

# Revision Checklist Analysis II

1. What is the  $(\varepsilon, \delta)$ -definition of a limit of a function? What are examples and counterexamples?
2. What is the epsilon-delta definition of a continuous function?
3. When does the quotient of two continuous functions produce a continuous function? What about the sum? The product?
4. What is the relation between the continuity of a function in higher dimension and the continuity of its component functions?
5. Do you know the definition of a bounded function, examples and non-examples?
6. Do you know the statements of the continuity theorems (IVT, Brouwer's Fixed Point Theorem, EVT)? Do you know how to apply them? Do you know the idea of the proof?
7. Do you know the statements of the theorems of Fermat and Rolle as well as the Mean Value Theorem? Do you know the idea of the proof?
8. Do you know the definition of a differentiable function, examples and non-examples?
9. When is the quotient of two differentiable functions a differentiable function? What about the sum? The product?
10. Do you know the definition of the derivative in higher dimension?
11. Do you know the relation between the derivative in higher dimension and partial derivatives? Do you understand its motivation?
12. Do you know that the existence of partial derivatives of a higher dimensional function does NOT imply that the function is differentiable? Can you give examples?
13. Do you know the notion of a closed set, open set, compact set? Do you know the connection between continuity of functions and open sets? Do you know the relation between compactness and convergence of (sub)sequences?
14. Have you gone through all the examples that we did in the lecture?
15. Have you gone through all the problem sheets?
16. Do you know the definition of a pointwise limit of a sequence of functions?
17. Do you know the definition of a uniform limit of a sequence of functions? Can you give a lot of examples and non-examples?
18. Do you know what a step function is?
19. Do you know the definition of the integral of a step function?
20. Do you know the definition of a regulated function?

21. Do you know the definition of the Cauchy Riemann integral (regulated integral) of a regulated function and its properties?
22. Do you know what the Riemann upper and lower integrals are?
23. Do you know Heine's theorem and how that implies that continuous functions are regulated?
24. Do you know a criterion when to commute limit and integration and can you give examples and counterexamples?
25. Do you know what an improper integral is and what absolutely integrable means?
26. Do you know the fundamental theorem of calculus and how to apply it? Do you know its proof?
27. Do you know what  $C^k$ ,  $C^\infty$  and  $C^\omega$  functions are?
28. Have you really done all problem sheets? Have you created a list of examples and counterexamples for yourself?
29. Could you explain all the concepts of the lecture course to a friend?