Sample Syllabus — Debanjana Kundu

I have had the opportunity to teach several courses in both the University of Toronto and UBC Vancouver. I have always taught multi-section courses which had a course coordinator. I have enclosed the following in my teaching dossier:

1. PDF version of syllabus page provided to students of MAT237 (UofT) – Summer 2020. This was a course on multivariable calculus, where I was one of the four coordinators/instructors.
2. PDF version of the course Canvas page[1] from MATH105 (UBC) – Jan to Apr 2021 – coordinated by Keqin Liu. This was a course on integral calculus for students in humanities.
3. PDF version of my section specific Canvas page from MATH105 (UBC) – Jan to Apr 2021. Since courses were running online ONLY, we were asked to record our lectures. I have provided here the Zoom links to the recordings of my lectures for this course. This also has the link to the OneDrive notebook that my students had access to.
4. PDF version of the course Canvas page[2] from MATH152 (UBC) – Jan to Apr 2022 – coordinated by Kalle Karu. This was a course on linear algebra for students in engineering.
5. PDF version of my section specific Canvas page from MATH152 (UBC) – Jan to Apr 2022. I have provided here links to some extra problems I assign to students (often for bonus points). This also has the link to the OneDrive notebook that my students had access to.
6. I have also enclosed some feed back I received from students at UBC.

Unfortunately, I no longer have access to the University of Toronto Canvas portal. Hence, I am unable to provide sample syllabus of courses I taught as a graduate student.

[1] some of the links may not work for those without access to the UBC Canvas pages
[2] some of the links may not work for those without access to the UBC Canvas pages

MAT237Y1Y (Summer 2020)

Online Questionnaire: Please fill this online questionnaire by May 6, 11:59PM (EDT). This will count for bonus marks (+1)!

Instructors' Information:

Instructor	Lectures	Office Hours	Email
Travis Ens	LEC0101 (H1F)	W/F 4-5PM	travis.ens@mail.utoronto.ca
Debanjana Kundu	LEC5101 (H1F)	T/Th 5-6 PM	dkundu@math.utoronto.ca
Armanpreet Pannu	LEC0101 (H1S)	TBA	arman.pannu@mail.utoronto.ca
Ren Zhu	LEC5101 (H1S)		ren.zhu@mail.utoronto.ca

TA Information:

TA	Office Hours	Email
Caleb Jonker	M/W 1-2PM	caleb.jonker@mail.utoronto.ca
Pouya Honaryar	T/Th 1.30-2.30PM	pooyahonaryar@gmail.com
Shuyang Shen	none	shuyang.shen@mail.utoronto.ca

Why Calculus?

Continuing from what you know of single variable calculus, our course aims to be more: functions of many variables are more natural, more exciting, and have more real examples. When have you heard of an effect that had only one cause? The applications of calculus are manifold, from gradient descent in machine learning, to partial differential equations in physics, biology and fluid dynamics, to mathematical applications in singularity theory. It also gives us the tools to draw great pictures of curves and surfaces, and to convert between a geometric and algebraic understanding of them. We will use aspects of proof writing to help you structure your brain effectively, organizing the reasons why formulas work to allow you to extend or find their limitations. The content of calculus is more concrete than many math courses, so clear reasoning cannot hide behind abstract obfuscation. Everyone should study multivariable calculus!

Learning Outcomes:

In this course, students will demonstrate the abilities to:

- Recall and give examples of definitions that extend concepts from single variable calculus to multivariable calculus.
- Read, write and justify proofs with multiple steps.

- ❖ Select appropriate tools using multivariable functions (derivatives, optimizations, iterated integrals, path integrals, divergence, curl) and compute them to solve problems.
- ❖ Interpret and construct visual representations of multivariable functions and vector fields.
- ❖ Select and apply theorems to simplify computations or justify proofs.

Prerequisites:

1. MAT137 *or* MAT157 *or* MAT135+6 with an A+. Our course requires a solid understanding of one variable calculus, including all definitions and theorems, so that we can extend them to multivariables.
2. MAT 223/MAT 240. Our course requires a solid understanding of algebraic manipulations, geometry of vector spaces and matrix operations.

Both prerequisites give you some familiarity with reading definitions and writing proofs, which we will build on.

Course equivalents between UTSC/UTM and main campus can be found here : http://www.math.toronto.edu/cms/undergraduate-program/potential-students-ug/course-equivalents/ . If you are unsure you should double check with the undergraduate administrator for the math department Ashley Armogan (**aarmogan@math.toronto.edu**) to verify your eligibility to take the course as you will automatically be removed if you do not have the correct prerequisites or a prerequisite waiver.

Role in your program:

If your program does not require MAT 237, it probably gives the option of taking 235 or 237. In both courses, students are asked to select appropriate tools and use them to solve computational problems, interpret and construct visual representations, and apply theorems to simplify computations. In MAT 237, we will also ask you to recall and extend definitions from single variable calculus, and to read and write proofs. Instructors from programs in math, statistics, computer science, and physics have told us that students who understand *why* the computations work are better at applying them, and the process of interpreting definitions and writing proofs helps to create and correct logical arguments. These two learning outcomes are the main distinction from MAT 235, and we hope they help you in your program and career.

Text:

We will use the *Multivariable Calculus* notes by Robert Jerrard. Available for free under a Creative Commons license (BY-NC-SA) at http://uoft.me/MAT237-notes.

Course Delivery:

This course will be delivered completely **online**. Lectures will be held **live** during the scheduled time via Zoom. Lectures **will not** be recorded as per University/ Faculty of Arts & Science/ Department of Mathematics guidelines. If these guidelines change in the future, we might reconsider and start recording lectures.

There will be quizzes in every lecture, so please make sure you sign up for a lecture section which you can attend. Instructors will post the Meeting ID and password on the Quercus page. Please make sure to login via your **@mail.utoronto.ca** account.

There will be **no tutorials**. However, we might schedule short interviews with students during tutorial hours. We suggest you keep yourself free during your scheduled tutorial hour.

Assessment:

When you submit work for assessment, you are usually interested in the mark you receive. We are interested in helping you improve, and these interests may conflict. Graded assessments are *summative* - we are evaluating how well you demonstrate understanding and adding up all of these to give a final grade. Ideally, you will also be interested in improving your work on later assessments. Assessments which give you feedback to improve are *formative* - we are hoping to guide you toward improvement. The final assessment is strictly summative. Work that you do in class, tutorials, on problems sets, or show us during office hours is strictly formative. The four tests are both summative and formative. Every formative assessment is an opportunity to gain confidence or improve your abilities, so you should take full advantage of them, even when they are not graded. For tests to be formative, you must be given an opportunity to demonstrate improvement in that area. Such improvement should be rewarded, which is why your grade on the final exam can improve your test grades.

Before the final assessment, you will be asked to choose **one** test whose score you would like to *change*. We will replace it by the average of that test score and score on problems pertaining to that section in the final assessment. Please note that this means, it is possible that your test score may go down.

Grading Scheme:

In-class quiz (best 16 of 22) 15%
Problem sets (best 6 of 8): 25%
4 Tests: 10% each
Final: 20%

Quizzes:

Quizzes will start the week of **May 11**. The quiz will be held in the first 15 minutes of your lecture **on TopHat**. The quiz will cover material taught in the previous lecture. The best 16 of 22 will count towards the final grade. TopHat is now **free**; a Join Code will be provided to you by your instructor. If there is any change in the pricing, we will shift to administering quizzes on Quercus.

Problem Sets:

There will be 8 problem sets (see schedule below). The best 6 of 8 will count towards the final grade. These questions will mainly focus on proof-writing. Only some of the problems will be graded by TAs. Please note there will be **no (case-by-case) extension** of deadlines for problem sets.

Tests and Exams:

There will be 4 term tests (120 mins each) and one final exam (3 hours). Tests and exams will be **open-book**. Tests will be administered via Gradescope. You will get **2 hours** in a **24 hours** window to turn in the exam. The exam will be **released at midnight (ET)**, on the day of the test (see schedule below).

Gradescope:

To help you effectively get feedback, we are using Gradescope for all graded assessments and tests. This allows us to give detailed feedback and allows you easily access to all assessments at any time. All assessments must be turned in via Gradescope. Uploads to Gradescope must be legible - if a grader cannot read your file, it will not be graded. All test regrade requests must also be submitted via Gradescope. The entry Code is NMR3G9.

Missed Assessments:

Missing a test for medical reasons requires a verification of illness form. However, the University has suspended the need for a doctor's note or medical certificate for absences because of cold or flu-like symptoms, or due to self-isolation requirements. Instead, you will need to record these absences through the Absence Declaration tool on ACORN. The tool can be found in the ACORN Profile and Settings menu. You should record each day of your absence as soon as it begins, up until the day before you return to classes or other academic activities. The University will use this information to provide academic accommodation and to monitor overall absences. The weight of any missed tests will be put on the relevant section of the final assessment. **There will be no accommodation made for missed quizzes or problem sets.**

Collaboration policy:

Collaboration and discussion are an important part of mathematics. A great part of having a large group learning calculus is that you can help each other by discussing concepts and difficulties you have outside of class. Naturally, this will extend to working on problem sets. You are welcome to discuss problem set questions together and post about them on Piazza however you must write up your own solutions. Due to social distancing measures, we discourage students from meeting in person. **Collaboration on tests and exams is not permitted**.

Academic Integrity:

Due to the online nature of this course, we are unable to proctor tests and exams. Remember that cheating is always possible and may increase your participation grade a bit. But it will hurt your appreciation of yourself, your knowledge and your test grades a lot more.

Here are some tips to avoid committing an academic offence:

- Do not photograph or copy anyone's problem set solutions.
- Write your submission using only your own notes.
- Do not share your drafts with any other students.

- ❖ Do not ask for solutions to problem set questions online, post solutions, or look up posted solutions.

For example, if you type up your solutions using notes that anyone else wrote, or get solutions online, you are committing an academic offence. For more information, see https://www.academicintegrity.utoronto.ca/.

If we have reasons to believe you have simply copied your answer from your friends, the internet, a textbook, and/or solution manuals, you will be asked to explain your solutions (via Zoom) to an instructor or TA during your scheduled tutorial time (or during Office Hours).

Resources:

We hold office hours every week so that students can drop in to get advice about course material, assessments, or your academic goals. Stop by and say hi!

We **highly recommend** LaTeX for typesetting assignments. It is the standard for mathematical writing and produces great looking documents (like your problem sets!). If you are new to LaTeX, try Overleaf for an online editor or LyX (with TexLive or MacTex) for an introductory desktop editor. You can find Sage Math cells at https://sagecell.sagemath.org/ for quick computations. Sage is based on Python, with an extensive library of mathematical operations, and many helpful articles are available.

You may want to learn about other topics that we don't have time to discuss, or more detail about specific topics. For related topics at a similar level, with a traditional theorem-proof layout, try Folland's *Advanced Calculus*. For many more computational examples and problems, check out Stewart's *Multivariable Calculus*, or Marsden and Tromba's *Vector Calculus*.

Contact:

- ❖ For issues regarding the course, check to see if they are answered in the syllabus or in Quercus announcements.
- ❖ Use the Discussions section on the course Quercus and/or Piazza– leverage the knowledge of your fellow classmates! Other students may have the same question, and another student or instructor may have answered it.
- ❖ For issues with content in the course notes, tutorials, problem sets, or content from lectures, like clearing up a misunderstanding contact your instructor/ TA.
- ❖ It is difficult to answer most mathematical questions via email. For anything more complicated than one line of writing, come to instructor office hours, TA help centre hours, or Piazza. Here is the link to our Piazza page: piazza.com/utoronto.ca/summer2020/mat237.
- ❖ There will be **no early sitting or make up** tests/ exams. For a regrade of a problem set or test, use the regrade feature on Gradescope.
- ❖ For administrative issues (like requests for accommodation), email admin237@math.utoronto.ca. We will try to respond to these emails as soon as possible.

Important Dates:

Classes:

- May 5, *lectures begin*
- May 11, *tutorials and Office Hours begin*
- May 18, *Victoria Day*
- June 17-25, *Reading week, no classes*
- July 1, *Canada Day, no classes*
- July 6, *lectures and tutorials resume*
- August 3, *Civic Holiday, no classes*
- August 17, *Last day of class*

Tests:

- Test 1*, due on May 25 at **11:59 PM**, material up to ~~section 2.1~~ section 1.5*
- Test 2, *due on June 15 at **11:59 PM**, material up to section 2.7*
- Test 3, *due on July 20 at **11:59 PM**, material up to section 4.2*
- Test 4, *due on August 10 at **11:59 PM**, material up to section 5.5*
- Final Assessment, August 19-27, *Exam period.*

Problem Sets:

Problem sets will be released by **12:00 midnight** one week before the deadline.

- Problem Set 1, *due on May 13 at **11:59 PM** ET*
- Problem Set 2, *due on May 20 at **11:59 PM** ET*
- Problem Set 3, *due on June 3 at **11:59 PM** ET*
- Problem Set 4*, due on June 10 at **11:59 PM** ET*
- Problem Set 5, *due on July 8 at **11:59 PM** ET*
- Problem Set 6, *due on July 15 at **11:59 PM** ET*
- Problem Set 7*, due on July 29 at **11:59 PM** ET*
- Problem Set 8, *due on August 5 at **11:59 PM** ET*

Administration:

- May 10, *Last day to enroll*
- June 10, *Last day to switch to MAT235 (find the form here https://www.math.toronto.edu/cms/undergraduate-program/current-students-ug/change-dates/)*
- July 20, *Last day to drop or add/remove CR/NCR option*

Calendar:

This is a tentative schedule for the term.

Lecture	Dates	Topics	Sections
1	May 5-6	Geometry of Euclidean spaces and multivariable functions	0.1-0.3
2	May 7-8	Open and closed sets, boundaries, and more	1.1
3	May 12-13	Limits, continuity, sequences and completeness	1.2-1.3
4	May 14-15	Compactness	1.3-1.4

5	May 19-20	Intermediate Value Theorem and Derivatives	1.5-2.1
6	May 21-22	Differentials	2.2
7	May 26-27	Chain Rule	2.3
8	May 28-29	Mean Value Theorem and higher order partial derivatives	2.4-2.5
9	June 2-3	Taylor's Theorem	2.6
10	June 4-5	Critical Points	2.7
11	June 9-10	Extreme Value Problems	2.8
12	June 11-12	Implicit Function Theorem	3.1
13	July 7-8	Implicit Function Theorem and Geometric Aspects	3.1-3.2
14	July 9-10	Inverse Function Theorem	3.3
15	July 14-15	Integration in One Variable	4.1
16	July 16-17	Integration in More Variables	4.2
17	July 21-22	Iterated Integrals	4.3
18	July 23-24	Change of Variables	4.4
19	July 28-29	More Integration Techniques	4.5
20	July 30-31	Line Integrals	5.1
21	Aug 4-5	Green's Theorem and Surface Integrals	5.2-5.3
22	Aug 6-7	Div, Grad, Curl and the Divergence Theorem	5.4-5.5
23	Aug 11-12	Stoke's theorem and Vector Fields that are Gradients or Curls	5.6-5.7
24	Aug 13-14	Review	

MATH 105 ALL 2020W Integral Calculus with Applications to Commerce and Social Sciences

Math 105, 2020W Term 2

Integral Calculus with Applications to Commerce and Social Sciences

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Course information

This is the common page for all sections of MATH 105 in Term 2 of the 2020W session (January to April 2021). Here you will find the course outline, suggested homework and practice problems, course policies, exam dates, common handouts and supplementary notes, other course information, and information on available resources. For section-specific information, please see the individual section links below or contact your instructor.

Individual section links

- Section 201 M-W-F 8-9am MATH 100 (Instructor: Anwesh Ray)
- Section 202 M-W-F 9-10am CHEM C126 (Instructor: Elyse Yeager)
- Section 203 M-W-F 9-10am LSK 460 (Instructor: Keqin Liu)
- Section 204 M-W-F 4-5pm LSK 201 (Instructor: Anwesh Ray)
- Section 205 M-W-F 12pm-1pm MATH 100(Instructor: Keqin Liu)
- Section 207 M-W-F 8-9am LSK 200 (Instructor: Debanjana Kundu)
- Section 208 Tu-Th 2-3:30pm MATH 100 (Instructor: Hannah Alpert)
- Section 209 Tu-Th 2-3:30pm CHEM C126 (Instructor: Debanjana Kundu)
- Section 210 M-W-F 8-9:00am CHEM C126 (Instructor: Matt Coles)
- Section 211 M-W-F 4-5 pm MATH 100 (Instructor: Keqin Liu)

MIDTERM EXAM NOTICE

- *Midterm exam 1 will be held on February 11* (Thursday). The time is from 6:30pm to 7:30pm.
- A sample midterm 1 is HERE
- An old midterm 1 is HERE

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- *Midterm exam 2 will be held on March 24 (Wednesday)*.
  The time is from 6:00pm to 7:00pm.

Math 105 midterm 2 will cover the following topics:

Definition of the Integral (3.1),
Basic Properties of the Definite Integral(3.2),
Fundamental theorem of calculus (3.3),
Substitution rule (3.4),
Integration by parts (3.5),
Trigonometric Integrals (3.6),
Trigonometric substitutions (3.7),
Partial fractions (3.8).

- A sample midterm 2 is HERE
- An old midterm 2 is HERE

MATH 105 FINAL EXAM NOTICE

The information about MATH105 final exam will be given in April.

- A sample final exam, which is Math 105 final exam for 2015, is HERE

Text

We use the locally developed online textbook *Optimal, Integral, Likely* prepared by Bruno Belevan, Parham Hamidi, Nisha Malhotra, and Elyse Yeager. It has two parts:

Textbook download (PDF)

This file has explanations of concepts.

Practice book download (PDF)

This file has questions to practice.

Bug bounty information

Beginning-of-term registration information

- If you are not registered in a section, please do not attend it without the instructor's approval.
- Instructors do not have the authority to "fit you in". Such requests have to be processed by the math department office (Room 121 Mathematics Building). The math department is conducting registration help sessions in January.

Grading Schemes

Your grade will be computed based on the following formula:

- Final Exam 46%
- 2 midterms 17% + 17% = 34%
- Course-common WebWorks assignments 10%
- Other section-specific coursework (to be decided by your instructor) 10%
- A student must get at least 35% on the final exam to pass this course. A student who gets less than 35% on the final exam and whose grade computed by the grading scheme would be a passing grade shall receive a final grade of 48%.

Math 105 Webwork site link

Students need to access Webwork through Canvas. To access WebWorK, you should login to Canvas and click on 'Assignments' tab in the MATH105 Dashboard.

Exam Dates and Policies

- **THE FINAL EXAM** for this course will be common to all sections of MATH 105. The exam will take place in April at a date to be announced.
- Midterms, which will be also common to all sections of MATH 105, are non-cumulative, but the final exam is based on the entire syllabus for the course.
- **Grade calculation:** The mark distribution of the term work may be scaled based on the final exam mark distribution. These adjusted term marks will then be used to compute a student's final grade. Any scaling is performed to ensure fairness in the final grades across sections. It is not expected that such scalings would result in significant grade changes.
- **Exam aids:** No unauthorized electronic devices will be allowed in the midterms or in the final exam. This includes calculators, cell phones, music players and all communication devices. Students should not bring their own formula sheets or other memory aids. Common formula sheets may be provided to all students depending on the material covered, in which case the content of the formula sheet will be disclosed in class prior to the exam.
- **Missing midterms:** If a student misses a midterm, that student shall provide a documented excuse or a mark of zero will be entered for that midterm. Examples of valid excuses are an illness which has been documented by a physician or Student Health Services, or an absence to play a varsity sport (your coach will provide you with a letter). **There will be no make-up midterms, and the weight of the missed midterm will be transferred to the final examination. To be eligible for this arrangement, you must notify your instructor of your failure to take the test within a week of the missed midterm, and come up with a timeline acceptable to both for producing appropriate documentation for your absence.** Please note that a student may NOT have 100% of their assessment based on the final examination. A student who has not completed a substantial portion of the term work normally shall not be admitted to the final examination.

- **Missing the Final Exam:** You will need to present your situation to your faculty's Advising Office to be considered for a deferred exam. See the Calendar for detailed regulations
- Your performance in a course up to the exam is taken into consideration in granting a deferred exam status (for instance, failing badly normally means you will not be granted a deferred exam). For deferred exams in mathematics, students generally sit the next available exam for the course they are taking, which could be several months after the original exam was scheduled.
- **Please bring your student ID-s to both midterms and the final.**

Coursework Policies

- The work that accounts for the remaining 10% of your coursework grade will be decided by your instructor and may vary from one section to another. This is based on various factors such as lecture times, class size etc.
- In addition to WebWork problems, a list of suggested practice problems is given at the end of this webpage. These are not to be turned in and will not be graded. It is however strongly recommended that you work through these problem sets as they are based on the syllabus for this course, and therefore omit problems that may be in the text but are unrelated to the course material. They also accurately reflect in terms of content and level of difficulty the problems you will encounter in midterms and the final.
- **Late Assignments:** WebWork will automatically close at a previously announced time specified on Canvas, so it is important to finalize and submit your work by that deadline. It will not be possible to obtain extensions on WebWork assignments.

Academic misconduct

- UBC takes cheating incidents very seriously. After due investigation, students found guilty of cheating on tests and examinations are usually given a final grade of 0 in the course and suspended from UBC for one year. More information.
- Note that academic misconduct includes misrepresenting a medical excuse or other personal situation for the purposes of postponing an examination or quiz or otherwise obtaining an academic concession.

Help outside class

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PEER ASSISTED STUDY SESSIONS

Peer Assisted Study Sessions (PASS) provide interactive and risk-free
opportunities to practice and internalize course concepts.  All sessions are
led by upper-year students and are open to all Math 105 students. Sessions are
offered twice a week beginning in February.
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`All PASS information, including how to sign-up for sessions and access workshop resources, can be found on the PASS Math 105 Canvas site: https://canvas.ubc.ca/enroll/Y9T3J4.`

- Each instructor will hold a few (2-3) office hours per week for students in his/her section. See section website for more details.
- **First year can be an overwhelming experience for many students. If you find yourself having serious academic difficulties in this course, it is best to talk to your instructor as soon as you can.**

Course Outline

- The course is divided into three parts. Roughly speaking, we will cover multivariable calculus (Chapter 1 and Chapter 2) and start on integration (Chapter 3) before the first midterm. We will complete the theory of integration and integration techniques (Chapter 3), followed by a week's worth of probability (Chapter 4) before the second midterm. The rest of the time will be devoted to discussing sequences and series (Chapters 5).
- Here is a week-by-week schedule of course material based on the appropriate sections of the text. The chapter and section numbers are from the online textbook. Follow the links for each week to get a more detailed description of the concepts covered that week, and for the learning objectives that you should use as self-checks.
    - Week 1 Vectors and Geometry in Two and Three Dimensions (Chapter 1) Learning goals
        - Planes (1.3)
        - Functions of two variables (1.4) , surfaces and level curves (1.5)
    - Week 2 Partial Derivatives (Chapter 2) Learning goals
        - Partial derivatives (2.1, 2.2)
        - Local Maximum and minimum values (2.3)
        - Absolute Maximum and minimum values (2.4)
    - Week 3 Partial Derivatives (Chapter 2) Learning goals
        - Absolute Maximum and minimum values (2.4)
        - Lagrange multipliers (2.5)
    - Week 4 Integration (I) (Chapter 3) Learning goals
        - Definition of the Integral (3.1)
        - Basic Properties of the Definite Integral(3.2)
    - Week 5 Integration (II) (Chapter 3) Learning goals
        - Fundamental theorem of calculus (3.3)
        - Substitution rule (3.4)
    - Week 6 Integration (III) (Chapter 3) Learning goals
        - Integration by parts (3.5)
    - Week 7 Integration (IV) (Chapter 3) Learning goals
        - Trigonometric Integrals (3.6)
        - Trigonometric substitutions (3.7)
        - Partial fractions (3.8)

- Week 8 Integration (V) (Chapter 3) Learning goals
  - Numerical integration (3.9)
  - Improper integrals (3.10)
  - Differential equations (3.12)
- Week 9 Probability (Chapter 4) Learning goals
  - Continuous random variable (4.3, 4.4)
  - Expected Value, Variance, and Standard Derivation (4.5 and 4.6)
- Week 10 Series and series (I) (Chapter 5) Learning goals
  - Sequences (5.1)
  - Series (5.2)
  - The divergence and integral tests (5.3.1, 5.3.2)
- Week 11 Series and series (II) (Chapter 5) Learning goals
  - The comparison and ratio tests (5.3.3, 5.3.4).
  - Power series (5.5)
- Week 12 Series and series (III) (Chapter 5) Learning goals
  - Extending Taylor polynomials (5.6.1)
  - Computing with Taylor series (5.6.2)
  - Evaluating limits using Taylor expansions (5.6.3)

Practice problems

This section contains a list of problems from Optimal, Integral, Likely, Practice Book

These are not to be turned in, but working through them will help crystallize the concepts covered in class. Not all parts of a textbook section will be emphasized equally in lectures, and these problems serve as guidelines for identifying the important and relevant parts that constitute the course syllabus.

- Section 1.2: 1, 3, 4, 7, 8, 10, 11
- Section 1.3: 1, 6, 7, 8, 9, 10
- Section 1.4: 4, 5, 6, 8
- Section 1.5: 3, 4, 5, 9,
- Section 2.1: 1, 2, 3, 4, 5, 6, 9
- Section 2.2: 2, 3, 4, 5, 8
- Section 2.3: 2, 3, 4, 5, 6, 7, 8
- Section 2.4: 3, 4, 5, 6, 7, 8, 9,10, 13
- Section 2.5: 4, 5, 6, 7, 8, 9, 10
- Section 3.1: 4, 6, 9, 12, 15, 21, 22, 25, 29, 33, 39
- Section 3.2: 5, 6, 7, 8, 9, 10, 12, 16, 20
- Section 3.3: 1, 3, 4, 6, 7, 10, 13, 20, 21, 22, 23, 24, 28, 29, 31, 32, 33, 38, 41, 47, 49, 51
- Section 3.4: 1,2, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 18, 19, , 22, 26
- Section 3.5: 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 20, 23, 28, 29
- Section 3.6: 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 17, 20, 21
- Section 3.7: 1, 2, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 20, 21
- Section 3.8: 1, 2, 3, 4, 8, 9, 10, 11, 12, 13, 14, 15, 21, 22, 24
- Section 3.9: 3, 4, 5, 11, 16, 18, 21, 28, 31

- Section 3.10: 6, 7, 8, 9, 10, 17, 19
- Section 3.12: 2, 9, 10, 11, 14, 15, 16, 17, 22, 24, 25,
- Section 4.3: 1, 4, 6, 10
- Section 4.4: 2, 6, 7, 8, 9, 10, 13, 14
- Section 4.5: 9, 10, 11, 12, 13, 15
- Section 4.6: 6, 7, 12
- Section 5.1: 3, 8, 14, 15, 16, 24, 28
- Section 5.2: 1, 3, 9, 10, 11, 12, 15, 17, 20, 21,
- Section 5.3: 1, 2, 5, 6, 8, 9, 14, 15, 16, 18, 23, 24, 25, 26, 27, 28, 29, 31, 33, 36, 38, 40, 45
- Section 5.5: 1,2,3,4, 5,6,7, 16, 17,19
- Section 5.6: 3, 4, 9, 10,11,13,15,16,17,18, 19, 20, 30, 31

Section 207 (Debanjana Kundu)

Lecture Times:

Lectures are Mondays, Wednesdays, and Fridays, 8:00 - 8:50 am.

Join Zoom Meeting

https://ubc.zoom.us/j/64305566905?pwd=Sy8wTG04Z1NteFpBWmVyNXZESFNndz09

Meeting ID: 643 0556 6905

Passcode: 13524

Please make sure you enter your full name (as it appears on Canvas) when joining the lecture. Attendance is encouraged, but not mandatory. In addition to attending lectures and following class notes, I encourage you to read the textbook very carefully.

Recordings will be visible here. Note that due to Zoom processing times, sometimes there is a significant delay between the end of class and the availability of the recording.

Links to the lectures are below:

Lecture 1: (Mon) Jan 11 Passcode: 9f8XBM5.T^

Lecture 2: (Wed) Jan13 Passcode: cE$1inMp

Lecture 3: (Fri) Jan 15 Passcode: wL8@U&2A

Lecture 4: (Mon) Jan18 Passcode: G?.u=8Z3

Lecture 5: (Wed) Jan 20 Passcode: TZ588.&P

Lecture 6: (Fri) Jan 22 Passcode: &g0c^NmY

Lecture 7: (Mon) Jan 25 Passcode: GC%4J^b2

Lecture 8: (Wed) Jan 27 Passcode: P%rb7mg@

Lecture 9: (Fri) Jan 29 Passcode: 3B%&HRwM

Lecture 10: (Mon) Feb 1 Passcode: Te?7khh%

Lecture 11: (Wed) Feb 3 Passcode: 9P#W%A#9

Lecture 12: (Fri) Feb 5 Passcode: gvLm@t76

Lecture 13: (Mon) Feb 8 Passcode: EivW1A+x

Lecture 14: (Wed) Feb 10 Passcode: #6=aec=M

Lecture 15: (Fri) Feb 12 Passcode: gRpn3%*B

Lecture 16: (Mon) Feb 21 Passcode: wEa3z@*R

Lecture 17: (Wed) Feb 24 Passcode: 7*hmmgkk

Lecture 18: (Fri) Feb 26 Passcode: ^$b=4WWU

Lecture 19: (Mon) Mar 1 Passcode: !i37yx7*

Lecture 20: (Wed) Mar 3 Passcode: F^K%47sQ

Lecture 21: (Fri) Mar 5 Passcode: n1qZy.1p

Lecture 22: (Mon) Mar 8 Passcode: vS#gv0N1

Lecture 23: (Wed) Mar 10 Passcode: 6XGQ5uX+

Lecture 24: (Fri) Mar 12 Passcode: C?k8wJ92

Lecture 25: (Mon) Mar 15 Passcode: Nc1=T1.2

Lecture 26: (Wed) Mar 17 Passcode: M?R9b3QW

Lecture 27: (Fri) Mar 19 Passcode: .6f3abQ.

Lecture 28: (Mon) Mar 22 Passcode: n!2.ZmuZ

Lecture 29: (Wed) Mar 24 : The lecture was not recorded, since it was informal review

Lecture 30: (Fri) Mar 26 Passcode: x=*V2x2y

Lecture 31: (Mon) Mar 29 Passcode: V.0KGbTu

Lecture 32: (Wed) Mar 31 Passcode: #!5BUMr=

Lecture 33: (Mon) Apr 7 Passcode: ^.E1JWt?

My (hand written) lecture notes in *view-only* mode are available through this link: Lecture Notes MAT105 Sec207

Discussions will be held via Piazza

Office Hours: OH will start the week of Jan 18.

To accommodate for different schedules and time zones, I will try to keep OH spread across the day. The time are as follows

Even weeks (of instruction)

Mondays: 9AM-10AM (Pacific Time)

Tuesdays: 3:30PM-4:30PM (Pacific Time)

Odd weeks (of instruction)

Thursdays: 10AM-11AM (Pacific Time)

Fridays: 7AM-8AM (Pacific Time)

The Zoom link for the Office Hours will be same as the lecture.

Practice Problems:

During class, I will give practice problems (similar to examples) which will also be posted here. Solutions to these problems will not be posted; you are encouraged to work on them by yourself and with friends. We can also discuss (some of) them in office hours.

Section Specific Assignments (different from WebWork):

Section Specific Assignments will be posted here with their corresponding due dates. The assignments will also be posted on the section-specific Canvas page under the *Assignments tab*. Solutions to the assignments **must** be submitted there. You may consider using the online LaTeX editor *Overleaf*

If you are not familiar with LaTeX, you may choose to use this basic template

In total there will be a total of 6 such assignments; **the best 5** will be counted towards your final grade.

Assignment 1: due January 24, 2021 5PM (Pacific time)

Assignment 2: due February 7, 2021 5PM (Pacific time)

Assignment 3: due February 21, 2021 5PM (Pacific time)

Assignment 4: due March 7, 2021 5PM (Pacific time)

Assignment 5: due March 21, 2021 5PM (Pacific time)

Assignment 6: due April 4, 2021 5PM (Pacific time)

Virtual Study Room:

The following Zoom link will be open till the end of the semester for you to work on practice problems with your friends. Please note this link is different from the one used for OH and lectures. This Zoom room will not be monitored by the TAs or myself. You may think of this as a common room where you are free to discuss mathematics :)

Join Zoom Meeting

https://ubc.zoom.us/j/65998634107?pwd=UE1sOTYyblBRN2ZXS3laZ0FJUzFvdz09

Meeting ID: 659 9863 4107

Passcode: 310650

MATH 152 ALL 2021W2 Linear Systems

Edit
Settings

Final Exam Information

Exam #2 Solutions

Exam #1 Solutions

Exam Regrade Request Form

Academic Concession Form

- **Individual sections**
  - 201, MWF 1-2, MATH 100, Yue-Xian Li,
  - 202, TuTh 8-9:30, LSK 200, Debanjana Kundu,
  - 203, TuTh 8-9:30, BUCH A102, Wenzhao Chen,
  - 205, MWF 12-1, MATH 100, Kalle Karu,
  - 207, MWF 12-1, LSK 201, Debanjana Kundu,
  - 208, TuTh 8-9:30, LSK 201, Anirudh Asuri Mukundan,
  - 209, TuTh 8-9:30, ESB 1012, Ben Bruce,
- **Lectures**
  - The first four weeks of lectures and office hours will be online. Please use the Zoom link for your section. Starting February 7 the lectures and exams will be in person.
- **Labs**
  - Computer labs are held on Zoom for the entire semester.
  - Labs are scheduled only during the weeks prior to lab due dates.
  - Labs begin the week of January 17-21.
- **Overview**
  - Math 152 is a first course in linear algebra. It emphasizes geometry in two and three dimensions, applications to engineering and science problems and practical computations using MATLAB. A detailed week by week outline can be found below.
  - Corequisite: Math 100.
  - Course learning goals

    - Grade breakdown for the course:
        - WebWork 10%
        - MATLAB assignments 10%
        - 2 midterm exams worth 15% each
        - final exam 50%
- **Textbook**
    - We will be using online lecture notes by Richard Froese and Brian Wetton, specifically written for this course. We will cover all six chapters, excluding the material listed as "additional topics". Additional course notes
    - written by Joel Feldman. Summary of complex numbers
- **WebWork Assignments**
    - WebWork assignments will be due on every Friday at 10PM.
    - There will be 11 assignments. Your lowest mark will be dropped from the average.
    - WebWork can be accessed under the WebWork or the Assignments tab.
- **MATLAB Assignments**
    - MATLAB assignments are due on every second Monday at 10PM.
    - There are 6 MATLAB assignments. All 6 assignments will count towards final grade.
    - See Assignments for due dates and instructions.
    - MATLAB material will be tested in exams.
    - See Getting Started with MATLAB for more MATLAB information.
    - If you have any questions:
        - Visit the MATLAB TA Office Hours: Thursday 2-3 and Friday 11-12 on Zoom
        - Post question on Piazza.
        - Contact Head MATLAB TA Michael Deakin mfdeakin@math.ubc.ca
- **Exams**
    - We will have two 50-minute midterm exams during class hours:
        - Feb 15/16 (On Tuesday and Wednesday.)
        - March 23/24. (On Wednesday and Thursday.)
    - The final exam is scheduled for April 23, 12PM.
    - Students who miss a midterm exam for a valid reason will have their final mark averaged proportionally over the other exams.
- **Where to get help**
    - Go to online office hours. See the list of individual sections above.

    - Attend your scheduled lab section on Zoom to get help with the MATLAB assignments.
    - The Math Learning Centre (MLC) will run online tutorials starting January 24. It is staffed by TAs who can help with course material, homework, MATLAB.
    - There is a Piazza page set up for the course.
- **Detailed Course Outline**
    - week #1 January 10-14: vectors and coordinate representation; vector length, dot product, projection. *Notes sections 2.1, 2.2, 2.3.*
    - week #2 January 17-21: determinants; cross product; lines in 2D, lines and planes in 3D. *2.4, 2.5.*
    - week #3 January 24-28: geometry of solutions of linear systems; linear dependence and independence; solving linear systems. *2.6, 3.1.*
    - week #4 January 31 - February 4: echelon form, reduced echelon form, rank; homogeneous equations. *3.2, 3.3.*
    - week #5 February 7-11: geometric applications; resistor networks. *3.4, 3.5.*
    - week #6 February 14-18: **Exam #1,** matrix multiplication; linear transformations. *4.1, 4.2.*
    - Spring Break: February 21-25.
    - week #7 February 28 - March 4: rotations, projections and reflections in 2D; matrix representation and composition of linear transformations. 4.2, 4.3.
    - week #8 March 7-11: random walks, matrix transpose; matrix inverse, determinants; 4.3, 4.4, 4.5, *4.6.*
    - week #9 March 14-18: complex numbers; complex exponential and polar form. *5.1, 5.2, 5.3, 5.4.*
    - week #10 March 21-25: **Exam #2,** eigenvalues and eigenvectors *6.1.*
    - week #11 March 28- April 1: powers of a matrix; application of eigen-analysis to random walks. *6.2.*
    - week #12 April 4-8: vector differential equations; LCR circuits. *6.3, 6.4.*
- **University policies.** UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate

accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions.
Details of the policies and how to access support are available on the UBC Senate website

Section 202: WT2-2021 (DK)

Lecture Times:

Lectures are on Tuesday and Thursday 8-9:30AM

For the first four weeks, lectures and office hours will be held online. We will be using the Zoom link below:

https://ubc.zoom.us/j/69148952956?pwd=dHFQWDc0TVVqYU9oU3RZYkcvU1l4UT09

Please make sure you enter your full name (as it appears on Canvas) when joining the lecture. Attendance is encouraged, but not mandatory. In addition to attending lectures and following class notes, I encourage you to read the textbook very carefully.

My (hand written) lecture notes in *view-only* mode is available through this link

Lecture 19 was by guest lecturer (Atharva Korde), the notes can be found here

Office Hours:

Tuesdays: 9:30AM to 10:00AM

Thursdays: 9:30AM to 10:00AM

Fridays: 1PM to 2PM

Office Hours after end of term (online)

- There will be no fixed time for office hours once classes ends. You may email me to book an appointment.
- I will have office hours April 20-22. Please watch this space for more information.

Piazza:

The Piazza link for this course can be found from the panel on the left or click here

Contact:

Please send me an email at dkundu@math.ubc.ca or send me a message via Canvas.

Practice Problems:

To grasp the concepts explained in class, I suggest you solve the problems at the end of each section in the textbook.

During class, I will give additional practice problems (similar to examples) which will also be posted here. Solutions to these problems will not be posted; you are encouraged to work on them by yourself and with friends. We can also discuss (some of) them in office hours. These are for your practice and do **not** need to be handed in.

Practice Problems Week 1

Practice Problems Week 2

Practice Problems Week 3

Practice Problems Week 4

Practice Problems Week 6

Practice Problems Week 8

Practice Problems Week 9

Practice Problems Week 10

Student Feedback

In 2021, I was nominated for the UBC Mathematics Department's Postdoctoral Teaching Prize[1]. I include here some of the comments I have received from my students in the mid semester or end of semester surveys:

1. "I thought Dr. Kundu was very organized this semester in terms of her notes and providing us with information regarding assignments, midterms, and the final. She was always open to answering student's questions. I think it was a great idea to include bonus marks for students and I think this should be continued in future terms as it gives students a chance to practice while potentially boosting their grade." – MAT105 UBC

2. "Dr. Kundu explained the concept well by using quite a few practice questions during class. In addition, she provided us with extra practice questions which were pretty helpful." – MAT105 UBC

3. "I enjoyed attending Professor Kundu's class. She communicated the material really well and she made math more fun. I found the weekly practice problems helpful as I always did them as extra practice and it allowed for me to brush up on topics that I had difficulties on." – MAT105 UBC

4. "Very respectful, dilligent, and dedicated teacher. Always made time to make sure students understood if they still had questions." – MAT105 UBC

5. "I loved Professor Kundu's style of lectures. She would take the notes with us and do a lot of practice questions and made sure that we had a full understanding before she moved forward. Not only is she a very effective teacher she also showed that she cared for our well being and is a very welcoming person." – MAT105 UBC

6. "Deb always made an effort to answer my emails and my questions in a timely manner and was very kind and respectful to me when I spoke with her. ... Deb is a lovely person who cares about her students, and made lots of effort to connect with us which was greatly appreciated." – MAT105 UBC

7. "Very effective that she asked about what she can do to change and improve the course." – MAT105 UBC

8. "The professor is really good at asking for/answering questions and the pace if the lectures was good." – MAT152 UBC

9. "Material presented in such way that inspired learning and made it interesting. The instruction was clear and easy to understand." – MAT152 UBC

10. "The practice midterms are very useful and applicable." – MAT152 UBC

[1] Nominations are from students or supervisors.