Review for Math 342 – Final

The final covers the material covered in sections 10.1-20.3 (except section 12.3) of the textbook and the topics covered in the lectures. Terms in bold are concepts covered in class that are not in the book.

Definitions to know:
1. Scalar product p. 270
2. Norm p. 271
3. Converging sequence p. 278
4. Interior point p. 283
5. Open set p. 283
6. Closed set p. 284
7. Boundary point p. 287
8. Exterior point p. 287
9. Continuous function p. 290
10. Sequential compactness p. 299

11. Compactness (in your notes)
12. Uniform continuity p. 303
13. Metric space p. 314
14. Cauchy sequence p. 322
15. Complete metric space p. 323
16. Limit point p. 348
17. Partial derivative p. 355
18. Directional derivative p. 366
19. Norm of a matrix p. 383
20. Positive definite and negative definite matrices p. 384
21. Linear mapping p. 394
22. Differentiability for functions between Euclidean spaces (from notes in class)
23. Constrained extremum p. 460
24. Upper and lower Darboux sums p. 472
25. Upper and lower integrals p. 473
26. Integrable p. 475
27. Jordan content 0, p. 486
28. Smooth change of variables, p. 505
29. Smooth curve and piecewise smooth curve, p. 520
30. Parameterized surface, p. 533

Theorems you should be able to state and/or prove:
1. Thm 17.3, p. 442 (Dini’s Theorem)
2. Thm. 18.24, p. 492
3. Thm. 20.12, p. 529

Theorems and/or facts you should know:
1. Cauchy Schwarz inequality p. 274
2. Triangle inequality p. 275
3. Thm. 11.11 p. 294 (equivalent conditions for continuity)
4. Heine-Borel Theorem (relating different definitions of compactness and closed and bounded) and Thm. 11.16 p. 299
5. Thm. 11.20 and the extreme value theorem p. 301
6. Thm. 11.25 p. 303
7. Thm. 13.17 MVT p. 368
8. Thm. 13.20 p. 369
10. Thm. 14.13 (Generalizes Cauchy Schwarz) p. 384
11. Thm. 14.22 (2nd order test) p. 391
12. Thm 15.39 (Chain Rule) p. 418
13. Thm. 16.12 (Inverse Function Theorem) p. 435
14. Thm 17.6 (General Implicit Function Theorem) p. 450
15. Thm 17.14 and 17.17 (Lagrange Multiplier Theorem) p. 461, p. 465
16. Thm. 19.1 and 19.7 (Fubini’s Theorem), p. 498, p. 503
17. Thm 19.19 (Change of variables theorem), p. 506
18. Green’s Formula, p. 546
19. Thm. 20.31, Stokes’s Formula, p. 555

20. Divergence Theorem, in notes

You should be able to:
1. Work with dot product and norm for Euclidean space
2. Know and use the triangle and Cauchy-Schwarz inequality
3. Know how to prove sequences in Euclidean space converge or diverge
4. Prove that sets are open, closed, or neither
5. Find the interior, boundary, and exterior of a set
6. Prove that a function is continuous or discontinuous
7. Prove that a set is compact or not and what compactness means for continuity. You should know the definitions of sequential compactness as well as compactness.
8. Know how to prove a space is a metric space and how to prove convergence for sequences
9. Find open, closed, and compact sets for metric spaces
10. Find the gradient of a function, partial derivatives, and directional derivatives and know the connections between these
11. Know how to compute higher order partial derivatives
12. Be able to use the MVT in higher dimensions (usually as a tool to prove other results)
13. Find a tangent plane and first order approximation for a function as well as when these will exist
14. Use the 2nd derivative test to find extreme points

15. Show that a matrix is positive or negative definite (for instance using Sylvester’s criterion).
16. Be able to use and apply basic facts from linear algebra as well as the norm of a matrix and the generalized Cauchy-Schwarz inequality.
17. Compute the derivative matrix and give conditions under which we know a derivative exists. You should also know the definition of the derivative as in your notes since this is not given in the text.
18. Know the inverse function theorem for 1-variable as well as the general inverse function theorem.
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20. Be able to apply the implicit function theorem to describe solutions of equations and surfaces.
21. Be able to use Lagrange Multipliers to find constrained maxima and minima.
22. Be able to prove that a function is integrable or not.
23. Given a set show that it is a Jordan domain or not.
24. Be able to apply the change of variables theorem to compute an integral.
25. Be able to compute an integral along a parameterized curve.
26. Find the surface area and compute integrals along surfaces.
27. Be able to use Green, Gauss, and Stokes Theorems to compute integrals.