differentiability (pg. 35, Def. 1.63).
 - (See also: Calculus 1, Lecture 13, pg. 4: Linear approximation)
- 21. Differentiability implies continuity (pg. 36, Theorem 1.66).
- 22. Differentiability and partial derivatives (pg. 37, Theorem 1.67).
- 23. The derivative vector (pg. 8, Def. 1.70).
- 24. Continuous partial derivatives imply differentiability (pg. 39, Theorem 1.71).
- 25. Equation of a tangent plane (pg. 42, Def. 1.74).
- 26. Directional derivatives (pg. 43, Def. 1.76, Theorem 1.77).