

# Math 280: Bridge to Higher Math

## (Section 2: TTh 10:10 - 11:40)

**Course name:** Math 280 - Bridge to Higher Mathematics (Section 2)

**Instructor:** Dr. Danny Crytser

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**Office phone:** (315) 229-5672

**Class Meetings:** TTh 10:10 - 11:40 in Valentine 205

**Office hours:** (Subject to revision)

- Wednesday from 10:00-11:30 and from 1:15-3:00;
- Friday 2:30-3:30;
- and by appointment. (Email me!)

**Textbook:** *Book of Proof* by Richard Hammack (third edition!). The book is available free at

<https://www.people.vcu.edu/~rhammack/BookOfProof/>

You can also buy a physical copy but you have to search using the ISBN number 978-0-9894721-2-8 instead of the title in order to **get the correct edition**. If you want a book to read alongside as an optional complementary text, I suggest *Chapter Zero* by Carol Schumacher or *How to Read and Do Proofs* by Daniel Solow.

**Course contents:** It is likely that most of your previous mathematical experience centered around how to calculate the answers to numerical problems (like, how far does this particle go if travels with velocity  $v(t)$  from  $t = a$  to  $t = b$ ?). This course will be completely different, and you will be doing very few calculations. Instead you will learn how to read and write mathematical proofs.

We will study the logic that mathematicians use to form statements, accompanied by the language of set theory, which is the basis of every mathematical subject. As part of set theory we'll cover the arithmetic of infinite sets (cardinal numbers), i.e. the idea of "different levels of infinity." We'll also cover finite counting methods (multiplication principle, permutations, binomial coefficients) and some basic number theory.

There are four basic proof patterns that you will master in this course: direct proof, indirect proof (contrapositive), contradiction, and induction. We have fairly small enrollment, which is fantastic because we can go wherever your interests lead you.

Along the way you will hone your problem-solving and critical thinking skills and learn the  $\text{\LaTeX}$  mathematical typesetting system. Hopefully you'll also learn something fun about your own mathematical abilities as well.

**Homework:** There are written assignments due at the beginning of class each Thursday meeting.

**Exams:** Two midterms (see course schedule) and **no final exam**. No reschedules on exams for personal travel (especially on the 3/14 exam!), but I'll do makeups for medical/personal emergencies. Personal travel does not qualify.

**Grading:** 12 HW assignments worth 25 points each, two 100 point exams, and a 100 point final presentation = 600 points total. There might be opportunities

94-100	4.0	73-75	2.25
91-93	3.75	70-72	2.0
88-90	3.5	68-69	1.75
85-87	3.25	65-67	1.5
82-84	3.0	63-64	1.25
79-81	2.75	60-62	1.0
76-78	2.5	0-59	0

Class	Read (before)	Topics	HW Due
Th 1/17	–	No class. Read short story	
T 1/22	§1.1	What is a proof? What are sets?	
Th 1/24	§1.2, 1.3	Cartesian products; subsets	§1.1: 2, 3, 7, 14, 17, 20, 26, 30, 36, 40, 41 50
T 1/29	§1.4, 1.5, 1.6, 1.7	Set operations.	
Th 1/31	§1.7, 1.8, 2.1	Collections of sets; statements.	§1.2: 2, 4, 12, 17 §1.3: 2, 6, 13, 14. §1.4: 2, 8, 10, 14 §1.5: 2, 4, 7
T 2/5	§2.1, 2.2, 2.3	Logical connectives. And, or, not, if.	
Th 2/7	§2.4, 2.5, 2.6	Biconditional; Truth tables, Logical equivalence	§1.6: 2, 6; §1.7: 4, 8 §1.8: 2, 4, 6, 8, 9 §2.1: 4, 6, 8, 10 §2.2: 1, 4, 8, 10
T 2/12	§2.7, 2.8, 2.9, 2.10, 2.11	Quantifiers, Translation, Negation	
Th 2/14	–	Mid-winter break.	
T 2/19	§3.1, 3.2	Lists and factorials	
Th 2/21	§3.3, 3.4	Counting subsets, Binomial Theorem	§2.3: 4, 5, 10 §2.4: 2, 4 §2.5: 8, 10 §2.6: 2, 8, 12 §2.7: 2, 6 §2.9: 2, 6 §2.10: 2, 4
T 2/26	Ch 4.	Direct proof	
Th 2/28	Ch 4	More direct proof	§3.2: 4, 6, 10 §3.3: 4, 8 §3.4: 4, 6, 8, 12 §3.5: 4, 8 §3.6: 8 §3.7: 1, 11 §4: 2, 6, 14.

T 3/5	Ch 5, Ch 6	Contrapositive proof; Modular arithmetic; Contradiction proof	
Th 3/7	Ch 7	Biconditionals; existence	§4: 20, 21, 26 §5: 1, 2, 5, 8, 19, 20, 24 12, 14, 15, 20 §6: 2, 4, 8, 10, 20, 24.
T 3/12	Ch 8	Proofs about sets	
Th 3/14	–	<b>Exam 1: Chapters 1-6</b>	§7: 2, 5, 9, 12, 21, 27
T 3/19	–	Spring Break	
Th 3/21	–	Spring Break , Ctd.	
T 3/26	Ch. 9 (+reread §2.10)	Disproof.	
Th 3/28	§10.1	Induction	§8: 4, 10, 11, 17, 20, 28, 29 §9: 2, 3, 6, 18, 30, 34
T 4/2	§10.2,10.3	Strong induction smallest counterexample	
Th 4/4	§11.0, 11.1	Relations	§10: 2, 5, 10, 13, 32, 33, 34
T 4/9	§11.2, 11.3, 11.4:	Equivalence relations; partitions; Integers modulo $n$	
Th 4/11	§12.1, 12.2	Functions; injective/surjective	§11.1: 2, 4, 6, 8, 9 §11.2: 2, 10, 12, 14, 17 §11.3: 2, 6, 8 ( on 11.3.6 give eq. classes too)
T 4/16	§12.4, 12.5, 12.6	Composition. Inverse. Image/preimage.	
Th 4/18	–	<b>Exam 2</b> Chapters 7-10, 11.1, 11.2, 11.2)	§11.4: 2, 4, 5, 6 §12.1: 1, 3, 6, 9,10 §12.2: 1, 4, 8, 9, 14, 15, 16, 18
T 4/23	14.1	Cardinality of sets	
Th 4/25	14.2, 14.3	Comparing cardinalities	§12.4: 1, 9 §12.5: 1, 6, 10 [hint: piecewise] §14.1: 1, 6, 7
T 4/30	14.4	Final presentations	
Th 5/2	14.4	Last class (wrap up final pres.).	

**Accessibility:** If you have a disability and need accommodations please be sure to contact the Student Accessibility Services Office (315.229.5537) right away so they can help you get the accommodations you require. If you will need to use any accommodations in this class, please talk with me early so you can have the best possible experience this semester. Although not required, I would like to know of any accommodations that are needed at least 10 days before a quiz or test, so please see me soon. For more specific information visit the Student Accessibility Services website

<https://www.stlawu.edu/student-accessibility-services> or

or email them

[studentaccessibility@stlawu.edu](mailto:studentaccessibility@stlawu.edu).

**Academic honesty policy:** Click on the link to the pdf at

<http://stlawu.edu/academic-affairs/resource/academic-honor-policy>

In this course you are encouraged to collaborate on HW, but don't copy your the work of your friends, and never cheat on quizzes or exams. When in doubt, please email me and I'll be very happy to clarify things for you.