

Spring 2013
Math 477
Applied Analysis 3
Black 202-01, 2:00 - 2:50 MF, Bouillon 103 W

Instructor: Dr. Jim Bisgard
Office: Bouillon 118
Phone: 963-2823
E-mail: bisgardj@cwu.edu
Office Hours: M-F 10:00 - 10:50 and by appointment.

Required Text: none, although lecture notes will be available at
www.cwu.edu/~bisgardj/teaching.html

1 Grades/Exams/Homework

- Grades

Grades will be calculated using the following weighting system:

Homework: 50%;

Exams: 50% total, broken up as follows: 25% for the mid-term and 25% for the final.

The grading scale will be at worst be the following:

	87 – 89.9 : <i>B+</i>	77 – 79.9 : <i>C+</i>	67 – 69.9 : <i>D+</i>	below 60 : <i>F</i>
93 – 100 : <i>A</i>	83 – 86.9 : <i>B</i>	73 – 76.9 : <i>C</i>	63 – 66.9 : <i>D</i>	
90 – 92.9 : <i>A–</i>	80 – 82.9 : <i>B–</i>	70 – 72.9 : <i>C–</i>	60 – 62.9 : <i>D–</i>	

Thus, if you get a 85% in the class, the worst you could do would be a B. I reserve the right to make the grade scale easier (for example, extending the As down to 85).

- Homework

You'll get a homework assignment every Wednesday (except the first week!) which will be due on the Thursday of the following week. You may use/ask/talk to whatever/whoever you'd like, as long as you say what resources you used. However, you must write your solutions up in **your own words** to hand in. **DO NOT** wait until the day before homework is due to start working on it. There won't be a large number of problems, but they will take some time to do!

- Exams

There will be two exams: a mid-term and a final. They will be take-home exams, and you'll have a week to work on them. In contrast to the homework,

YOU MUST WORK ON YOUR EXAMS BY YOURSELF!!!!!!!!!!!!!!.

The mid-term will be handed out during the beginning of February, and the Final Exam will be handed out on March 6 and be due Friday, March 15.

- Expectation for Homework and Exams

Your homework and exams should be written up neatly and legibly, using complete sentences where appropriate. You should also use correct and proper english - don't expect to get a perfect if your grammar and/or spelling is poor! Writing mathematics well is very difficult, and it takes a lot of practice. It is often helpful to actually read your writing out loud to yourself, and make changes as appropriate.

2 Course Goals

There are a number of goals. As an over-arching and rather nebulous goal, we hope to increase your mathematical maturity so that you will be able to read and understand mathematical proofs and ideas in a variety of contexts. You will also practice your proof writing skills. As much more specific goals, we will pick from the following list:

1. Vector Spaces and Analysis

(a) Minimization and applications:

- i. Show that if $A : \mathbb{R}^d \rightarrow \mathbb{R}^d$ is linear and self-adjoint, then there is a basis for \mathbb{R}^d that consists of orthonormal eigenvectors of A .
- ii. Suppose that A is self-adjoint and $\langle A\mathbf{x}, \mathbf{x} \rangle > 0$ for all $\mathbf{x} \in \mathbb{R}^n \setminus \{\mathbf{0}\}$. Give method of steepest descent and conjugate gradient method for approximating solutions of $A\mathbf{x} = \mathbf{b}$.

2. Functional Analysis

- (a) Introduce ℓ^2 as a version of \mathbb{R}^∞ , along with its norm and inner-product. Introduce $w^{1,2}$ as a particularly nice type of subspace in ℓ^2 .
- (b) Closed and bounded sets **ARE NOT** compact in such spaces!
- (c) Weak convergence in ℓ^2 .
- (d) weak compactness.
- (e) Minimization and applications.
 - i. weak lower semi continuity
 - ii. continuity, convexity, and coercivity
 - iii. Show that if $A : \ell^2 \rightarrow \ell^2$ is symmetric and compact, then there is a basis for ℓ^2 that consists of orthonormal eigenvectors of A .
- (f) Repeat the above for functions!
 - i. Applications of minimization to get the solution operator of various boundary value problems.
 - ii. Introduce the various orthonormal bases of L^2 , as eigenbases for the solution operators of various boundary value problems.

Be aware that we will certainly not cover all of these in a single quarter!

3 Legalese/Fine Print

Students with disabilities who wish to set up academic adjustments in this class should give me a copy of their "Confirmation of Eligibility for Academic Adjustments" from the Disability Support Services Office as soon as possible so we can discuss how the approved adjustments will be implemented in this class. Students without this form should contact the Disability Support Services Office, Bouillon 205 or dssreceipt@cwu.edu or 963-2171.