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ENGL 393H

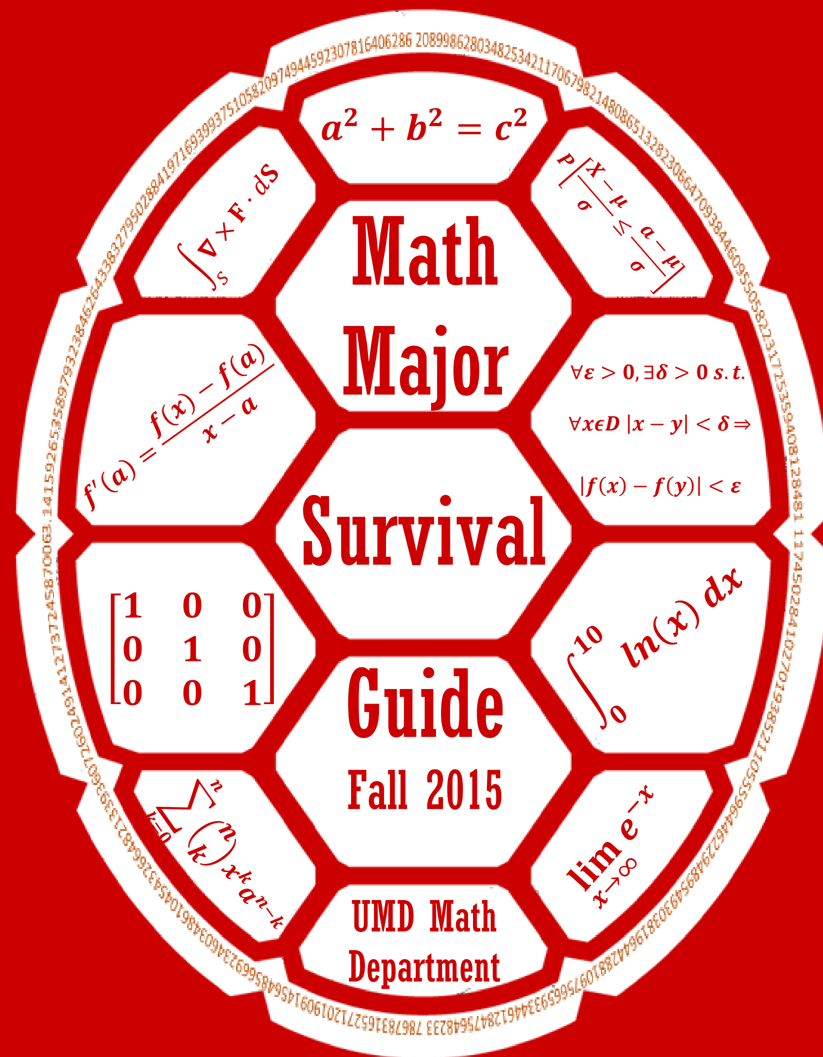
November 23, 2015

Cover Memo

The purpose of the *Math Major Survival Guide* is to help math majors succeed during two traditionally difficult transitional periods in the major: the transition from high school math classes to college computation classes and the transition from computation classes to proof classes. The booklet is written by the UMD Math Department for both incoming freshman and students currently in the major. Freshman math majors would receive this booklet in a packet of welcome materials during their summer orientations. Students who change their major to math or add the major will also receive the booklet. More information about the booklet and its organization can be found in the Purpose section of the booklet.

The booklet is formatted so that every page in Word contains two mini-pages. The first Word page contains the front and back cover of the booklet. The front cover is on the right mini-page and the back cover is on the left mini-page. Every page after the table of contents is numbered in the bottom left or right corners. Every two mini-pages is supposed to be viewed as if they are a page spread in a printed booklet.

I have included in my submission the booklet, cover memo, and a bibliography of my images. If an image is not accounted for in the annotated bibliography, it is a clip art image or one I made myself. I decided to stick with MLA formatting. I understand that in-text citations would normally not appear in a professional booklet.



mathematics
university of maryland

UNIVERSITY OF
MARYLAND

Math Major Survival Guide

UMD Math Department

The only way to learn mathematics is to do mathematics.

PAUL HALMOS

Table of Contents

1 Purpose

The purpose of the *Math Major Survival Guide* is to help math majors succeed in their math classes during two traditionally difficult transitional periods: the transition from high school math classes to college computation classes and the transition from computation classes to proof classes.

The booklet is organized into four parts: introductory material, computation classes, proof classes, and resources. The introductory material contains information about the math major at UMD and administrative topics. Look in this section if you would like to learn about the classes math majors take, what you can do with a math degree, why a syllabus is useful, and time management.

The second section is helpful to students in computation classes. It outlines how your college computation classes are different from your high school math classes. The third section is useful for students in proof classes. It describes how proof classes are different from computation classes.

In both sections, you can find a number of strategies for success, such as effective notetaking methods, how to read your textbook, completing homework assignments, and studying for examinations. While many of the topics covered in these two sections are the same, the details provided in each section vary. Reading both sections over your college career will help you do well in your math courses.

The fourth section provides a list of resources for students in both computation and proof classes. It includes information about the various tutoring services at UMD, how

to make office hour visits productive, and Help Sessions for proof classes.

If you take advantage of the strategies provided in this guide and apply them to your classes, you should do quite well.

Go Terps!

2 UMD Math Major Overview

Congratulations on deciding to major in math! If you are reading this booklet for the first time as a freshman, congratulations on your acceptance to UMD! You should be proud of your accomplishments and excited for the next four years. This section provides a brief overview about the math program at UMD and what you can do with a math degree.

UMD Math Major

There are four tracks you can take as a math major: the Traditional track, the Statistics track, the Applied Mathematics track, and the Secondary Education track. These tracks each start out with the same sequence of introductory computation courses:

- MATH 140 Calculus I
- MATH 141 Calculus II
- MATH 241 Calculus III
- MATH 240 Linear Algebra
- MATH 246 Differential Equations

All math majors must take a computer science class and a three course supporting sequence in an area other than mathematics. Options for the computer science and the supporting sequence requirements are provided on the next page.

Computer Science Options
• CMSC 122 Introduction to Computer Programming via the Web • CMSC 106 Introduction to C Programming • CMSC 131 Object-Oriented Programming I • CMSC 132 Object-Oriented Programming II • ENAE 202 Aerospace Computing • ENEE 150 Intermediate Programming Concepts for Engineers • PHYS 165 Introduction to Programming in the Physical Sciences • AOSC 358L Computing and Data Analysis: Deciphering Climate Change Clues

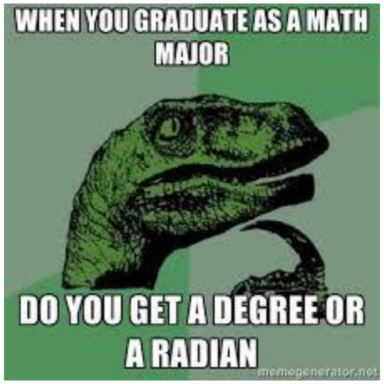
Supporting Sequence Options (3 courses from 1 option)
• Physics • Engineering • Computer Science • Chemistry • Economics • Business Management • Biological Sciences • Astronomy • Geology • Atmospheric and Oceanic Sciences

All majors, regardless of track, take MATH 310 Introduction to Mathematical Proof unless exempted due to earning A grades in MATH 240 and 241. However, exempted students should still take 310 to be successful in MATH 410 Advanced Calculus I, another class all majors are required to take.

Computation classes are different from proof classes and do not prepare you for the rigors of proof courses. It is a good idea to gain some experience with proofs in MATH 310. All students in MATH 410 are expected to know the material covered in MATH 310 from the start of class. The 310 material is not reviewed at the beginning of the semester.

The tracks diverge after MATH 410. Each track requires eight upper level classes, many of which involve proofs, to complete the major. Some of these classes overlap between the tracks. More information about the specifics of each track can be found online.

Please consult the UMD Math Department website for more details on each math track:
http://www-math.umd.edu/course-requirements.html



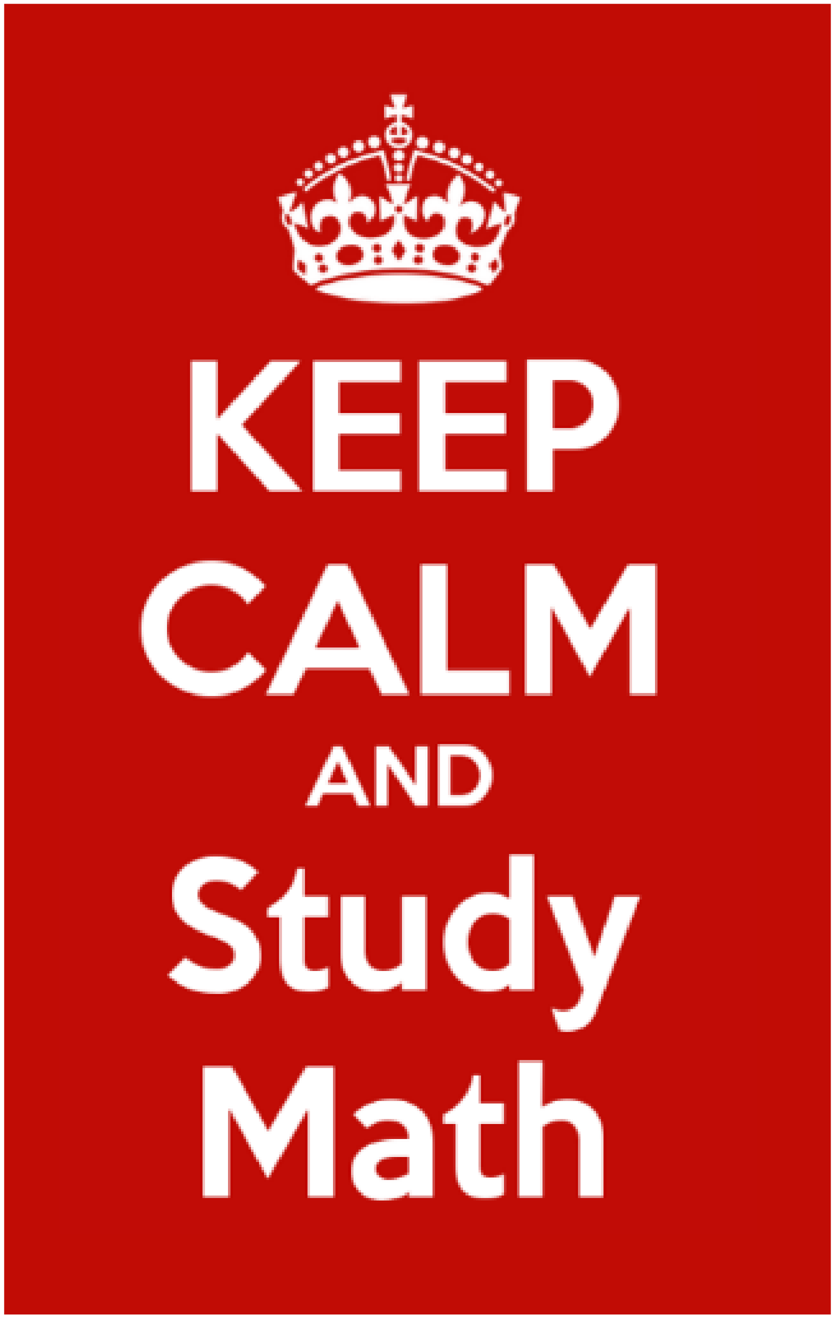
What Can **You** do with a Math Degree?

Students have the choice of attending graduate school in mathematics or any subject that relies on mathematics like engineering, physics, economics, or chemistry or a diverse selection of careers. Some careers that use mathematics are teaching, actuarial science, computer science, operations research, biomathematics, cryptography, and finance.

The Mathematical Association of America claims that Mathematician was ranked the best job in 2014 by the site CareerCast. Furthermore, statistician and actuary, other professions that use math, were ranked third and fourth respectively. Many careers use math like engineering and computer science. These careers require problem solving skills and analytical thinking that mathematics students learn to excel at.

By studying mathematics, you are setting yourself up for many career options and a good chance of finding a job that you will enjoy.

Check out these two sites for more information on careers that use math:
http://www.maa.org/careers
http://www.math.duke.edu/major/whyMajor.html



3 Administrative

This section covers information on syllabi, course websites, time management, and UMD's Honor Code. Understanding your classes' and UMD's policies as well as how to stay organized is key to your success.

3.1 Navigating the Syllabus

Course syllabi serve three main purposes: a contract, a permanent record, and a tool for learning (Parkes and Harris 55). The policies and procedures students and teachers must abide by are outlined in the syllabus. In order to do well in your math classes, you need to know what the policies are and follow them.

For example, understanding what the procedure is for requesting a make-up exam is extremely important. If you are too ill to take an exam, you must follow the policies outlined in the syllabus to schedule a make-up exam. If you don't, you will receive a zero on the exam.

Additionally, syllabi contain other important details like where the offices of your teacher and TAs, graduate students who serve as teaching assistants, are and when you can visit them for help. Every syllabus will have information on what material you are responsible for learning and when you must learn it by. Sometimes there may be important instructions on formatting homework assignments; you may lose points if you don't follow them. So read and make sure you understand your syllabus; it will help you do well in the class!

Let's look for key information together:

MATH 246, SPRING 2015 SECTIONS 03XX,
TU-TH 11 - 12:15 ARM 0126

A current, updated copy of this syllabus will be available at
www.terpconnect.umd.edu/~fibich

Dr. G. Fibich, SCIC Bldg. 4125. e-mail: fibich@umd.edu
Office hours: Thursday from 2 to 3 or by email appointment

Discussion sections
0311 W 8:00am - 8:50am MTH 0407 Chae Clark
0312 W 8:00am - 8:50am MTH 0409 Addison Bohannon
0321 W 9:00am - 9:50am MTH 0407 Chae Clark
0322 W 9:00am - 9:50am MTH 0409 Addison Bohannon
0331 W 10:00am - 10:50am MTH 0407 Chae Clark
0332 W 10:00am - 10:50am MTH 0409 Addison Bohannon
0341 W 11:00am - 11:50am MTH 0407 Chae Clark
0342 W 11:00am - 11:50am MTH 0409 Addison Bohannon

Graduate assistants' contact information and office hours:
Chae Clark, math 2121, Cclark18@math.umd.edu.
Office hours: Monday 10am-11am, Tuesday 3pm-4pm, Tutoring Room (MATH 0301) Thursday 10am-11am

Addison Bohannon, CSS 4326 , addisonb@math.umd.edu,
Office hour: Wednesday 3:30-5:30pm, Tutoring Room (MATH 0301) Friday 12-1pm

Please feel free to come to any of these office hours.

Textbooks: On-line notes by Prof. Levermore
https://courses.math.umd.edu/math246/NODE/1415S/main.html
(log in with your University username and password), and a Matlab textbook by Hunt, Lipsman, Osborn, Rosenberg , Differential Equations with Matlab, **third** edition.
The final grade will be based on Matlab Homework (10%), three 20 minutes in-class quizzes (20%) three in-class exams (40%), and a uniform final exam (30%).

Students with less than 50% of the maximum possible will receive an F. I expect the C/D cutoff to be around 60%.
The most recent exams (given by Prof Levermore) can be found at
1

3.11 Office Hours and Contact Information

Office hours are times when students can visit their teachers and TAs for help. The times and locations for office hours are usually posted at the top of the syllabus. Some professors have more than one office, so double check ahead of time that you are going to the right one. If office hours conflict with your schedule, oftentimes you can arrange an alternate meeting time with your professor. The best way to do so is by email. If you speak to a teacher after class about meeting, they may forget the conversation. Most instructors include their email address in the syllabus and students to contact them with questions or concerns. Some provide a phone number. More information about how to prepare for and make the most out of office hours can be found in the Resources section.

3.12 Class Materials

Information on the textbook and any other resources like a solutions guide are usually included in syllabi.

3.13 Grades

Teachers usually post standard grade cutoffs in their syllabi such as A 90-100, B 80-89, and so on. These cutoffs are approximate or ideal. More often than not, the grade cutoffs are readjusted at the end of the semester based on the class' overall performance. Generally, cutoffs are lowered. Sometimes individual assignments like exams will be curved so that the grading scheme provides a more even distribution of grades. If the grading scheme is unclear or you have any questions about it, talk to your instructor.

3.14 Exams and Quizzes

Exam and quiz dates are usually included in syllabi. They are major grading events. It is important not to miss an exam or quiz. If you do, you will need to look in the syllabus for any policies on making up exams. Be on the lookout for suggested study materials in syllabi. This syllabus has a link to practice exams.

`http://www.terpconnect.umd.edu/~lvrmr/2013-2014-F/Classes/MATH246/Exams.html`

These will serve as practice exams for our class.

Quiz dates:
Tuesday, February 10
Tuesday, March 10
Tuesday, April 21

Exam dates:
Thursday, February 19
Thursday, April 2
Tuesday, May 5

Uniform final exam: Thursday, May 14, 1:30-3:30pm at a location to be announced later.

Make-up policy: **There will be no make-ups for in-class exams or quizzes.** In the case of an absence due to illness, religious observance, participation in a University activity at the request of University authorities, or other compelling circumstances, your blank grade will be replaced by the average of your other in-class exams (respectively, quizzes).

The major grading events for this class are the three in-class exams and the final. I will accept a self-signed note which acknowledges valid reasons for missing one exam, but will require formal written documentation (such as from a medical provider) for subsequent absences.

After each in-class exam or quiz students have one week from when the exam is returned to appeal the grading. Appeals for the final grade must be made in writing. **No appeals for regrading work done during the semester (including the third exam), can be made after the day of the final exam.**

On exams students must write by hand and sign the following pledge:
I pledge on my honor that I have not given or received any unauthorized assistance on this examination.

During exams, students are expected to apply the ideas they learn to some problems that are significantly different from the examples and homework they have seen.

3.15 Class and Homework Schedules

The class and homework schedule are usually combined in some way. In this syllabus, there is a homework schedule. However, you can deduce what topics will be covered in each class period from the assigned homework. Some schedules are organized by week, such as the one below. Others may be organized by day. Usually the topics covered correspond to sections in the textbook, so you can easily look up information or work ahead. Schedules can help you see what material will be covered on quizzes and exams.

The following problems from the on-line notes by Dr. Levermore will assigned, but should not be turned in. You should keep your work in a notebook, and check your answers against the ones in the notes. Some of these problems will appear on quizzes and in-class exams.

Problems for February 4
I.1 (3)-(6)
I.2 : (1 a, b, f), (3), (4), (6), (7), (8), (12), (15), (16)
I.3: (1), (7), (6), (7), (10), (12), (13), (15), (17)
I.4 (2), (3), (6)

Problems for February 11
I.5 (1), (2), (3), (4), (6)
I.6 (2), (6), (7), (8), (15)

Problems for February 25
I.7 (2), (3), (4), (10)

Problems for March 4
I.8 (1), (3), (6), (8), (12), (18)
I.9: Not covered.
II.1: (8)
II.3: (1a), (1b), (3a), (4a), (11)

Problems for March 25
II.2: (1), (3), (7), (8), (11), (16), (18), (20), (31), (32)

Problems for April 1
II.4: (1)–(4), (6), (8), (10), (11), (15), (17), (33), (35), (37), (40)
II.5: (2), (5), (9), (10)
II.6: (2)–(5), (13), (15), (19)

Problems for April 8
II.6: (21)–(23), 25, 26
II.7 (1), (2), (4), (23)

3.2 Course Websites

Some teachers opt for a course website instead of a syllabus. Some websites are more complicated than others. Here is an example of a site that contains a lot of information but is well organized.

Office hour information is displayed at the top. Take note that the instructor has two offices. Email addresses for the teacher and TA are provided as well.

Important announcements are displayed in the middle including an update to the notes and the date and time of the final exam. Since websites can be updated any time, it is important to keep checking the site for major changes and announcements.

Links to other pages provide greater detail on the topics listed below. The Office Hours link explains the instructors schedule for his two offices. Notes and Homework are useful resources for completing homework and studying for exams.

Website for MATH 410, Section 0201 Advanced Calculus I, Fall 2015

This website contains the official syllabus for the course.

Lectures: 9:30am - 10:45am Tuesdays and Thursdays in MTH 0104
Website: http://www.terpconnect.umd.edu/~lvrmr/2015-2016-F/Classes/Math410.shtml

Instructor: Professor David Levermore
Office: CSS 4309 and MTH 3313
Phone: 301-405-5127 and 301-405-5067 respectively (If I am not there then use e-mail.)
Email: lvrmr"at"math.umd.edu (Please include ``MATH 410'' in the subject heading.)

Grader: Scott Schmieding
Office: MTH 4312
Email: scott"at"math.umd.edu (Please include ``MATH 410'' in the subject heading.)

The Headlines

- **Eleventh Homework** is due on Tuesday, 17 November.
  Twelfth Homework is due on Tuesday, 24 November.
  Thirteenth Homework is due on Tuesday, 1 December.
  Fourteenth Homework is due on Tuesday, 8 December.
  Fifteenth Homework is not collected.
  This material is covered on the Final Exam.
  Click below on "Homeworks" for more details.
- A new version of **Riemann Integrals and Integrability** was posted on 14 November.
  Changes from the 7 November version are minor.
  Click below on "Class Notes" to find them.
- **Final Exam** on Tuesday, 15 December, 8:00am to 10:00am in classroom.
  Click below on "Exams" for more details. GOOD LUCK!
- Class Notes are Available Covering:
  - **Real Numbers** (7 October version)
  - **Functions and Regularity** (11 October version)
  - **Riemann Integrals and Integrability** (7 November version)

  Click below on "Class Notes" to find them.
- Special Math 410 Help Sessions
  Click below on "Help Sessions" for more details.
- Calculus Review Notes are available
  Click below on "Calculus Notes" for more details.

The Details

- Office Hours
- Help Sessions
- Class Notes
- Texts and other Resourses
- Calculus Review Notes
- Description and Prerequisites
- Syllabus
- Exams
- Homeworks
- Grading Policies
- Attendence and Drop Policies

3.3 Time Management

Math classes are challenging and require a great deal of time to master the material. The math advisors warn that working over ten hours a week is not conducive to academic success. It is important for you to manage your time so that you can complete your homework, study, and have fun.

Try to start assignments as early as possible so that you have more time to get help if you need it. For computation classes, strive to complete the assigned homework problems the day the corresponding topic is covered in class. Waiting any longer puts you at risk of falling behind. For proof classes, brainstorm ideas about how you might use what you learned in class that day to solve any homework problems.

It is important to review daily. Study strategies will be covered later in the Computation Classes and Proof Classes sections. Having a plan to complete your math assignments as well as assignments in your other classes will keep you organized and prevent you from forgetting to do an assignment or falling behind. Two strategies you can use are making a weekly schedule of tasks you need to accomplish each day and a semester calendar, which provides a big picture of the semester. The semester calendar will let you see into the future and plan out your weekly schedule more effectively. Sometimes your weekly schedule can be extracted directly from the semester calendar.

It is a good idea to make a digital weekly schedule and semester calendar so that you can easily make an update if the date of an assignment is changed. An example of a month from a semester calendar can be found on the next page.

October

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1 MATH: Exam #1 STAT: Exam #1	2 ENGL: MWA2 ECON: APL	3
4	5 ENGL: reading ECON: Exam 1	6 MATH: HW #5	7 ENGL: discussion post ECON: A9-AB	8	9	10
11 Birthday! ECON: APL	12 ENGL: reading ECON: 10	13 MATH: HW #6	14 ENGL: MWA3 draft and discussion post ECON: 10	15 ENGL: peer review	16 ENGL: MWA3	17
18 ECON: APL	19 PHIL: short resp ECON: 10, 11 ENGL: major project conference #1 + MWA5 Proposal	20 MATH: HW #7	21 ENGL: discussion post and Self Reflective Essay #2 ECON: 10, 11	22	23	24
25 ECON: APL	26 ENGL: reading, correspondence, and executive summaries ECON: A11-A,B,12	27 MATH: HW #8	28 ENGL: discussion post + MWA4 draft ECON: A11-A,B,12	29 ENGL: peer review	30 ENGL: MWA4	31

3.4 Honor Code and Academic Honesty

Every student at UMD is charged with upholding the university's honor code. This means that students do not cheat or plagiarize on their homework, examinations, or quizzes. In math classes, you will sign the honor pledge after taking an exam.

Honor Pledge:
I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination.

For more information visit:
http://shc.umd.edu/SHC/StudentAcademicDishonesty.aspx

4 Computation Classes

The fundamental problem with today's college students is that most arrive thinking that college is a simple continuation of high school.
– Steven Zucker, Johns Hopkins University

The math classes you took in high school were calculation based. Your college computation classes are also calculation based; however, they will be very different from your high school classes. Your classes will be much faster paced in college. Exams will cover weeks of material, and finals are generally cumulative. You will have to understand the big picture behind the methods introduced to you rather than how to solve specific problems. Oftentimes, you will be asked on an exam to apply something you have learned to a problem or scenario you have never seen before. So, you will need a good grasp of the material and the ability to adapt what you know to solve new problems.

Much of your learning will take place outside of the classroom. You can't rely on the professor to teach you everything. He or she is more of a guide in college. Many of the strategies you used in high school to do well in your math classes like cramming the night before a test may no longer serve you. You are responsible for your own learning. You may need to spend two hours or more for every hour that you are in class to master the material (Zucker).

The number of hours outside of class may seem daunting, but this guide will help you work efficiently to reduce the amount of time you will need to spend outside of class. Further resources can be found in the Resources section at the end of the booklet.

4.1 In the classroom

4.11 Coming to Class

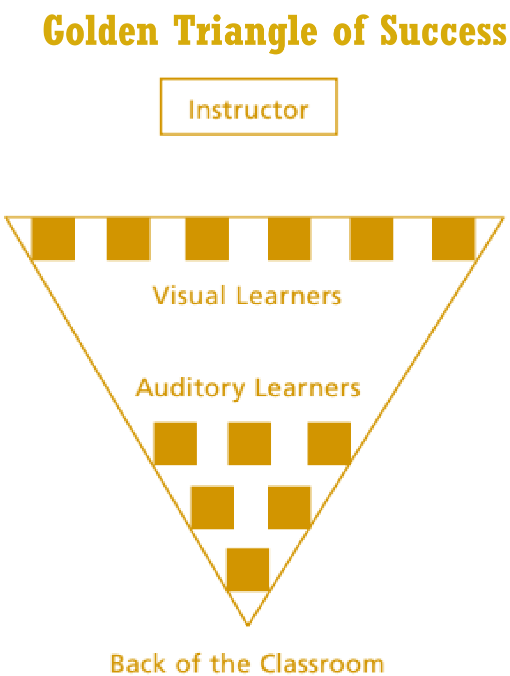
It might seem obvious that you should go to class if you want to learn, but many students skip their classes. The introductory classes are in large lecture halls. Students realize that their presence or lack thereof will not be noted by the instructor. Some do not attend because of laziness. Or, they think that they already know it all.

Every bit of exposure you can receive on the material will help you learn it. Also, sometimes teachers give pop-quizzes in class or extra credit opportunities, and you don't want to miss those.

A study on class attendance in college found that class attendance is a better predictor of college grades than studying skills and amount of time spent studying (Credé et. al 288). So, go to class!

4.12 Managing Distractions and Paying Attention

- Sit towards the front in the center. Your computational classes will be in large lecture halls in the Armory. The chalkboards in the Armory are long and if you sit at the end of a front row you may have difficulty seeing the other side of the board. There will be less to distract you if you sit up front. Also, the teacher will be more likely to see you raise your hand if you have a question and call on you. It is best for visual learners to sit in the front.
- If you prefer to sit in the back, try to sit in the middle row to have a better view of the board. Sit in the back, middle section if you are an auditory learner.



- Put your phone away! Classes move quickly and any moment you are not focused on the lecture, you fall behind.
- Put your laptop away! Take notes with pencil and paper. It is difficult to take math notes on a laptop. If you take notes on a tablet, make sure you discipline yourself not to leave the notes application.

4.13 Taking Notes

This section provides some general notetaking tips and two notetaking methods. It is a good idea to create your own shorthand or abbreviations to save time writing. Color coding with pens and highlighters may help you organize your notes; however, it is usually best to take notes in pencil in case you or the professor makes a mistake and you have to correct something. Here are some times when you should definitely take notes:

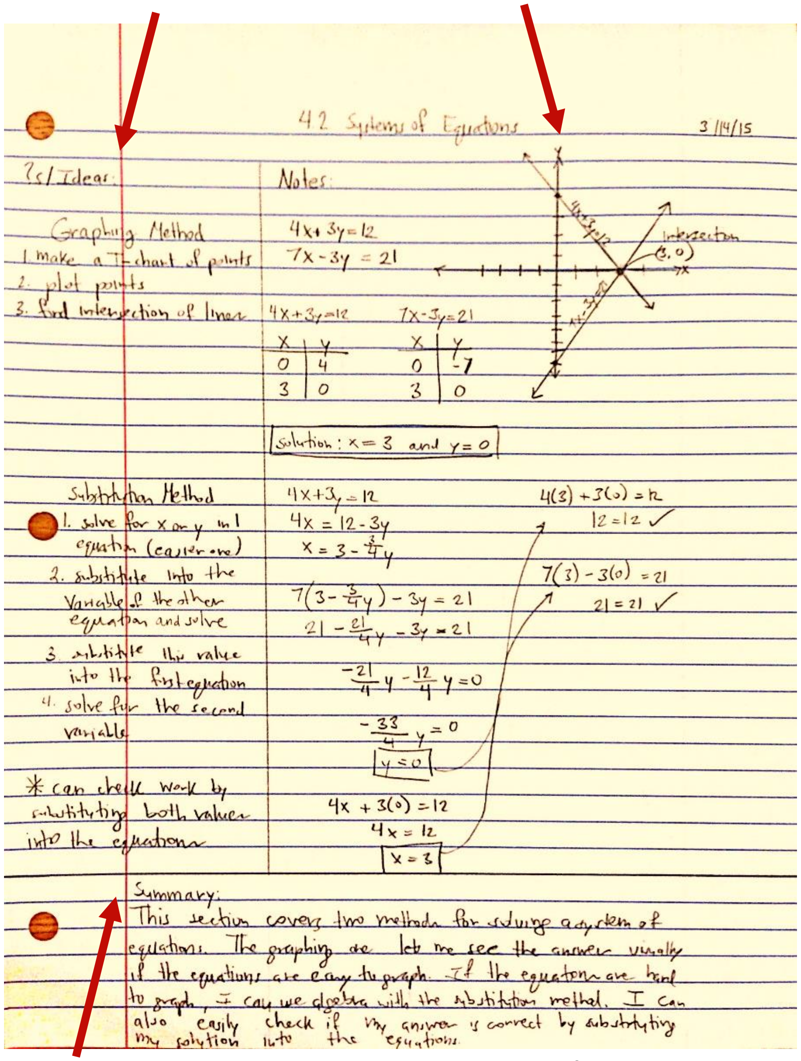
- The professor says a problem is difficult or that a problem like it will be on an exam.
- The professor does multiple examples of a similar problem type.
- The professor provides a summary of an idea or what he or she just covered.
- The professor lists steps or information and repeats the information many times (Nolting 55).

There are two notetaking methods useful for taking notes in computation classes: the Cornell method and the Outline method. Examples of each method are provided on the next two pages. Experiment to see which one you like best or is more natural to you.

Cornell Method

Big ideas and questions go in the smaller left column.

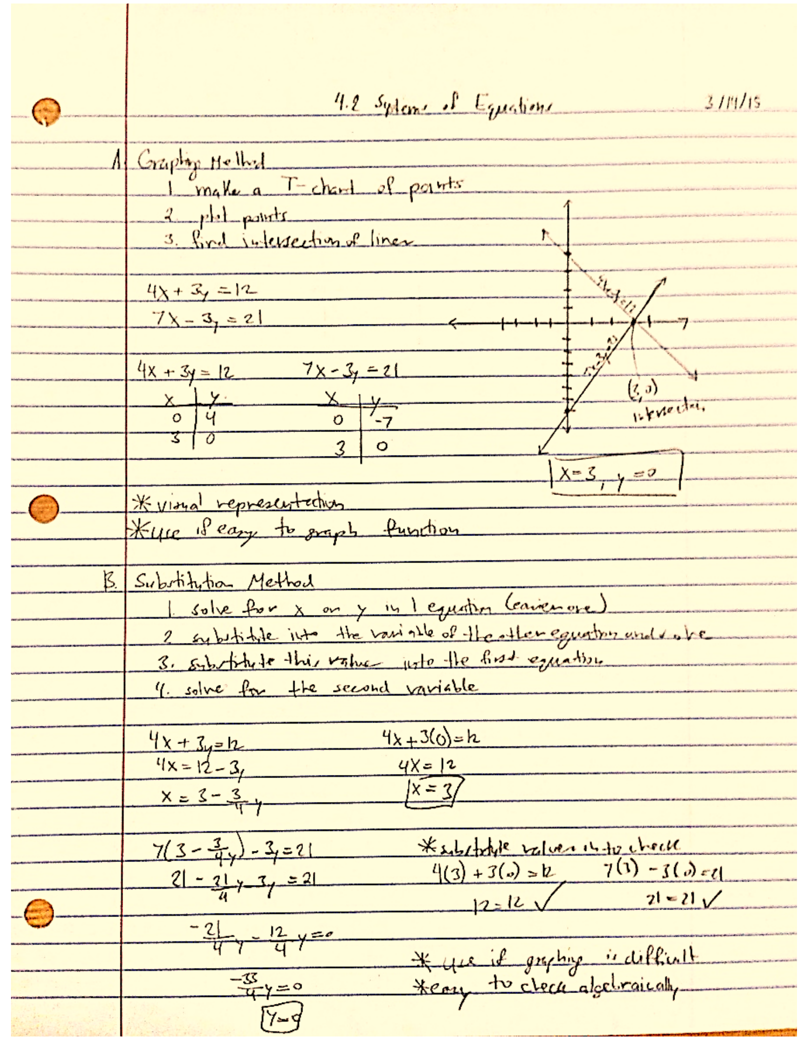
Notes go in the larger right column.



A summary goes at the end. You can write this after class to review your notes. When you go back to study the notes, you can read the summary to refresh your memory.

Outline Method

Notes and important information are arranged in an outline format. The order is based on how the material is presented in class.



4.14 Discussion Sections

Discussion sections are extra class periods led by TAs to review course material. Many students do not attend discussion sections because they think they are not required. While discussion sections do not require your attendance, they are required for your success in the course because they provide extra assistance on and review of the material.

Discussion sections can be organized a number of ways. Sometimes discussion is a review of the week's material. The TA overviews what was covered and asks the students if they have any questions. These kinds of discussions are useful to you because you can clear up any areas of confusion you may have. In some discussions, TAs will go over any questions you have on homework problems. So, it is important to do the homework problems before you attend discussion.

In other discussions, you will work on quizzes or worksheets. It is especially important not to miss these discussions as the assignments are factored into your grade. Furthermore, worksheets provide extra practice on the material that will greatly benefit you. Worksheets are usually done in groups, and you can meet potential study buddies by working on the worksheets. Whichever way discussions are organized, they are designed to help you, so take advantage of them!

4.2 At Home

4.21 Reading the Textbook

You may have never read your high school math textbooks. Perhaps you looked at a couple of examples in the text when you had difficulty with a homework problem. In college you will need to read your math textbooks in order to learn the material. Many teachers provide only an outline of the material in class. It is your responsibility to fill in the gaps by reading the textbook.

You may need to read a section in the textbook more than once. In fact, it is quite helpful to first skim the section to see what it covers and then complete a close reading (Saltzman and Coffin 2).

Reading a math textbook effectively requires three steps:

1. Previewing:
   Before you begin reading, you should think about what you already know about the material and articulate to yourself what you would like to learn from the reading.
2. Reading:
   Monitor your comprehension by paraphrasing what you have read. Think about how what you are reading fits into your existing knowledge.
3. Post-reading:
   After you have finished reading, summarize what you have read and try to apply the information in new situations by trying some problems (Draper 34).

A more detailed version of these strategies is found on the next page.

Things a Good Reader Does While He or She Is Reading Math

Before Reading	**Previews** the text by looking at the title, the pictures, and the print in order to evoke relevant thoughts and memories.	Skim the lessons you are about to read. Write down all boldface words and determine how well you know these words.
	Builds background by activating appropriate prior knowledge through self-questioning about what he or she already knows about the topic, the vocabulary, and the form in which the topic is presented.	Write down the title of the lessons; brainstorm what you think these words mean and what you already know about these concepts. Draw pictures of things the title and boldface words bring to mind.
	Sets purposes for reading by asking questions about what he or she wants to learn.	What do you want to learn? What do you want to find out? Write it down!!!
During Reading	**Checks understanding** of the text by paraphrasing the author's words.	Write a brief summary of each paragraph. Write your own example similar to the ones the author provides in the book; write your own solution to that example.
	Monitors comprehension by using context clues to figure out unknown words and by imaging, imagining, inferring, and predicting.	Write the definitions of previously unknown words or concepts. Predict how this information will be useful in future problems.
	Integrates new concepts with existing knowledge, continually revising purposes for reading.	Write down how this information connects with information you already know. Write down a new purpose for reading after each paragraph or example. Now that you know that, what do you want to know?
After Reading	**Summarizes** what he or she has read by retelling the plot of the story or the main idea of the text.	Write two to three sentences explaining what the lesson is about (*in your own words!*).
	Evaluates the ideas contained in the text.	Decide if the information in the lesson makes sense to you. Decide if you need to re-read the lesson and/or find another source of information in order to get all the learning.
	Makes applications of the ideas in the text to unique situations, extending the ideas to broader perspectives.	Do some problems following the lesson. Think about how the new information goes together with your previous knowledge.

4.22 Homework

The only way to learn math is to practice solving problems. You should make studying a part of your homework. This means before diving into the problems, you should review and reflect on your notes. If you forget something when solving a problem, you can refer to your notes. This will further solidifying the concept in your mind.

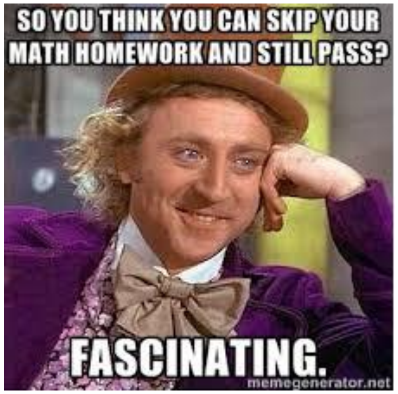
It may be useful to make notecards on the challenging homework problems. You can write the problem on one side of the notecard and the solution on the other. This will help you remember how to do the hard problems. You can then review the notecards and think about how you would solve the problems. Thinking about how to solve difficult problems will help you solve problems more quickly on exams.

There are two kinds of homework assignments in computation classes: WebAssign and Ungraded Assignments. This section describes both types of assignments and how to complete them.

4.22.1 WebAssign

WebAssign is an online homework system that is used in MATH 140 Calculus I and MATH 141 Calculus II. Questions ask you to type in a number or expression. You are allowed three tries per question. If you are wrong each of your three tries, unfortunately, the correct answer is not displayed. For this reason, it is a good idea to work with someone else or in a group on the assignments. You can work through the problems together and help each other get the right answer. If you don't get the right answer and your partner or partners do, they can explain the solution to you.

Also, the assignments are usually due two days after the material is covered in class. It is important to start the assignments as soon as possible so that you have enough time to complete them and ask for help if you need it.



4.22.2 Ungraded Assignments

You will have ungraded assignments in MATH 241 Calculus III, MATH 246 Differential Equations, and MATH 240 Linear Algebra. The trouble many students have with ungraded homework assignments is that they put off doing them. This is a major mistake! When an exam comes around, they realize that they should do the problems. They have accumulated a long list of problems and will likely not have enough time to complete all of them and master them to the level one needs to be successful on the exam.

The hardest part about completing ungraded homework assignments is making it a priority to do them. Every day you have lecture, you should try to complete the problems that pertain to the material you learned that day. Doing so will help you retain the concepts and keep you disciplined. Also, starting the problems sooner rather than later will allow you plenty of time to ask for help with difficult questions.

4.23 Studying for Assessments

There are three types of assessments in computation classes: quizzes, midterms and final exams.

4.23.1 Quizzes

You will probably have between 14 and 15 quizzes a semester, which means there is one quiz a week. Usually the best 10 quiz scores are counted, so if you don't do so well on a few quizzes, it isn't a big deal. Sometimes quizzes are scheduled during discussion; other times quizzes will either be scheduled or randomly given during class time.

The best way to prepare for quizzes is to complete all of the homework problems. Usually quizzes have problems directly from the homework or problems similar to ones on the homework.

Study Break!

Your ability to learn wanes if you do not take occasional study breaks. It is a good idea to take a break after working for 45 minutes to an hour. If you feel that your mind is wandering it may be a good time for a break (Nolting 78). Be careful not to take too many breaks. You may want to create a study schedule with beaks. If you push yourself to do a lot during the study time, your break will be much more rewarding and you will be more productive too.

4.23.2 Midterms

You will have three to four midterms in your computation classes. To prepare for them, you should gather the relevant homework problems, practice exams, and quizzes. If your teacher does not provide you with practice exams, the Test Bank section in Resources explains how you can find some. Studying with others is also useful. When studying if you come across something you do not understand, ask for help.

It is especially important to do well on the first exam, as this exam covers the easiest material and can serve as an insurance policy if you do not do as well on future exams (Nolting 7-8). It is much harder to improve your grade at the end of the semester than consistently putting forth a good effort throughout the semester.

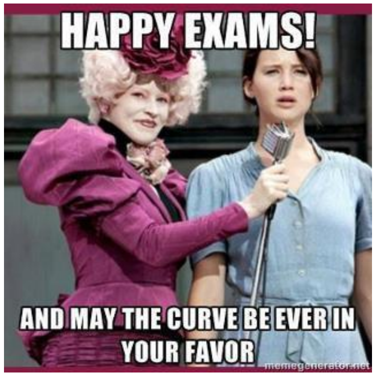
4.23.3 Final Exams

The first day of class is when you start preparing for the final exam. – Paul Nolting

Math final exams are challenging because they are usually cumulative. Therefore, you should gather all of your midterm exams, quizzes, homework problems, and midterm and final practice exams. You can find additional practice exams using the Test Bank. Details about the Test Bank can be found in the Resources section. Studying with others is also useful. When studying if you come across something you do not understand, ask for help.

Introductory math classes usually have their final exams on the first day of final exam week. It is extremely important that you begin studying for the exam as soon as possible.

If you are taking two introductory courses, you will need to talk to your math professors about taking one final at an alternate time. This is usually not difficult to arrange as many students are in this position each semester. It is important, however, to let your teachers know that you are taking more than one math class early so that they can accommodate you more easily. Usually you take the higher numbered class at the designated time and reschedule the lower numbered one.



4.24 Taking Assessments

Studying for a quiz or exam is only half the battle. You also need to know how to take an exam to maximize your score. Here is a list of test taking tips (Saltzman and Coffin 8):

- Scan over the test and identify the problem type of each question. Start with the question you think is the easiest or worth the most points.
- Since you will be working very quickly to solve all the problems, you will evidently be make some small mistakes. Check your work after each problem and at the end.
- If you get stuck on a problem, make a note of it and move on. You can come back to it later if you have time. If you don’t have time, you will get some partial credit and the points for the other problems you complete.
- If the wording of question is unclear ask. There may be typos!
- Write down any equations you think are relevant to the problem, even if you are not sure how to use them. You will likely get some partial credit.

5 Proof Classes

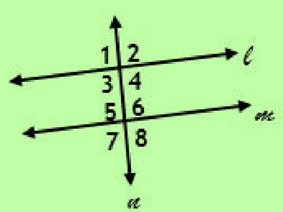
Pure mathematics is, in its way, the poetry of logical ideas. – Albert Einstein

Congratulations on surviving your introductory computation classes! Now you are ready for your next challenge, proof classes. Your proof classes, beginning with MATH 310 Introduction to Mathematical Proofs, will be extremely different from any math class you have taken up to this point.

What is a mathematical proof? A proof is a logical argument of a mathematical statement. You may remember writing two column proofs occasionally in high school Geometry. These proofs were simple to complete as they involved one given or hypothesis and the format was always the same. The proofs you wrote probably went something like this:

Given: ℓ is parallel to m

Prove: $\angle 2 \cong \angle 7$



Statements	Reasons
1. ℓ is parallel to m	1. Given
2. $\angle 2 \cong \angle 6$	2. Parallel lines → corresponding angles $\cong$
3. $\angle 6 \cong \angle 7$	3. Vertical angles are $\cong$
4. $\angle 2 \cong \angle 7$	4. Transitive property of $\cong$

In the proof classes you are taking now or are about to take, you will learn how to read and write proofs that are much more complicated and abstract than the ones you wrote in Geometry.

You have definitely seen a number of proofs thus far in your computation classes. The purpose of the proofs was to explaining the reasoning behind the calculations you performed. You likely ignored the proofs as you were never tested on them. However, math is really about proofs, and to complete the math major you will need to take a number of upper level proof classes.

Hopefully you have taken or are taking MATH 310. It is important to take this class to gain some experience understanding and writing proofs before you are thrust into MATH 410 Advanced Calculus I. Even if you are exempt from MATH 310, it is still a good idea to take the class because your previous experience in math is not enough to prepare you for proof heavy courses.

In your proof classes, you will learn how to be a communicator of mathematics rather than a user of mathematics, as you were in your computation classes. So, you must learn the language of mathematics and how to use it clearly and effectively. There a number of mathematical symbols and expressions as well as writing conventions that you will need to become familiar with. You will need to be able to convince others through proofs that your ideas are correct (Chartrand 1). You can find useful information to help you learn how to write proofs in chapters 0-5 in the MATH 310 textbook *Mathematical Proofs: A Transition to Advanced Mathematics* as well as various online sources.

5.1 In the Classroom

5.11 Coming to Class

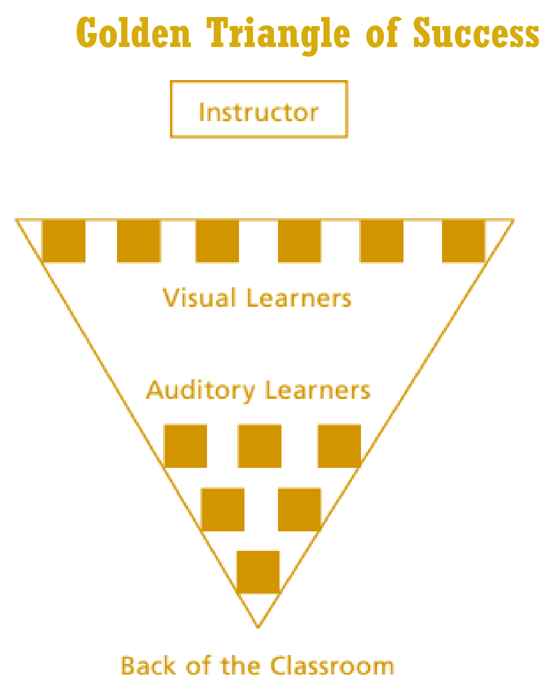
It might seem obvious that you should go to class if you want to learn, but many students skip their proof classes. It is easy to become lost at the beginning of a lecture, fail to comprehend the rest, and leave feeling you learned nothing. Since students think that they are not learning in class, they decide to no longer attend. However, the material is extremely difficult to learn on one's own, and many students end up putting it off. This results in poor grades on homework and exams. This guide will outline a number of strategies to make sure you learn each lecture and help you recover from confusion in class.

Also, your proof classes are much smaller than your computation classes. Instead of sharing a lecture hall with around 200 other students, you are in a small classroom of around 20-25 students. The professor is much more likely to know your name and make an effort to get to know you. Your professor will know if you are not present in class. Coming to class shows the teacher that your value his or her class and are putting in the effort to do well. When assigning final grades, he or she may remember how you were always present in class and bump up your grade if you are close to a cutoff.

While attendance is not mandatory in the sense that part of your grade is attendance, it is mandatory if you want to do well in the class. A study on class attendance in college found that class attendance is a better predictor of college grades than studying skills and amount of time spent studying (Credé et. al 288). So, go to class!

5.12 Managing Distractions and Paying Attention

- Even though your classes will be much smaller, it is still a good idea to sit towards the front in the center. There will be less to distract you if you sit up front. It is best for visual learners to sit in the front.
- If you prefer to sit in the back try to sit in the middle to have a better view of the board. Sit in the back, middle section if you are an auditory learner.



- Put your phone away! Classes move quickly and any moment you are not focused on the lecture will make you fall behind.

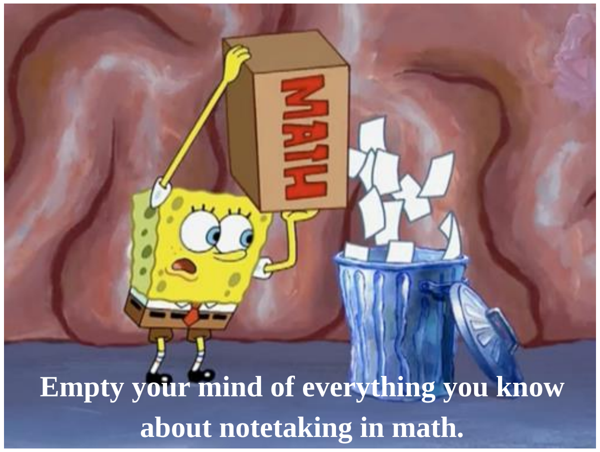
- Put your laptop away! Take notes with pencil and paper. It is difficult to take math notes on a computer. If you take notes on a tablet, make sure you discipline yourself not to leave the notes application. The only exception is if the teacher provides online lecture notes and you would like to refer to the notes as he or she goes through the lecture. As with the tablet, make sure that you are not surfing the web during class! More information on online lecture notes is provided in the next section on taking notes.

5.13 Taking Notes

The main reason why students leave their proof classes without understanding much is because they are not taking notes the right way. You probably wrote down everything your professor wrote on the board in your computation classes and had no trouble following along with what your teacher was saying. In proof courses, it is very difficult to take notes and listen at the same time. It takes a lot of concentration to copy down the symbols and theorems teachers write on the board properly. While you are writing down the information, you are likely missing the important details about the logic behind the steps in a proof or what a theorem means. You will likely become lost in all the symbols and fail to learn anything in class. When you go back to look at your notes, you will have a lot of information that you do not understand.

The secret to taking notes in your proof classes is to not take notes at all. That's right, don't take notes! Many teachers provide online notes for their classes. You can print them out and bring them to class or use your laptop or tablet to view them during class. The reason why it is a good idea not to take

notes is because it eliminates the problem of having to write information down and listen at the same time. Everything you would normally write down is already in the notes, so all you have to do is listen. You will find that it is much easier to follow the lecture and that you will learn a lot more when you aren't taking notes. You can still make notes in your notebook or on the printed notes to emphasize certain points the professor makes or to add anything that he or she shares in class but does not include in the notes. If your teacher does not provide notes, you can bring the textbook to class and follow along in your book (Saltzman and Coffin 3-4).



Empty your mind of everything you know about notetaking in math.

5.2 At Home

5.21 Reading the Textbook

From your computation classes, you are well aware of the importance and benefits of reading your math textbooks. Reading the textbook is also useful in proof classes.

You can still make use of many of the tactics for textbook reading described in the Computation Class section of the booklet. A few more strategies that work well in proof classes are listed here:

- Read your textbook at least twice. During your first reading, it is a good idea to look at the theorems, lemmas, and propositions and how they might all fit together (Tomforde). In your second and following readings, you should try to understand what the theorems, lemmas, and propositions mean.
- Your proof classes each provide a mathematical narrative or story. It is your job to follow along and read all the parts of the story including the examples and pictures. You should think about how the examples and pictures contribute to the mathematical narrative (Tomforde).
- You may get stuck between steps in proofs. If this happens, pause and think about why the steps make sense and attempt to fill in the gaps. You can write inside your book to literally fill in the gaps (Saltzman and Coffin 2).

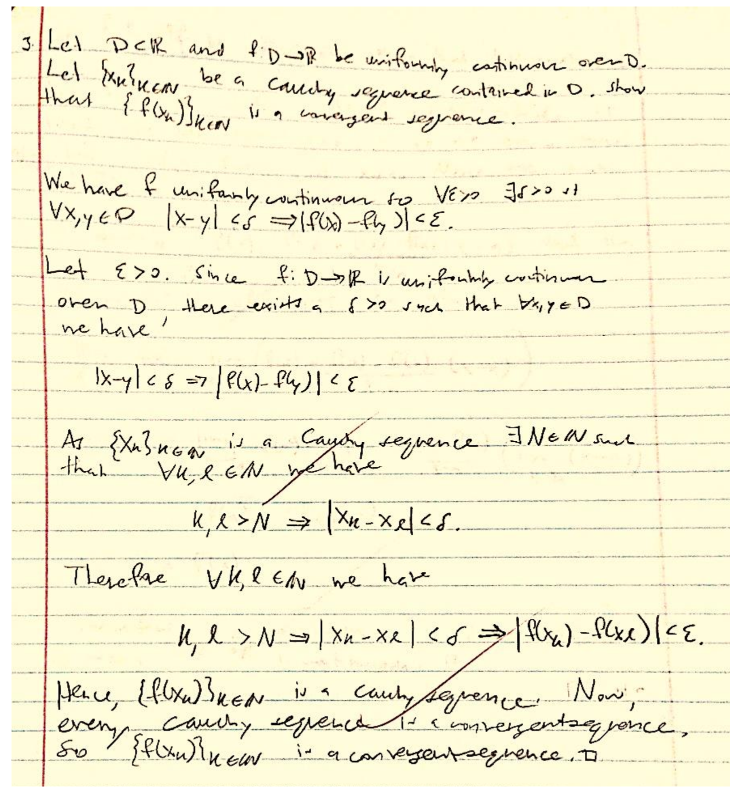
5.22 Homework

Unlike your computational classes, you will have problem sets to turn in for a grade in your proof classes. There will be many times where you first read a problem and think to yourself, "I have no idea how to do that!" The hardest parts of many proof homework problems is figuring out what the

question is saying and how to start. Have no fear! This guide is here to provide some suggestions on how to get started on these difficult problems.

Before attempting to write a proof you should think about what definitions, properties, theorems, and lemmas you may need to write the proof. You should make a list of the all the information you need and write out the statements in full.

Many times writing out the definitions of the hypothesis makes the proof jump out at you from the page. For example, the proof below uses the definitions of uniform continuity and Cauchy sequences to show that the sequence of the function's images is a convergent sequence.



3. Let $D \subset \mathbb{R}$ and $f: D \to \mathbb{R}$ be uniformly continuous over D. Let $\{x_n\}_{n \in \mathbb{N}}$ be a Cauchy sequence contained in D. Show that $\{f(x_n)\}_{n \in \mathbb{N}}$ is a convergent sequence.

We have f uniformly continuous so $\forall \varepsilon > 0\ \exists \delta > 0$ s.t. $\forall x, y \in D$ $|x-y| < \delta \Rightarrow |f(x) - f(y)| < \varepsilon$.

Let $\varepsilon > 0$. Since $f: D \to \mathbb{R}$ is uniformly continuous over D there exists a $\delta > 0$ such that $\forall x, y \in D$ we have:

$$|x-y| < \delta \Rightarrow |f(x) - f(y)| < \varepsilon$$

As $\{x_n\}_{n \in \mathbb{N}}$ is a Cauchy sequence $\exists N \in \mathbb{N}$ such that $\forall k, \ell \in \mathbb{N}$ we have

$$k, \ell > N \Rightarrow |x_k - x_\ell| < \delta.$$

Therefore $\forall k, \ell \in \mathbb{N}$ we have

$$k, \ell > N \Rightarrow |x_k - x_\ell| < \delta \Rightarrow |f(x_k) - f(x_\ell)| < \varepsilon.$$

Hence, $\{f(x_n)\}_{n \in \mathbb{N}}$ is a Cauchy sequence. Now, every Cauchy sequence is a convergent sequence, so $\{f(x_n)\}_{n \in \mathbb{N}}$ is a convergent sequence. □

It is important to get started on the homework as soon as possible because you are definitely going to need help completing it. You need to make sure that you have enough time to meet with others in your class to work together to come up with solutions to proofs. Working together can help you complete your homework faster and you will learn a lot by listening to others explanations as well as making your own explanations (Kouba). You can also attend office hours for assistance.

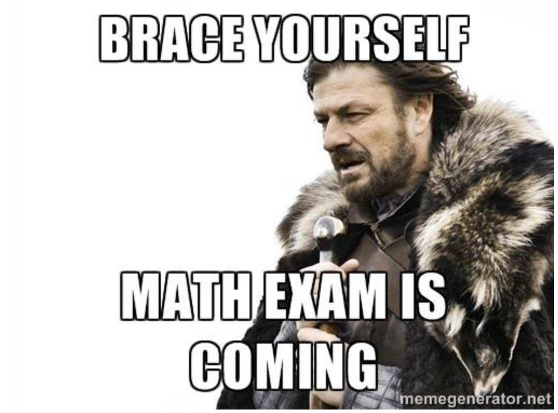
You will learn a lot by completing your homework assignments. Additionally, it is extremely important that you do your homework because, more often than not, homework problems become future exam problems.

Since you are turning your homework in, it is imperative that you turn in a neat, legible copy of your best work every time (Saltzman and Coffin 6). If the grader cannot read your homework, he or she may take off points. Sometimes instructors require their students to format their homework in certain ways. This information is usually found in the syllabus. So, check to see if there are any homework formatting instructions in the syllabus.

Make sure to explain why any assumptions you make are valid. Sometimes it may be unclear whether or not you need to prove a certain fact before you can use it to prove something else. If you are uncertain about whether or not you need to prove something, ask your instructor. It is a good idea to provide as much detail as you can so as to not lose points.

5.23 Studying for Assessments

In proof courses, there are two types of assessments: midterms and final exams. There are usually fewer midterm exams in proof classes than computational classes. It is not abnormal for you to have only two midterm exams. Since there are fewer exams, it is even more imperative that you do well on the exams.



Here are some general studying strategies for proof classes (Stout):

- As you complete your homework problems, you should make an effort to learn not only what the definitions, theorems, propositions, and lemmas say but also what they mean. The sooner you understand them, the easier it will be for you to study for exams. To learn the meanings, it may help to make up your own examples.
- To help you learn all the mathematical statements, you should examine each of the hypotheses individually to determine how they work together and how the statements would fall apart if any of them are missing. Once you understand each hypothesis, you will have a complete understanding of the statement.

- Practice negating statements. You will need to use negated statements in proofs by contrapositive and contradiction. Furthermore, your professor may have question on an exam asking you to negate a statement. Make sure to review the two quantifiers for every and there exist!
- Creating an outline of how mathematical statements relate to one another can help you see the bigger picture and make proof writing easier. You can do this every time you have to write a proof for homework. If you do this enough times, come exam day, you will have a good idea of how the theorems and definitions fit together. Here is an example of an outline:

```
Mean Value Theorem
      Rolle's Theorem
           Candidate Lemma
                Meaning of the sign of the derivative
                     Definition of derivative
                Definition of max and min
      Existence  of  max  and  min   for  continuous  functions  on [a, b]
                Definition of max and min
                Definition of closed interval
                Least upper bound axiom
                Definition of continuity
```

- Once you figure out how to write a proof of a theorem, try to write a second proof of the theorem. If you are able to prove something more than one way you will prove to yourself that you really understand the material.
- The worst thing you can do is to start studying the night before the exam. You need to make studying a priority when you complete your homework assignments. If you start early and are diligent, you will do well.

5.23.1 Midterms

In order to prepare for your midterms, you should gather the relevant homework problems and practice exams. If your teacher does not provide you with practice exams, the Test Bank section in Resources explains how you can find some. Studying with others is also useful. It is important to review your homework problem, as teachers often pull problems from the homework for exams. You should try to avoid memorizing the solutions and instead think about a strategy for solving the problem or problems similar to it. When studying, if you come across something you do not understand, ask for help.

It is especially important to do well on the first exam, as this exam covers the easiest material and can serve as an insurance policy if you do not do as well on future exams (Nolting 7-8). It is much harder to improve your grade at the end of the semester than consistently putting forth a good effort throughout the semester.

5.23.2 Final Exam

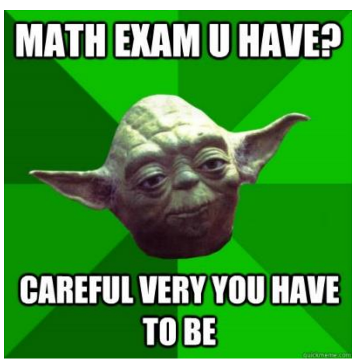
The first day of class is when you start preparing for the final exam. – Paul Nolting

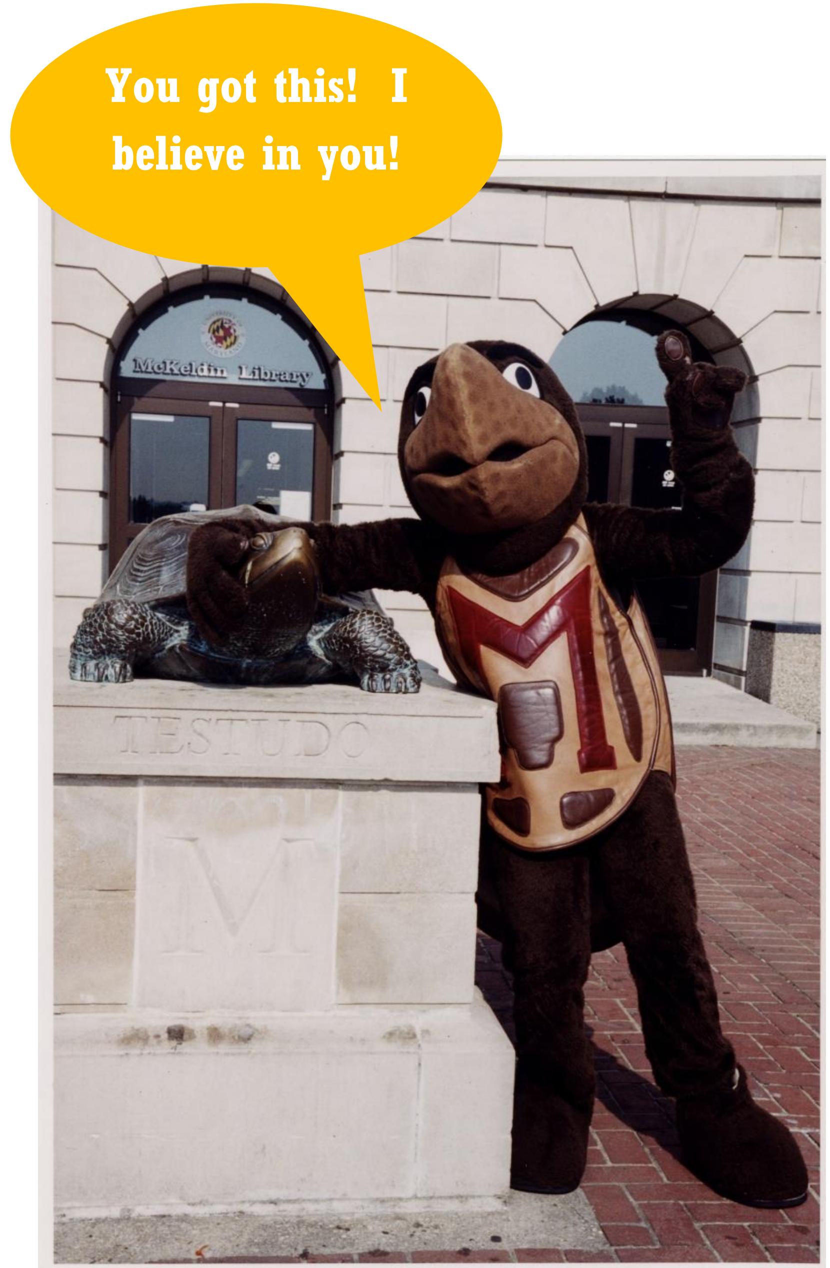
Math final exams are challenging because they are usually cumulative. Therefore, you should gather all of your midterm exams, homework problems, and practice exams for both midterms and final exams. You can find additional practice exams using the Test Bank. Details about the Test Bank can be found in the Resources section. Studying with others is also useful. When studying, if you come across something you do not understand, ask for help.

5.24 Taking Exams

Studying for a quiz or exam is only half the battle. You also need to know how to take an exam to maximize your score. Here is a list of test taking tips (Saltzman and Coffin 8):

- Scan over the test and identify the problem type of each question and start with the question you think is the easiest or worth the most points.
- Since you will be working very quickly to write the proofs for each problem, you will evidently be making some small mistakes. Make sure to check your work after each problem and at the end.
- If you get stuck on a problem, make a note of it and move on. You can come back to it later if you have time. If you don't have time you will get some partial credit and the points for the other problems you complete.
- If you get stuck, write down the relevant hypotheses and definitions and theorems. Many times having all of the information in front of you will lead to a proof. If you can't figure it out, it's ok, you will likely get a good amount of partial credit for knowing the information related to the problem.





6 Resources

Seeking help is not a sign of weakness but one of strength. Your professors and TAs welcome your questions and are happy to help answer them. Asking for assistance understanding the material shows professors that you are interested and dedicated to doing well in the class. Here are a number of resources that will help you be successful in your math classes. If you seek out help, you will find it!

6.1 Office Hours

In order to make the most out of your office hour visit to your professor or TA, you need to come prepared with the questions you want to ask. Make a list of all the questions you have so that you won't forget to ask them. You can also rank your questions in order of importance or urgency in case office hours are busy and you don't have enough time to ask all of your questions. Bring any materials relevant to your question like the text book or list of homework problems.

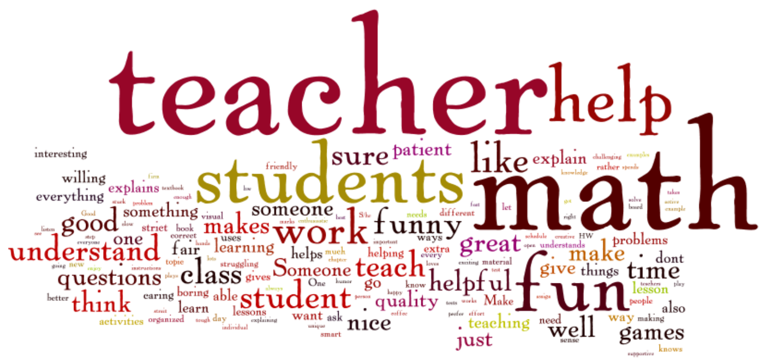
If you are confused about a concept try to pinpoint exactly what about the concept is causing the confusion. Instead of saying that you don't understand the entire concept, determine the line in your notes or the textbook where your understanding falters and ask for an explanation from there. The more specific you can be about your confusion, the better your teacher or TA can help you.

Before going to ask for help with a homework problem, make sure that you have put in your best effort at solving the problem.

You can explain the steps you took and the reasoning behind them to your professor or TA. Sharing your thought process will enable him or her to point you in the right direction and fill in any gaps in your knowledge.

If he or she works through the solution to a problem with you, sometimes it is a good idea to copy the main ideas rather than the whole solution. When you go back to work on the problem, you will learn more by attempting to reproduce the solution than rewriting the solution.

One last piece of advice: always thank your professor or TA for his or her help at the end.



6.2 Tutoring

There are both free and private tutoring (for a fee) options available at UMD. It will take a bit of effort to find a private tutor. In order to prepare for a tutoring session, you should determine what your questions are and bring the relevant materials to the session. Try not to use the tutor as a way to get your homework done; utilize him or her as a source to help you understand the material.

6.21 Free Tutoring Services

6.21.1 Tutoring Room

Walk-in tutoring for lower level computational classes is available in MTH 030. Tutors are graduate students who TA for the classes.

Undergraduate Tutoring Hours

Fall Tutoring Schedule

Start Date: Tuesday, September 8, 2015 - End Date: Friday, December 11, 2015 - Location: Math Building Room 0301

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8am-9am	**015/115** Stephen Kcenich	**011/111** Marquerite Jarchow 220 Yue Fan	220 Adil Virani 221 Zhao Liu	**013/113 Santuria Orsetti** 220 Patrick Daniels	113 Jian-Long Liu
9am-10am	141 Nathan Dykas 241 Daniel Zollers	141 Matthew Begue 246 Hsin-Yi Lin	113 Elif Kuz 141 Hechao Sun 246 Yousheng Shi	**140 David Finder** 241 Ioannis Markou	113 Laura Iosip 241 Douglas Ulrich
10am-11am	213 David Pincus 241 Chunting Lu	113 Shujie Kang **140 David Finder** 220 Jean-Phillipe Burelle	212 Jenny Rustad	**140 David Finder** 141 Martin M Fructuoso 241 Ke Xue	141 Buddhim Akurugodage
11am-12pm	141 David Russell	141 Matthew Becker 240 Maziar Raissi 246 Pratima Hebbar	141 Corry Bedwell 220 Anna Sotnikova 241 Jonathan Fernandes	240 Samuel Bloom 241 Oliver Rourke	212 Angela Stoltz
12pm-1pm	113 Stefan Poikonen	241 Danul Gunatilleka	**010/110 Ben Bezejouh** 212 Carolina Napp	241 Maxx Cho	**140 David Finder**
1pm-2pm	241 Jacky Chong 246 Stefan Doboszczak	110 David Reynoso Valle 220 Colleen Stock	214 Sean Ballentine 241 Robert Maschal	241 Nathaniel Monson	113 Tao Zhang 141 Kilian Cooley
2pm-3pm	**140 Noah Robinson** 241 Nicholas Paska 246 Brandon Alexander	**140 Mark Wilson** 141 Jeremiah Emidih 241 Suddhasattwa Das	**140 Noah Robinson** 241 Zachary Greenberg	**140 Mark Wilson** 240 Grahan Antoszekwski 241 Wenbo Li	113 Ryan Kirk 240 Jing Zhou
3pm-4pm	**140 Mark Wilson** 241 Ming Zhong 246 Geoffrey Clapp	**140 Mark Wilson**	**140 Noah Robinson**	**140 Mark Wilson** 246 Ian Johnson	141 Weikun Wang
4pm-5pm	111 Jesse Milzman 220 Yixin Ren	111 Charles Daly 220 Judith Law	**140 Noah Robinson**	**140 David Finder** 240 Srimathy Srinivasan	141 Xuesen Na 220 Ying Han

6.21.2 Office of Multi-ethnic Student Education

Walk-in tutoring in 1101 Hornbake Library by undergraduate and graduate students is mainly for lower level computational classes, but some tutors are available to assist with upper level proof classes. As the tutoring schedule can vary, check the OMSE website for tutor availability: http://www.omse.umd.edu/tutoring.html

6.21.3 MATLAB Tutoring

MATLAB tutoring is available to assist with MATLAB projects in MATH 206, 240, 241, 246, and 461. Times for each class vary by day, so consult the schedule below. MATLAB tutoring is in MTH 0203, the Math Building Computer Lab.

MATLAB Tutoring for MATH 206, 240, 241, 246, and 461

Location: Computer Lab in Math Building - Rm 0203

Start: TUESDAY, SEPTEMBER 8, 2015 AND ENDS FRIDAY, DECEMBER 11, 2015

Hour	Monday	Tuesday	Wednesday	Thursday	Friday
8am-9am	Yi Ren				Yi Ren
9am-10am	Yi Ren				Yi Ren
10am-11am	Yi Ren				Yi Ren
11am-12pm	Yi Ren	Junyu Gong		Junyu Gong	Yi Ren
12pm-1pm	Yi Ren	Junyu Gong		Junyu Gong	Yi Ren
1pm-2pm		Junyu Gong		Junyu Gong	Junyu Gong
2pm-3pm		Junyu Gong			Junyu Gong
3pm-4pm					Junyu Gong

6.22 Private Tutoring

The Math Department keeps a list of names of those willing to tutor for a fee and updates it every semester. You will need to contact the math advisors to obtain the list. Their email addresses can be found on page 51. The list will have the names and contact information of the tutors as well as subjects they are able to assist in. The tutors are graduate students in mathematics. When you receive the list, look for all the tutors who are willing to tutor for your class or classes and make your own list with those tutors. Then you can send an email requesting tutoring to as many or as few people on your list as you'd like. The hourly rates of these tutors vary so make sure to ask yourself how much you are willing to spend and check with each potential tutor how much they charge.

6.3 Math Success

Math Success is a free service that assists students mainly in lower level classes complete homework assignments and study for exams. Students are assisted by math coaches, undergraduates talented in mathematics. You can also work with other students under the guidance of a math coach in a collaborative study group.

When: 6 pm- 9 pm Sunday through Thursday
Where: Oakland Hall's Academic Enrichment Center

For more information visit:
http://reslife.umd.edu/programs/math_success/

6.4 Help Sessions

Help Sessions, run by Dr. Bhatia, are for solving problems in some upper level math classes including Math 310, 402, 406 and 410. Dr. Bhatia can help explain how to use different strategies to solve homework problems and clarify concepts. He asks that you email him with what you need help with at least 24 hours in advance of the Help Session you would like to attend. Help Sessions are extremely useful for students transitioning from computational classes to proof classes in MATH 310 and 410. Help Sessions train students to become better at writing proofs. Help Session times for each class and Dr. Bhatia's email can be found below.

Problem Solving and Help Sessions for Math 310, 402, 406 and 410

Instructor: M. Bhatia (mbhatia@math.umd.edu)

Location: Math Building, Room 1104

Dates: Help Sessions will be available Monday, September 7, 2015 to Friday, December 11, 2015.

Day / Time	11:00-11:50	1:00-1:50	2:00-2:50	3:00-3:50
Mon	402/406	410	310	Not available
Tue	406	410	310/402	Not available
Wed	402/406	410	310	Not available
Thu	406	410	310/402	Not available

6.5 Test Bank

The Math Department Test Bank is a compilation if midterms and final exams of all UMD's math classes. Some classes may only have final exams posted. Sometimes solutions are provided for the exams.

Some teachers may provide sample exams to prepare you for the real exam. In that case, the Test Bank can be an extra resource. Other teachers do not provide samples, so the Test Bank can give you an idea of the topics and problems that may be on your exams.

The Test Bank is organized by class. So, first find your class, and then look for your teacher to see their past exams. If you do not see your teacher listed for your class, it is still helpful to see what kinds of problems and concepts are tested on exams.

You can access the Test Bank via the link below:
https://drive.google.com/folderview?id=0B9Iw6R7
OblHhfjgxMHFDZXZ2OUEzMTRJelltZjJ3NHlORnoy
ZExlNTlyZTBzNlY1eTZUWFU#list

6.6 Other Students

Your peers are excellent resources. You can work on homework assignments and study for exams with them. Many MATLAB projects can be done in groups, and working in a group to complete the projects can help you complete the project faster. Working with others does not mean that you copy their solutions or rely on them to help you understand the material. Copying is considered cheating and academic dishonesty. Furthermore by copying solutions you are cheating yourself out of understanding the concepts and will likely perform poorly on exams, which are weighted more

heavily for your grade. You are responsible for your own learning, but you can help each other be successful.

6.7 Learning Assistance Services

Learning Assistance Services is run by the Counseling Center. LAS offers workshops on managing math exam anxiety, preparing for final exams, strategies for math success, and preparing for midterms. The Counseling Center is located in the Shoemaker Building.

Visit the LAS site for more information:
http://www.counseling.umd.edu/LAS/

6.8 Advisors

You can meet with the Math Department advisors, Ida and Kate, if you have any concerns about how you are doing in your classes or would like to discuss career or graduate school plans. You are welcome to drop by their office any time MWF 9 - 11:30 and 1:30 – 4 and TTh 9 - 1:30 and 3:30 – 4 or send them an email if you would like to meet with them. They are available for walk-in advising except during registration, which is from October 22 to late November/early December. During this time, it is best to email them about any issues you would like to chat about. Ida and Kate may be able to recommend further resources other than those outlined in this booklet or direct you other programs or areas of interest.

Ida's email: ichan@math.umd.edu
Kate's email: rendke@math.umd.edu

6.9 Online

You can find a number of other resources online. A search for similar courses at colleges and universities can yield class notes, links to textbooks, and practice exams.

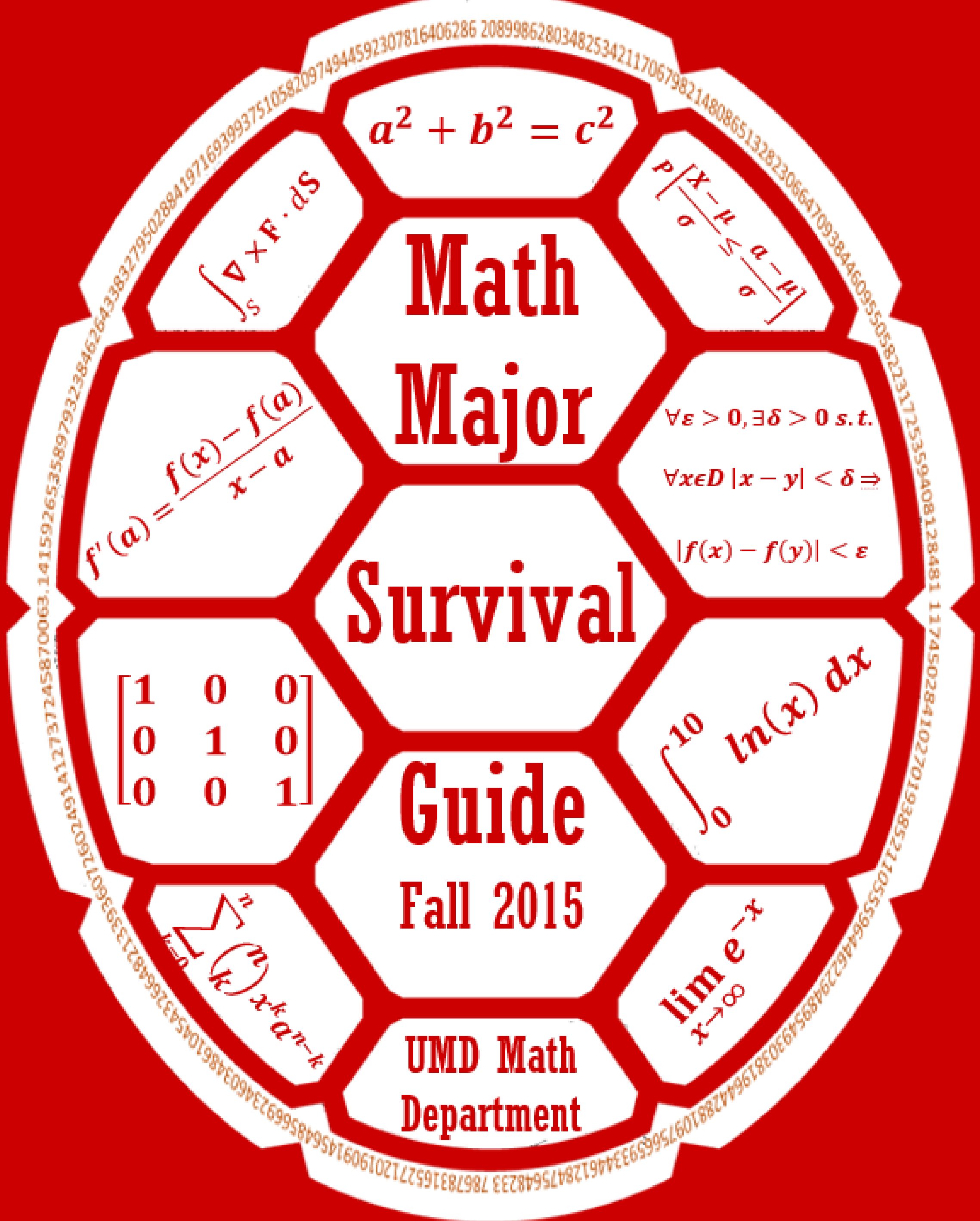
Here are four helpful sites:

1. YouTube – any math topic
2. Khan Academy – computational topics
3. Wolfram Alpha – computation engine
4. Paul's Online Math Notes – computational topics

7 End Note

We hope that this guide was helpful and taught you some strategies to be successful in your math classes. If you put in the effort and seek out the help you need you will be successful. If you have any comments or feedback about this booklet please, send them to math@umd.edu.

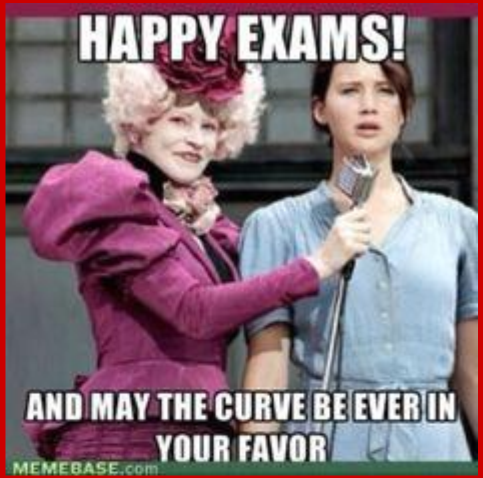
With best wishes for you success,
UMD Math Department


$a^2 + b^2 = c^2$
$\int_S \nabla \times \mathbf{F} \cdot d\mathbf{S}$
Math
Major
$P\left[\frac{X-\mu}{\sigma} \le \frac{a-\mu}{\sigma}\right]$
$f'(a) = \frac{f(x) - f(a)}{x - a}$
$\forall \varepsilon > 0, \exists \delta > 0\ s.t.$
$\forall x \epsilon D\ |x - y| < \delta \Rightarrow$
$|f(x) - f(y)| < \varepsilon$
Survival
$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$
$\int_0^{10} ln(x)\, dx$
Guide
Fall 2015
$\sum_{k=0}^{n} \binom{n}{k} x^k a^{n-k}$
$\lim_{x \to \infty} e^{-x}$
UMD Math
Department

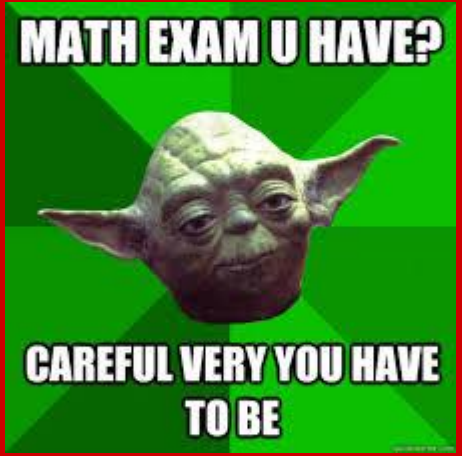

This booklet should
make the math major as
simple as
3.141592...

Contents

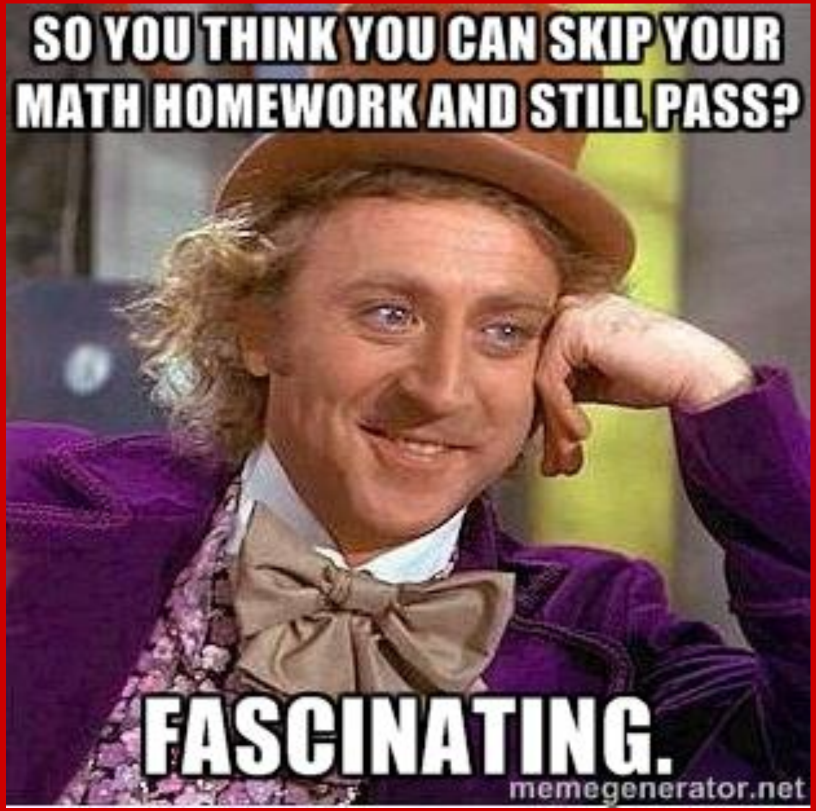
1. UMD Math Major Overview
2. Administrative
3. Computation Classes
4. Proof Classes
5. Resources



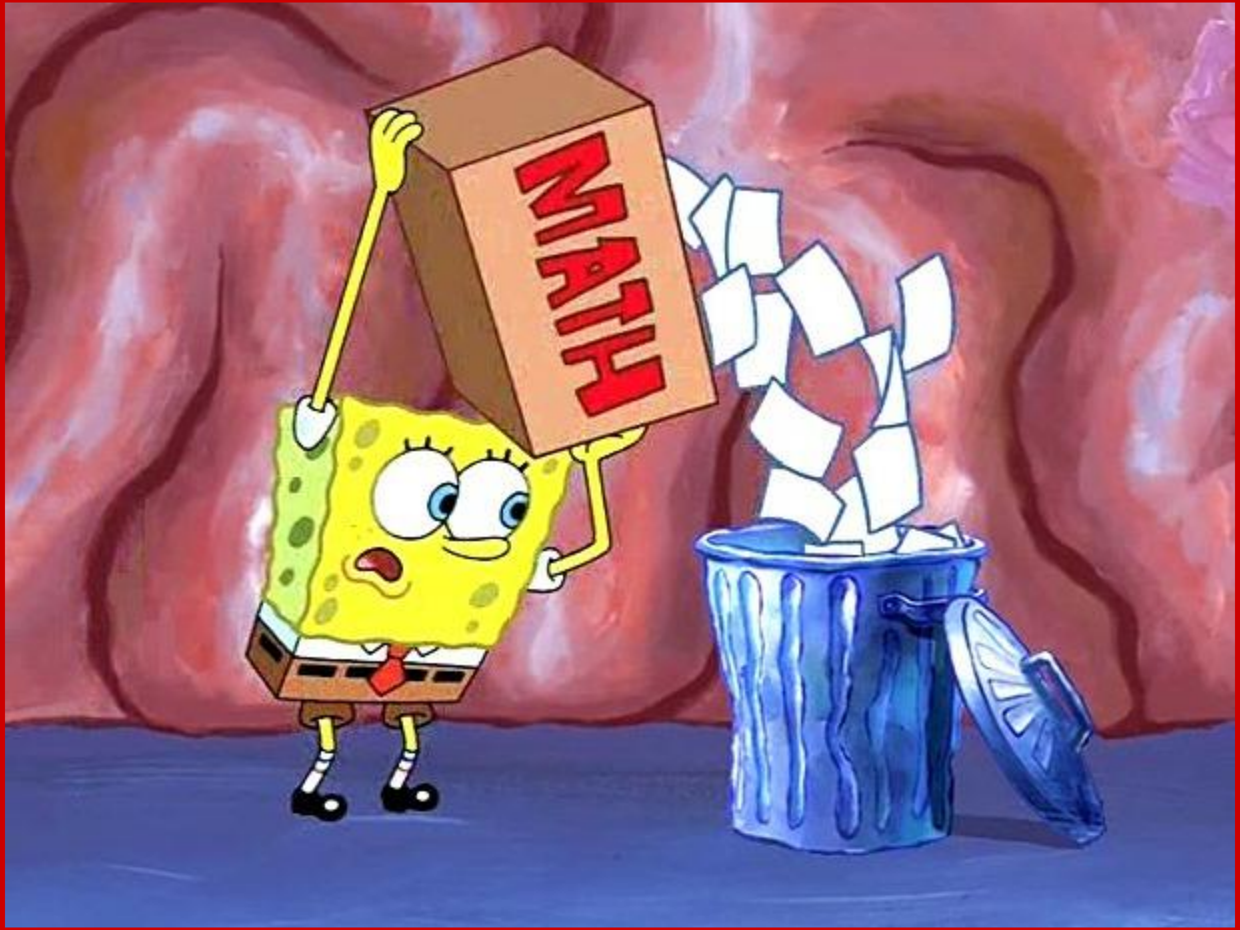
(math success)



Computation Classes - Homework



Proof Classes - Notetaking



Empty your mind of everything you know about notetaking in math.

5. [10] Let $D \subset \mathbb{R}$. A function $f : D \to \mathbb{R}$ is said to be Hölder continuous of order $\alpha \in (0, 1]$ if there exists a $C > 0$ such that f satisfies the Hölder bound

$$|f(x) - f(y)| \leq C\,|x - y|^\alpha \qquad \text{for every } x, y \in D\,.$$

Prove that every such function is uniformly continuous over D.

Solution. By the ϵ-δ characterization of uniform continuity (the definition in the notes), we want to show that for every $\epsilon > 0$ there exists $\delta > 0$ such that for every $x, y \in D$ we have

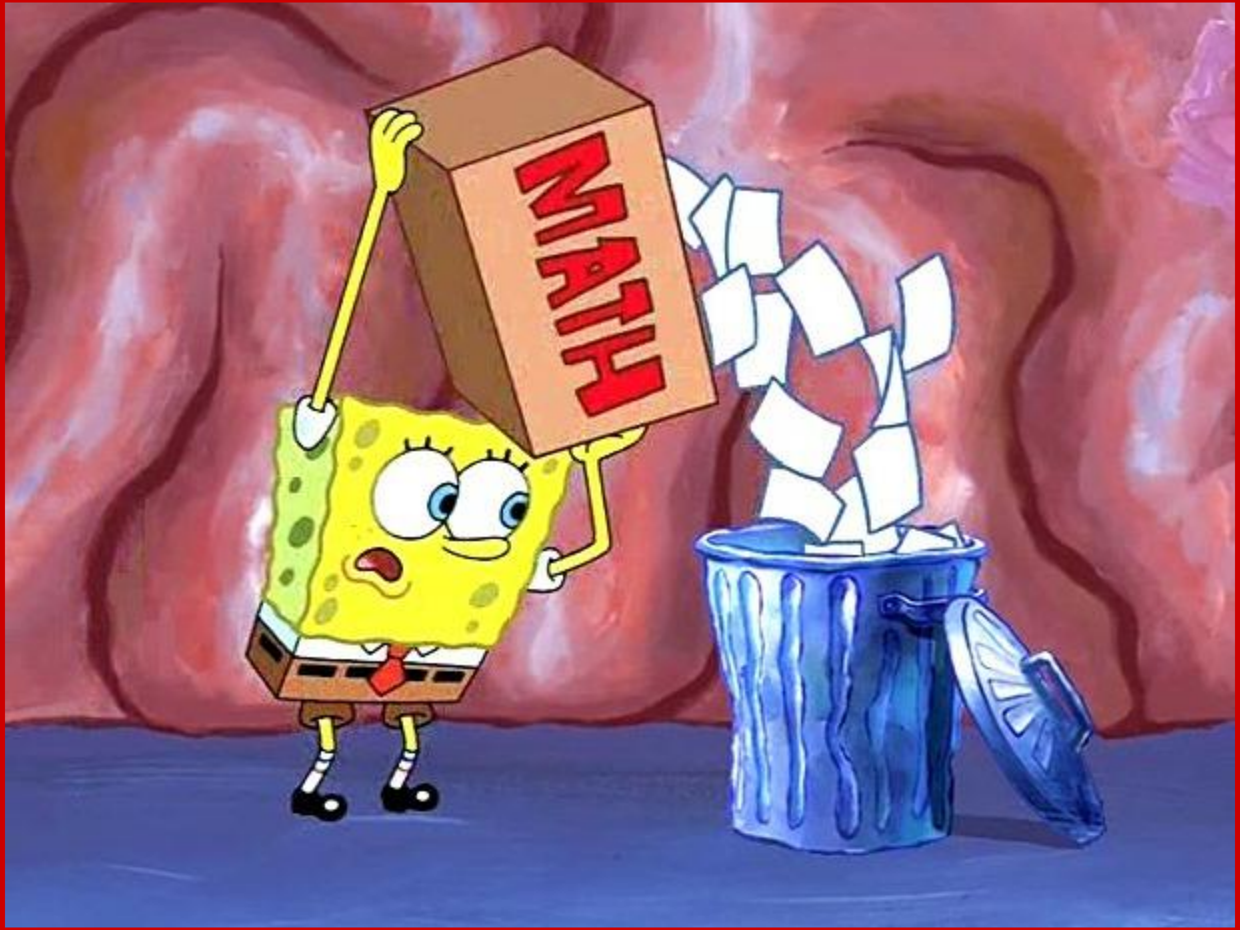
$$|y - x| < \delta \quad \Longrightarrow \quad |f(y) - f(x)| < \epsilon\,.$$

Proof. Let $f : D \to \mathbb{R}$ satisfy the Hölder bound for some $\alpha \in (0, 1]$ and $C > 0$. Let $\epsilon > 0$. Pick $\delta = (\epsilon/C)^{\frac{1}{\alpha}}$. Then for every $x, y \in D$ we have

$$|x - y| < \delta \implies |f(x) - f(y)| \leq C\,|x - y|^\alpha < C\,\delta^\alpha = \epsilon\,.$$

Therefore f is uniformly continuous over D. $\square$

Proof Classes - Notetaking



Empty your mind of everything you know about notetaking in math.

You got this! I believe in you!

Alexa Tsintolas

Annotated Bibliography

Academic Success and Disability Services, University of Redlands. "Five Note Taking Methods." *Lincoln Land Community College*. N.p., 8 Oct. 2010. Web. 8 Nov. 2015. <http://www.llcc.edu/wp-content/uploads/2014/10/5-methods-of-notetaking.pdf>.

Chartrand, Gary, Albert D. Polimeni, and Ping Zhang. *Mathematical Proofs: A Transition to Advanced Mathematics*. 3rd ed. Boston: Pearson Education, 2013. Print.

In Chapter 0 of their book, Chartrand, Polimeni, and Zhang share that the difference between lower level and upper level college math classes is that the lower level classes focus on solving problems using particular processes or procedures while upper level classes constitute writing proofs. The authors describe proofs as an explanation of why something in mathematics is true. They emphasize the importance of writing proofs in both a clear and logical manner. Chartrand, Polimeni, and Zhang introduce a number of mathematical writing conventions such as writing in the third person and not overusing symbols.

I plan on using this section to explain to students the difference between their lower level computational classes and upper level proof classes. I would like to share with them that they need to learn how to communicate mathematics effectively in order to be a part of the larger mathematical community. In addition to writing proofs, students will be expected to read and understand proofs. I will highlight some of the conventions used in mathematical writing outlined in the chapter to make reading and writing proofs easier for students.

Credé, Marcus, Sylvia G. Roch, and Urszula M. Kieszczynka. "Class Attendance in College: A Meta-Analytic Review of the Relationship of Class Attendance with Grades and Student

Characteristics." *Review of Educational Research* 80.2 (2010): 272-95. *JSTOR*. Web. 8 Nov. 2015. <http://www.jstor.org/stable/40658464>.

This article examines the impact of students' class attendance on their academic success through a meta-analysis or statistical study. The authors first identify a number of possible hypotheses that may be able to explain a possible relationship between class attendance and grades like do students with certain characteristics go to class and achieve higher grades or are student characteristics independent of grades and class attendance. Then, they describe the various sources of their data, perform a meta-analysis of the data, and discuss the results. The authors conclude that class attendance is a better predictor of students' grades than any other source like the SAT and the amount of time students spend studying.

I want to emphasize how important it is for students to attend their math classes. I find it interesting that the amount of time spent studying is not as important for students' success as attending class and want to share that information in the booklet. The more exposure students have to the material the better they will do on their assessments.

Draper, Roni Jo. "Jigsaw: Because Reading Your Math Book Shouldn't Be a Puzzle." *Clearing House* 71.1 (1997): 33-36. *JSTOR*. Web. 8 Nov. 2015. <http://www.jstor.org/stable/30189321>.

In her article, Draper claims that many students do not read their math textbooks because they are overly technical and dense. In order for students to understand the information presented to them in their textbooks they need to perform a close reading and understand every word and concept. Draper also says students do not read their textbooks because it is not required of them. She outlines an active reading strategy to keep students engaged as they read and glean as much as they can out of their reading. First, students should preview the reading, think of any background knowledge they have about the material, and articulate what they would like to learn from the reading. As the students read the textbook, they should paraphrase the author as they go in order to monitor their comprehension of the text. Students should think about how the information they are learning fits into what they already know about the subject. After reading, students should summarize what they have read and apply the material to new situations to ensure that they have thoroughly understood the text. The article contains a math activity for students called Jigsaw to introduce them to the math textbook reading strategy.

This article will help me provide students with a strategy for reading their math textbooks. While professors do not require their students to read the textbook, students should regard the textbook as required reading if they want to do well in the class. I want to explain to students that textbooks are not reference books and a place to find homework problems but valuable resources that provide students with a means to take charge of their personal learning. If students can gain more from reading they will be more successful in their classes. Also, the article has a useful table that outlines the strategies at the pre-reading, reading, and post-reading stages that I would like to include in the booklet.

Kouba, D. A. "Doing Well in Calculus." *D. A. Kouba University of California, Davis*. N.p., 2015. Web. 8 Nov. 2015. <https://www.math.ucdavis.edu/~kouba/CalculusTips.html>.

D. A. Kouba, University of California, Davis math professor, provides some advice on how to well in college math classes in this article. He shares tips on doing homework such as working with other students can make doing homework more efficient and reduce the amount of time required. He suggests students study math every day and that serious exam preparation occur at least five days before the exam. He says that students should use all the resources available to them including classmates, homework, office hours, and notes to learn the material.

This source is useful for providing various strategies to students on how to complete homework assignments and study for exams. I plan on incorporating these strategies in both the computation and proof sections of the booklet as the information in this article is more general and can apply to both kinds of math classes.

Mathematical Association of America, ed. "Careers." *Mathematical Association of America*. N.p., 2015. Web. 8 Nov. 2015. <http://www.maa.org/careers>.

This webpage from the Mathematical Association of America (MAA) describes how studying mathematics provides a seemingly endless set of career opportunities. The MAA claims that Mathematician was ranked the best job in 2014 by the site CareerCast. Furthermore, statistician and actuary, other professions that use math, were ranked third and fourth respectively. Many careers use math like engineering and computer science and the require problem solving skills and analytical thinking that mathematics students learn to excel at. It also provides a list careers that use mathematics, which includes teaching, actuarial science, computer science, operations research, biomathematics, cryptography, and finance. The page has many links to further information on careers that use math.

This source is useful for the introduction section of the booklet. I am using this source to share that studying math has major career payoffs in the end and helps students gain skills valued by employers. I am trying to encourage students to be excited about the prospects that are available to them if they study math. I want to let students know that they have many options are likely to find a career they will enjoy. I also plan on including a link to this page so that students can further look into math careers if they are so inclined.

Nolting, Paul D. *Math Study Skills Workbook*. 4th ed. Boston: Cengage Learning, 2011. PDF file.

Parkes, Jay, and Mary B. Harris. "The Purposes of a Syllabus." *College Teaching* 50.2 (2002): 55-61. *JSTOR*. Web. 8 Nov. 2015. <http://www.jstor.org/stable/pdf/27559083.pdf?acceptTC=true>.

This article explains the three purposes of a syllabus: a contract, a permanent record, and a learning tool. It includes descriptions of what information college professors should include in their syllabi to make the documents as useful as possible for their students and themselves. A sample syllabus that attempts to fulfill the three purposes appears in an appendix at the end to provide instructors ideas for constructing and revising their existing syllabi.

I am using this source to explain to math majors how reading and understanding their math class syllabi are important steps they need they need to take to do well. Students need to know that their math class syllabi are extremely useful tools for doing well in their math courses.

Saltzman, Matthew, and Marie Coffin. "How to Survive Your College Math Class (and Take Home Something of Value)." 25 Aug. 1998. PDF file.

In this article, Saltzman and Coffin share a number of tips on how to do well in math classes. They discuss reading the textbook can require at least two readings and that note taking and highlighting are helpful. They claim that homework is more of a check for the instructor to see how the class understands the material and that students need to make the effort to do as many extra problems as they need to make sure they have a good grasp of key concepts. The authors also provide an interesting note taking strategy, which is to not take notes if the material covered in lecture is presented in the textbook and listen to the instructor instead. Saltzman and Coffin address important questions like how much should students write on their homework assignments. They also discuss how to best prepare for and take exams. Saltzman and Coffin believe students need to review their homework problems as well as notes and practice solving problems under time constraints to prepare for exams. During exams students should first preview the test and then make a strategy for completing the problems and try to solve the problems as quickly and efficiently as possible.

Saltzman and Coffin provide a variety of useful strategies on textbook reading, completing homework assignments, taking notes, preparing for exams, problem solving and proof writing tips. Their suggestion to not take notes during class if the material is already in the textbook and listen is one that I had never considered before and would like to include in the booklet. I plan on using the homework and exam tips in the booklet as I do not have as many sources that address how to be successful in those two areas as in depth as this one does. However, I do not agree with their claim that the homework problems assigned are checks on the students understanding not what students need to know to do well in the course. I believe homework assignments are good indicators of the material that will be covered on exams. I especially like the suggestions it gives on how to take math exams and will use those in the booklet.

Stout, Lawrence Neff. "How to Study Mathematics." *Lawrence Neff Stout Professor of Mathematics Illinois Wesleyan University*. N.p., 2015. Web. 8 Nov. 2015. <https://sun.iwu.edu/~lstout/HowToStudy.html#top>.

Illinois Wesleyan University’s Lawrence Stout explains from the prospective of a math professor how students should study mathematics. He first notes that high school math is different from college math because college math classes emphasize theory and rather than teach certain techniques for solving specific problems teach many techniques and it is the student’s responsibility to determine which ones to use. Stout also shares some steps students can take to learn definitions, theorems, propositions, lemmas and corollaries. He provides tips on proof writing as well.

This source will help me explain how high school computational classes are different from college computational classes. I can also use this source to provide strategies for students to do well in their proof classes. Stout offers helpful advice on how to learn theorems and apply them to writing proofs, a skill that many students struggle with. A few of the strategies I would like to highlight are thinking about the implications of theorems' hypotheses and how they shape the theorem as well as creating one's own examples for a theorem.

Tomforde, Mark. "Tips for Reading Your Mathematics Textbook." 2015. PDF file.

Mark Tomforde of the University of Houston shares some useful strategies on how to get the most out of reading mathematics textbooks. He explains that many students improperly read a textbook by solely looking at the examples in the text that mimic the assigned homework problems. Tomforde suggests that students learn the concepts in the textbooks that way they will have a firm grasp on the techniques required to solve any problem on the topic posed to them. He says that students will likely have to read sections of their textbooks multiple times. During the first reading students should try to understand the big picture of the chapter or section they are reading. In subsequent readings, students should study the examples, take notes, examine any figures or pictures, and learn the vocabulary and theorems. If students have trouble understanding material in the textbook they can check the appendix or index to see if there is further explanation on the topic or ask their instructor.

I will use this article to help me articulate strategies for reading mathematics textbooks. Tomforde provides some advice not shared in other sources such as making use of the appendix or index and to read the textbook multiple times with different goals in mind and tasks to perform. I would like to share these strategies in the booklet.

UMD Mathematics Department. "Home Page." UMD Department of Mathematics. N.p., 2015. Web. 27 Oct. 2015. <http://www-math.umd.edu/>.

Zucker, Steven. "Telling the Truth." *Notices of the American Mathematical Society* Mar. 2003: 325. PDF file.

The fundamental problem with today's college students is that most arrive thinking that college is a simple continuation of high school. Zucker explains that while many college freshman expect that the strategies they used in high school will help them be successful in college, it turns out that many of these strategies are no long effective. He shares how high school students need to understand that they are responsible for their own learning in college and must put in a greater amount of effort to do well. Zucker also claims that students should not to solely rely on their teachers to learn the material and must consult their textbook to do well. He stresses that college classes are more fast-paced, require one to apply material learned to new problems, and have more content heavy exams.

I believe that this source does an excellent job at outlining how high school math classes are different from college math classes. Many math majors arrive at college thinking that their classes will be a breeze because they have not had great difficulty in their high school math classes. I want to explain to them that college math classes require a greater amount of effort and responsibility on the student's part to study and complete homework assignments. I am not trying to discourage them by saying that their classes will be hard but rather encourage them that if they put in the time and effort they will do well, learn a lot, and have a rewarding experience as a math major. I also want to share with them that this guide will provide strategies and resources to help them make the transition from high school math to college math a successful one.

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