Math 330 Section 1 - Spring 2026 - Homework 12

Published: Tuesday, March 17, 2026 Running total: 39 points
Last submission: Friday, April 10, 2026

Status - Reading Assignments:

The reading assignments you were asked to complete before the first one of this HW are:

MF lecture notes:
ch.1 – ch.3, skim ch.4, ch.5.1 – ch.12.2 (skip ch.10.3 and ch.11.2.3.)

B/G (Beck/Geoghegan) Textbook:
ch.1 – 7.1, ch.8 – 13.4

Other material (optional):
B/K lecture notes ch.1.1 and ch.1.2, except ch.1.2.4
Stewart Calculus 7ed - ch.1.7: "The Precise Definition of a Limit"

Reading assignments for the Spring Break:

- **a.** Catch up with your reading. In particular, review Ch.9.3 (Convergence and Continuity in $\mathbb{R}$) and ch.11.2.2 (Normed Vector Spaces).
- **b.** Carefully read MF ch.12.3 - ch.12.5. through Example 11.11 (Vector spaces of real–valued functions).
- **c.** Prepare for the second Midterm!

No written assignments!

Supplementary instructions for reading MF ch.12:

When you read or reread any topics in those chapters then the following is good advice:

- **a.** MF ch.12.1: Draw as many pictures as possible to get a feeling for the abstract concepts. Use the metric spaces $(\mathbb{R}^2, d\big|_{\|\cdot\|_2})$ and $(\mathscr{B}(X,\mathbb{R}), d\big|_{\|\cdot\|_\infty})$ for this. Do these drawings in particular for
- open sets and neighborhoods (ch.12.3)
- convergence, expressed with nhoods (the end of def.12.10 in ch.12.4)
- metric and topological subspaces (ch.12.7): draw an irregular shaped subset $A \subseteq \mathbb{R}^2$ in two pieces $A = A_1 \uplus A_2$ which do not overlap. Draw some points $x_j \in A$ with ε–nhoods (circles with radius ε about x_j) so that some circles are entirely in A, one with $x_j \in A_1$ which reaches into $A^\complement$ but not into A_2, and one with $x_j \in A_2$ which reaches both into $A^\complement$ and A_1. What is $N_\varepsilon^A(x_j)$?
- Contact points, closed sets and closures (ch.12.8): Draw subsets $B \subseteq \mathbb{R}^2$ with parts of their boundary (periphery) drawn solid to indicate that points there belong to B and other parts drawn dashed to indicate that those boundary points belong to the complement. What is $\bar{B}$?
  Draw points "completetely inside" B, others "completetely outside" B, and others on the solid and dashed parts of the boundary. Which ones can you approximate from within B by sequences? Which ones can you surround by circles that entirely stay within B, i.e., which ones are interior points of B? Which ones can you surround by circles that entirely stay outside the closure of B, i.e., which ones are entirely within $\bar{B}^\complement$? Use those pictures to visualize the definitions in this chapter and thm 12.7 and thm.12.8.
- Now repeat that exercise with an additional set A which is meant to be a metric subspace of $\mathbb{R}^2$.
- **b.** MF ch.13.2 (Continuity): Draw as many pictures as possible to get a feeling for continuity, especially if you did not take multivariable calculus and are not used to dealing with continuous/differentiable functions of more than one variable. Here is a picture.

Figure 0.1: ε-δ continuity