
Teaching Dossier

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UNIVERSITY OF MANITOBA

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1 Biographical Background

I have been teaching in Department of Mathematics at the University of Manitoba since September 2015. Most recently, I am a research mentor for undergraduate students. I was an instructor for MATH 2132: Engineering Mathematical Analysis 2 in Winter 2021, a class of 203 students. I have been a teaching assistant for various first and second year courses, and have also worked at the Math Help Centre where all first and second year mathematics students come to ask questions. In addition to giving lectures, my teaching duties include preparing, invigilating, marking and grading tests. I conducted several workshops, such as PIMS JUMP-Math, Math Boot Camp, Saturday Workshop Series, etc. I was hired as an instructor for these workshops by Department of Mathematics, University of Manitoba.

I have also worked with Department of Extended Education and Department of Nursing at the University of Manitoba. The former hired me to work as a tutor for Access and Aboriginal Focus Program, which consisted of giving several teaching lesson to individual students and reporting their progress to the concerned department. I learnt several techniques of teaching students with special education needs, and a lot of about the Indigenous cultures of Canada. The Department of Nursing appointed me as a tutor for Aboriginal Nursing Cohort Initiative and Pathway to Indigenous Nursing Education programs. Many of my tutees asked me to conduct a workshop to help them in passing a nursing mathematics examination, thus I ran a number of workshops which helped students for succeeding in their test.

I started volunteering at an early age, even while I was at high school. I have a long standing interest in interacting with young children. It is evident through my participation in Math Mania by PIMS, under which I visited several elementary schools in Manitoba with Dr. Darja Barr. I have been a Booth Captain for Science Rendezvous for many years. I have helped in running Math Kangaroo Tests, and also enjoy giving free East Indian classical music lessons. My years of service to teaching has given me a deeper understanding of diverse cultures, learning abilities, special education needs, and the art of forming connection with students from all age groups. I have developed course curriculum, supervised teaching assistants, and helped in organising several events. I want my career to grow in academic, as I consider teaching as one of the greatest services to humankind.

2 Summary of Teaching Experience

1. Graduate Student Research Mentor

Manitoba eXperimental Mathematics Laboratory,
University of Manitoba, Winnipeg, MB
Jan. 2022 - April 2022
Project: Simulation of fluid flow inside a disk.

2. Instructor

University of Manitoba, Winnipeg, MB
Jan. 2021 - April 2021

- MATH 2132-Engineering Mathematical Analysis 2- Winter 2021.
- Class of 203 students.
- Letter of performance evaluation and course outline are attached at the end of this document. My class discussion on Piazza can be viewed through this link: **MATH 2132 Winter 2021-Piazza**.

3. Teaching Assistant

University of Manitoba, Winnipeg, MB
Sept. 2015 - PRESENT

- Nominated for Faculty of Science Award for Excellence in Teaching Assistance.
- First year courses include:
 - Applied Finite Mathematics
 - Calculus I
 - Elementary Discrete Mathematics
 - Mathematics in Art
 - Techniques of Classical and Linear Algebra
 - Vector Geometry and Linear Algebra
- Second year courses include:
 - Introduction to Analysis
 - Linear Algebra 2
 - Mathematical Modelling
 - Multi-variable Calculus
 - Mathematics for Data Science
 - Numerical Analysis I
- **Math Help Centre**, where students of all first and second year courses come to ask questions.

4. Tutor for Pathway to Indigenous Nursing Education

University of Manitoba, Winnipeg, MB
Sept. 2021 - PRESENT

- This is a program designed for aboriginal students studying nursing at the University of Manitoba.

2 SUMMARY OF TEACHING EXPERIENCE

5. Instructor for JUMP Math Workshop

PIMS-University of Manitoba, Winnipeg, MB, Sept. 2020

- A four-day online workshop for preparing students for the Applied Finite Mathematics course at the University of Manitoba.

6. Instructor for Math Boot Camp

University of Manitoba, Winnipeg, MB

Aug. 2020

- A series of six online tutorials sessions for teaching Pre-Calculus to the University of Manitoba students.

7. Instructor for Saturday Workshop Series

University of Manitoba, MB

Sept. 2019, Jan. 2020, Sept. 2020

- A series of three workshops designed to prepare students for university-level Mathematics.

8. Tutor for Aboriginal Nursing Cohort Initiative

University of Manitoba, Winnipeg, MB

Sept. 2020 - Dec. 2020

- This is a program designed for aboriginal students studying nursing at the University of Manitoba.

9. Tutor for Access and Aboriginal Focus Programs

University of Manitoba, Winnipeg, MB

Sept. 2019 - Dec. 2020

- This is a program designed for aboriginal students or for students needing additional support. This job requires to give individual attention to each student and reporting their progress to the instructor.

10. Teaching Assistant for Math Boot Camp

University of Manitoba, Winnipeg, MB

2016-2017

- A workshop for teaching Pre-Calculus to the University students.

3 Service to Teaching

3.1 Outreach

1. Volunteer

PIMS-Math Mania, PIMS Manitoba,
2018 - PRESENT

- A math education outreach programme for children, involving visits to local schools and to schools on remote First Nation reserves.

2. Booth Captain, Volunteer

Science Rendezvous, University of Manitoba
2020, 2019

- A hands-on science festival to encourage public engagement with science.

3.2 Other Services

1. Committee Member

Committee of Graduate Students for Scientific Interdisciplinary Talks (CoGSIT),
University of Manitoba
Feb. 2019 - PRESENT

- The work consists of inviting world-renowned scientists and organizing their talks.

2. Volunteer

Math Kangaroo Contest, University of Manitoba
2019

- Helped in organizing the event.

3. Committee Member

Mathematics Headship Search Committee, University of Manitoba
2018

- A committee for hiring the head of the Department of Mathematics.

4. Volunteer Teacher

Indian Classical Music Training, Gurdwara Nanaksar, Winnipeg
2019

- As a part of free summer school for children at the Gurdwara Nanaksar.

4 Teaching Development

1. Graduate Teaching Program

The Centre for the Advancement of Teaching and Learning, University of Manitoba, Winnipeg, MB
May 2021-PRESENT

- Accredited through **SEDA**, a professional association in the United Kingdom that promotes innovation and good practices in higher education.
- For more information, see **GTP**.

2. Graduate Student Teacher Training

University of Manitoba, Winnipeg, MB
2016

- Under Dr. Donald Trim.
- A workshop with award-winning educator on teaching techniques which included peer and mentor feedback on a teaching presentation.

5 Teaching Philosophy

The admiration and competence for teaching run in my family. It began when my maternal grandmother started teaching at Air Force School India in the early 1970s. Later, her passion developed into her school for young kids. It was also my first school. All of her three children inherited her love, thus are teachers. My mother was a biology teacher from 1986 to 2015 in India and won many awards, including the Incentive Award by KVS, a central government school organization in India. Presently, she continues to teach in the Winnipeg school division. Their dedication is truly an inspiration for me.

While growing up in a family full of teachers, I learned that teaching is one of the greatest services to humankind. In India, many daily wage workers earn less than their deserved pay because of lack of awareness. During my elementary school days in India, I was stunned to learn that our custodian did not understand the concept of a country. If people are unaware of where they reside, then they have no idea about of the constitution as well. This was the biggest motivation for me to participate in teaching activities. My love for mathematics and teaching lead me to the present occupation of being a PhD Mathematics student, research mentor, sessional instructor, teaching assistant, tutor, and facilitator of several workshops at the University of Manitoba. I want to keep growing this field by becoming a postdoctoral fellow, my current goal. I firmly believe in the following values of teaching.

5.1 Passion for teaching

To excel in any job, one needs to be passionate about it. My participation in a broad range of teaching jobs and volunteering activities portrays my passion for teaching. I have conducted several pre-calculus workshops at the University of Manitoba for hundreds of students, which prepare them to learn university-level mathematics in an attempt for them to have a smoother transition. I was an instructor for the JUMP-Math workshop funded by PIMS, and I gave workshops to prepare students to pass nursing examinations. Currently, I am a research mentor for an undergraduate student. My interest also lies in providing individual attention to students through personal tutoring for various mathematical courses. I also volunteer for mathematical fairs for elementary school students, such as Math Mania by PIMS and Science Rendezvous. I enjoy the creative ways of teaching mathematics to kids, such as a Big-Mat game for a sorting algorithm, Math Magician giving a quick lesson for matrix properties, etc. I feel pleasure in teaching several levels of university courses. These practices have given me a better understanding of students from diverse backgrounds. And a greater appreciation for individual patterns of learning among students.

I encourage students' involvement by taking a keen interest in mathematics and valuing the possible contribution that any student can make in the future. For instance, while teaching a pre-calculus workshop to hundred of students, I explain the logic behind the mathematical concepts and take students' argumentation on it. Knowledge is not an asset to be possessed, as this treasure grows on sharing and is lost by keeping. I always learn more by interacting with students to address their questions and ideas. During in-person workshops, I move around to take a quick look at the progress of students and also take queries of some of them individually. For an online course or workshop, I enroll my students on Piazza or university's discussion platform, respectively, to facilitate discussions, where they can post their queries. I also occasionally post my own stories or thoughts on a topic on Piazza, which sometimes encourage student based discussions.

5.2 Motivation

I strive to infuse motivation for learning among students through my passion for mathematics and teaching. The concept of motivation for learning is the most relevant principle of Andragogy. A student's interest is multiplied by making a topic familiar or describing the benefits of learning a particular concept. Several factors affect motivation among students, as it is an internal aspect. On my first day of teaching as an instructor for the course MATH 2132: Engineering Mathematical Analysis 2 to a class of 209 students, I picked up an example of a list of grocery items to introduce infinite sequences, which are an infinite list of numbers. I try to bring myself to the level of the majority of students before taking them up to the main concept. This simple example made my students feel that it was the easiest concept ever, so they learnt it with a bit of

wit and enthusiasm. For infinite series, I started with the question, “how can we add a list of infinite numbers when our entire lifetime is finite?” It stirred up a good discussion in our class. Being a visual learner myself, I map the details in the form of easy-to-read diagrams. Or funny pictures such as an alien among family humans to explain a singular solution and an n-parameter family of solutions for an n-th order linear ordinary differential equation with constant coefficients.

5.3 Respect for diverse talent and way of learning

Every student should feel included in the process of teaching. I try to implement inclusion by welcoming students from diverse cultures, giving the necessary accommodations to students with special education needs, and providing assignments, projects or resources for bright students to perform research in their field of interest. I learned about the rich Indigenous cultures, which could not flourish. Since 2019, I have tutored numerous students at the University of Manitoba who have indigenous ancestry. Many of them were either the first member of their family to come to seek such a level of education or grew up in foster care with little educational support. A positive change in students’ academic progress occurred by giving them individual attention. I once had a classmate who needed special education. He was a bright student who aced physics and mathematics with guidance from his teachers. Also, some students with high intellect learn faster and are eager to contribute to research. We must include and cherish the broad range of talent in teaching practices.

5.4 Communication

A key component of teaching is communication, which has many facets. In my viewpoint, good communication is establishing a healthy relationship with students, gaining their trust, taking their feedback, reporting their progress, and most importantly, giving comprehensible lessons. I believe that students take a course more diligently if there is a good flow of information in all of those aspects. A role in society is crucial for an adult learner. An instructor can build trust by sharing their journey of becoming an expert in the field and incorporating students’ feedback during the delivery of a course. They may define a student’s role by outlining their expectations and how students’ participation can influence the future development of the course curriculum, the science, and their careers.

From the first day of the class, I try to talk to my students before class starts to make them feel comfortable. I always stay for at least ten minutes after class is over. For instance, I asked about various time zones among my students during the first Zoom session. I try my best to make them feel that they can approach me, not just regarding questions with the course, but any academic queries relevant to me. In the course outline for MATH 2132 course, I listed my expectations from the students and what they may expect from me. I also provide the schedule for assessments and criteria of

evaluation in the first class to enforce clarity. I encourage them to visit me during my office hours. In addition to discussing applications, I talk about my research related to the topic. I feel this way students feel more connected to me and the subject. I give them prompt feedback on their questions, ideas, and performance in the class in private, either when they ask for it or when I feel necessary. I often take feedback on my teaching performance from students, as that aids in improving their experience far better than taking only one evaluation at the end of the term. The students appreciate my efforts of making a connection with them, which is evident from their feedback giving in ??.

5.5 Commitment to ongoing development

The world is changing at a record pace. The beginning of the COVID-19 pandemic introduced new teaching platforms in a few days. Thus, it is imperative to learn state-of-art teaching techniques as our world evolves. To develop my teaching skills, I completed the Graduate Student Teacher Training under Dr. Donald Trim in 2016. I have attended various teaching workshops conducted at my school. I am currently enrolled in the Graduate Teaching Program, accredited through SEDA, a professional association in the United Kingdom that promotes innovation and good practices in higher education.

6 Future Teaching Goals

6.1 Focus on understanding the concepts

My teaching goal is to build an intuition for the mathematical concepts among students. Every mind has a unique way of interpreting the material. I want to enforce a delivery style that ignites their thoughts to implement the logic needed for understanding the course material. Because I have often observed that some students memorize steps of solving a problem and get a good score, which could be a poor measure of their understanding. On the flip side, some students with better mathematical skills may lose marks for a simple calculation mistake. Many students suffer from math anxiety out of fear of losing marks because of small calculation mistakes.

I have tried giving students easier invigilated quizzes to check their understanding of the material and boost their morale in the exceptional remote learning environment. I designed the marking schemes to evaluate students on their understanding of the concepts rather than mere calculations. Students highly approved this format, and some also mentioned that it reduced their math anxiety.

6.2 Alternative form of assessments

Evaluation of a student's performance in mathematics is executed generally through written examination, quizzes or assignments. It is challenging to catch academic dishonesty in online examinations, which requires only an individual student's work. I reported three students for academic dishonesty in the entire course as I matched their IP addresses on Chegg. However, it is nearly impossible to catch other forms of cheating. I intend to prepare alternative forms of assessments, that motivate students to grasp a topic towards its roots and motivate them to pursue applications for it. In a broad sense, I want to encourage active participation in the class. For a smaller class, I would like to have more discussion-based sessions. As I have studied fuzzy logic, I want to prepare less rigid grading criteria for a large class and represent a good reflection of their abilities.

6.3 Incorporating blended learning

As the current situation remains uncertain, I will invest time in preparing contents for a course which will help in delivery of course in both online and in-person delivery. Such type of content includes pre-lecture videos, fill-in-blanks lecture notes, polls during a lecture, post lecture online quizzes, discussion prompts, group project ideas, various problem styles etc. These will be beneficial to improve efficiency of teaching a course in any format.

7 Evidence of Teaching Effectiveness

The evaluations of my teaching performance, done by Department of Mathematics at the University of Manitoba, are given in appendix A. I got a perfect rating of 5/5 by my students for the first teaching assistant position in Winter 2016. This trend continued for years to follow. I taught several workshops funded by the University of Manitoba and the Pacific Institute of Mathematical Sciences. I will be guiding a group of four advanced undergraduates on the research project. Below are some summarized comments given by a group of students from my tutorials while I was a **teaching assistant**.

- **MATH 1210 Classical Techniques of Linear Algebra:** “There was no question she couldn't answer. She always asked if anyone needed help. The lab answered questions about course subjects I struggled with. Overall, nice and was always helping students by explaining course material clearly.”
- **MATH 1500 Calculus I:** “The first time I took this course, my TA was awful and I got 40% on the midterm. This time my TA explained everything really well, always made sure everyone understood before continuing. I ended up getting 94% on my midterm this time around.”

- **MATH 2080 Introduction to Analysis:** “Excellent TA. She actually shows up 10-15 minutes early every week to write relevant theorems on whiteboard for reference. Able to answer our questions clearly. She also encouraged us to see her at office if we needed additional help. Overall, one of the best TAs I have ever had!”
- **MATH 2160 Numerical Analysis I:** “Best TA ever! Nominated for TA of the year. She marks fairly, understands what she is teaching, is available outside of class. Explanations clearer than the prof himself. She really helped me potentially pass this course.”

As an **instructor**, I received a rating of 3.5/4 for teaching MATH 2132: Engineering Mathematical Analysis 2 in Winter 2021. The following are comments I received from students of MATH 2132. My class discussion is available to be viewed on Piazza through this link: MATH 2132 Winter 2021-Piazza.

- “Firstly, it is evident that Avleen holds a strong understanding of high level mathematics as she presents complex material with ease and clarity. The notes that she created for the class were always thoughtfully laid out with an emphasis on key learning points. Another strength of Avleen’s rests in her compassion towards students. As I am sure you both know, it can be especially difficult to develop a personal connection in a remote learning setting. Each lecture period, Avleen signed on early and stayed late (sometimes contributing over an hour of her time in addition to the lecture period) to answer student questions. Avleen’s person philosophy that grades are not the only measure of student understanding changed my perspective on math courses. She helped me to gain a greater confidence in my technical abilities which I will take throughout my engineering career.”
- “Avleen Kaur, by far as been the best math professor I have had. She made sure you LEARNED the material and were just not taught to memorize stuff. She made every exam/quiz fair. Her notes were very clear, detailed and provided good examples. Her expectations of us were fair and clearly laid out. She was very good at explaining the material, and at the beginning of each class she would recall the material from the previous class to help me understand the new material better.”
- “Instructor Kaur made fair tests and examinations that reflected the course material appropriately and provided students with extra resources on um learn regularly. I highly recommend other students taking courses with her as the instructor. She also was always very friendly with us making sure to answer everyone questions and trying to get us involved in the classes on Piazza we would get answers within 30 minutes reliably. It was like having our own personal math help center, which was extraordinary. This class was an easy A+ with Avleen teaching it.”
- “I am not a math person but I still enjoyed the class with Avleen. I hope she becomes a member of the faculty permanently so other students can benefit from her great teaching skills!”

- “The instructor provided a friendly atmosphere which made online learning a pleasant experience. Provide comprehensive notes and recorded lectures. The quizzes also helped a great deal. She made sure we understand each and every possible way of doing one math, learning from the very basic and go through all the problems we have. The Piazza platform was extremely helpful and the instructor was approachable and easy to contact. She was excellent, went above and beyond to assure that students understood content, always willing to stay after and provide assistance when required.”
- “She posted amazing notes templates to fill in on my OneNote. But most importantly, this professor is the most accessible professor that I’ve ever had before. She was constantly available, whenever we would ask questions.”
- “Miss Kaur was an incredibly competent and helpful teacher. She was prompt with emails, delivered lectures masterfully and (most importantly) showed a deep passion for all forms of mathematics. Flexible office hours, lots of practice questions were available and her way of teaching was excellent. Gave clear explanations on how to solve problems and was great at teaching difficult concepts. Also quite often asked if there were any questions during lectures which was very helpful. She was a great teacher and gave us all material we needed to succeed. Really helpful fill-in-the-blank notes that made following in class much easier.”
- “Avleen had a passion for teaching and it showed. Her love of math and ensuring her students found success was evident. Extremely helpful. Lots of different options to study and helped guide studying. Best Video Lectures/Explanations clear! great tutorial questions, great pace!”
- “Excellent online learning experience, providing necessary information through email and uploading course material in a good timely manner. Avleen Kaur came and stayed 10 minutes before and after class to answer questions and used piazza to answer any question we had in a very short amount of time. She was clear and concise and shows very easy. Her classes were very organized and easy to follow. Her step-by-step instructions on how to approach a variety of types of questions helped my immensely.”
- “The instructor did an amazing job at showing her understanding of the material and making it easy for students to understand. Her dedication was above and beyond any prof I have dealt with, she answered all questions. Very friendly and personable. Slowed down and spent more time on sections of the class that were hard to understand.”
- “In a way you don’t even have to read again after listening to her explanation. She provided reasonable expectations and deadlines along with course material and tests that accurately reflected the material taught in class. She also highlighted material that was important for our future engineering care.”

I have several thank you emails by my students through years of teaching. I will be uploading them to the link: Emails Collection. I list some of them here, the original copy of which are attached in appendix A.

- **Abby Koch:** I completed the MATH 2132 course over the Winter 2021 semester taught by Avleen Kaur. Whenever I have a particularly outstanding instructor, I like to leave comments on the course's SRI with my contact information to be used as a student reference towards the instructor's future promotion or tenure. As the course didn't have an SRI available, I asked Avleen who I could send my feedback to. Therefore, I am passing these comments on to the both of you!
 - Firstly, it is evident that Avleen holds a strong understanding of high level mathematics as she presents complex material with ease and clarity. The notes that she created for the class were always thoughtfully laid out with an emphasis on key learning points.
 - Another strength of Avleen's rests in her compassion towards students. As I am sure you both know, it can be especially difficult to develop a personal connection in a remote learning setting. Each lecture period, Avleen signed on early and stayed late (sometimes contributing over an hour of her time in addition to the lecture period) to answer student questions.
 - Avleen's person philosophy that grades are not the only measure of student understanding changed my perspective on math courses. She helped me to gain a greater confidence in my technical abilities which I will take throughout my engineering career.

When the time comes for Avleen to apply for another instructor position or promotion, I am happy to provide these comments once again to support her. In addition to my thoughts, I have also attached class chat screenshots of Avleen's final MATH 2132 period held on April 16, 2021, where dozens of students shared similar sentiments on her instructional style. Please do reach out if you have any questions on my comments.

- **Amanda Rizmani:** I just wanted to give some feedback. Your notes and explanations are amazing. Thank you for uploading them. Not too many professors do that, and it can be frustrating to find the one point needed to fix something or figure out on your own. The extra resources on UMlearn are very much appreciated. Thank you for putting so much effort into this class.

One constructive criticism is the cheating speech each quiz. I would bet that those people never watched a single video, so your messages never reached them.
It's been great to learn from you and get motivated.

- **Breanna Stratton:** I couldn't find anywhere I could submit a course evaluation for Math 2132 with you, but I have a lot of positive things to say about it, so I figured I'd just send straight to you.

I think you are a wonderful teacher. Something you did that I especially appreciated was briefly reviewing topics from the previous prerequisites before explaining how they pertain to the course. That was very helpful in understanding and is surprising hard to come by in professors.

Also, the tools you used in class like highlighters and particularly that reddish glowing writing tool that you delete after using made following along easy. Whatever platform you used for the notes is definitely the best note writing platform I've seen used since courses went online; and you used it well.

Another something that made for a great course experience was your encouragement of the use of piazza and your explanations given on there. Although I didn't really ask any questions on piazza, I found what was posted to be super helpful and it encouraged me to try all the recommended exercises listed, not just the even numbers for which I had solutions for. Anyways, I just thought you conducted this course excellently, regardless of it being your first course, and I wanted to let you know.

- **Harwinder Sharma:** I am replying to your email from earlier regarding evaluations. I do not see one available for this class on UM learn. I was wondering where I can give my input, because nonetheless this was most definitely my favorite class.

I want to start off by saying that I have NEVER liked math courses offered at the uofm. Whether it be because how it was taught, the content, etc. I have never had a good math experience at the uofm, however, this term was different. You taught this course so well! And made it so easy to follow and understand, I never thought I would be saying that about a math course but here I am.

I want to say thank you so much for making this class easy and making it a breeze. If there is a way I can give you a rating as a professor, please let the class know because I'm sure the class agrees with me aswell. Everyone even in the groupchats outside of class say you were probably one of the best teacher they had and the best one to teach this course. You did amazing and I hope that you will teach math 3 aswell because your teaching style is one that ALL students can understand. Thank you for the great semester!

- **Josh Cowell:** I saw that you were asking for feedback on the course in the format email, I thought I'd give some. Even though I've been sitting pretty well right on the middle of the curve, it's hard to pick out any of the questions on the tests as unfair. They've all been representative of the material we've covered throughout the course, and anything I've gotten wrong I can only fault myself for. My understanding of concepts presented in this course is, I think, more solid than in a lot of the other courses I've taken so far. The lectures and the notes were always clear, and the examples were useful and really helped me to understand the theory, which helped to keep the information stuck in my head. All in all, this class has been my favourite of the math courses I've taken so far. Even though it's been

taught online, it's gotten me more interested in math than I thought I'd ever be, and for the first time I'm looking forward to taking all of these engineering math courses.

- **Makenna Coldwell:** I was a student in your winter 2021 Math 2132 class. I just wanted to say that you were a fantastic instructor and that I believe you should definitely continue being a professor, and that I wish you the best in your career endeavors. I enjoyed your teaching style and being in your class very much even though for most of the semester I had to work a lot of overtime and night hours so I usually watched the recordings. You provided very clear examples and explanations and always answered questions online on piazza within such a short time frame! I enjoy mathematics so much and after taking this course with you as the instructor I am contemplating doing a minor in math while doing my biomedical engineering degree. It was nice hearing you mention mathematicians and theories occasionally in class since I spend so much of my personal time reading about them! I just finished my last final exam for this semester which is why I took so long getting to writing this email. I hope that you can see your family in India and that they are doing well too. Finally, I just wanted to inquire with you and ask if you are instructing any further math courses such as Math 3 or that if you are going to continue with Math 2 (so that I can recommend other students enrolling in your class) ? Thank you for reading this email, as a woman in STEM I think very highly of you and your accomplishments and hope to achieve as much as you have in the future.
- **Yuyao Du:** I am yuyao and writing this email to thank you for being so kind and helpful during this semester. I believe you will come a wonderful and great professor in the short term. You put so much effort on this course during this tough time. Everyone loves you in the class. We Even have an slogan is called protect Avleen, giving the great feedback on the evaluation and rate my professor. As our math class, you build a great and healthy relationship between students. From academic aspect, Your teaching skills are great. As an instructor you are a person who has warm heart. I am proud that I am the one of your first class. This is a amazing experience But I believe this wouldn't be your best class. You further is so bright.
- **Zoe Dyck:** I would like to say a huge thank you for teaching this course. It was a privilege to learn from you, and I can't believe this was your first time ever teaching a class, because you exceeded all my expectations. I haven't had many profs that take the amount of time that you did to really make sure we understood every single aspect of the material that we were learning. This showed me that you really truly care about your students, which is very important to me. I wish I could have been taught by you in person, and I hope our paths cross again in the future.

A Teaching Evaluations and Other Documents

All of the original documents are attached at the end of this document. The contents and link to them are as follows:

- **Results of evaluation of my teaching as an Instructor of MATH 2132 course by Department of Mathematics, University of Manitoba.**

The evaluations by students from MATH 2132 are not scaled well in this document. The original file is at the link: [MATH 2132 Student Evaluations](#).

- **Results of evaluation as a Teaching Assistant by Department of Mathematics, University of Manitoba.**

These are copies of the feedback handed over to me by office. Further detailed reports are available from the office by request.

- **Original copies of emails by my students.**

Some more emails are listed in [Emails Collection](#).

- **Course Outline for MATH 2132: Engineering Mathematical Analysis 2, Winter 2021, University of Manitoba.**

- **Course Notes for Section 1.1 of MATH 2132.**



**University
of Manitoba**

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18 June 2021

Avleen Kaur
Department of Mathematics
University of Manitoba

Dear Avleen,

As you may know, sessional instructors are evaluated each semester by the Department Head. Below is my evaluation for the course MATH 2132 that you taught in Winter 2021 semester. The assessment is based on a report on a classroom visit that was made by a member of the Undergraduate Studies Committee, and on the SRI evaluations provided by the students in your classes during the period under review. For SRI evaluations, the usual practice in the Department of Mathematics is to consider the average of the students' responses to the question 'Overall, the quality of my learning experience with this instructor so far', which was 3.5/4. The value of the score this term was questionable because of the low response rate, and the extenuating circumstances. Having said that your score was spectacular, underlying your care and dedication toward your students. Further, the report on the visit to your online class was positive overall. Please see the report at the end of this letter. The Department greatly appreciates your time and effort devoted to online delivery of your course.

I am pleased to say that your performance for the semester was excellent, and I take this opportunity to thank you for your contribution to the education of students.

Your Sincerely,

A handwritten signature in black ink, appearing to read "Shaun Lui".

Shaun Lui
Professor and Acting Head
shaun.lui@umanitoba.ca

Sessional Evaluation Form

Sessional Name: Avleen Kaur
Course: Math 2130
Location: Online
Date: March 29, 2021

Organization

Well prepared lecture. Notes are good. Examples were relevant and her solutions show that she knows what she's doing.

Presentation

Great introduction at the beginning of the class, reviewing the concepts of the previous lecture/topic.

Good use of what I'm assuming was a document camera. The writing was a bit small, but still legible. I would recommend writing a bit bigger for the students who might have a harder time seeing.

She definitely has a strong grasp on the use of the technology and has put in a good effort. She also has a strong voice and can easily be heard.

Interaction

Very little interaction with the class. During examples, she would ask questions of the class. "How would we start this problem", but never would let the students answer, or even think about what the answer would be before jumping into the solution. A better idea would be to ask that question, but let the question guide the next step(s). She did it a couple times, but it could be happening much more often.

Further, while difficult during an online class, you still want to be looking at the class. Most of the time she was staring down.

I would also recommend keeping a closer eye on the chat. A student asked

a question, and it was not answered in a timely manner.

Additional Comments and overall assessments

In addition to the interactions in class, Avleen and her class uses the Piazza message board a lot which is great. She is quite timely with her responses and it appears the students are quite appreciative. My only suggestion would be to not completely answer questions for the students. A lot of times, the student appears to be stuck. I would suggest helping them get over the spot where they get stuck, but stop there instead of doing every future step.

In general, the class was good, but needs to be much more active and including students as part of the process. Otherwise, they might as well just be reading the textbook.

Supervised by Nick Harland

MATH 2132

Course projects, assignments, tests, and/or exams provided opportunity for me to demonstrate an understanding of the course material.		Overall, the quality of my learning experience in this course was... Overall, the quality of my learning experience with this instructor was ...	
A Great Deal	Very Good	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
Moderately	Good	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
Mostly	Good	Good	Good
A Great Deal	Excellent	Excellent	Excellent
Mostly	Good	Good	Good
A Great Deal	Excellent	Excellent	Excellent
Moderately	Good	Good	Good
A Great Deal	Excellent	Excellent	Excellent
Mostly	Very Good	Excellent	Excellent
Mostly	Good	Excellent	Excellent
A Great Deal	Very Good	Good	Good
Mostly	Excellent	Excellent	Excellent
Mostly	Very Good	Excellent	Excellent
A Great Deal	Good	Good	Good
A Great Deal	Excellent	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
Mostly	Very Good	Good	Good
Mostly	Very Good	Excellent	Excellent
Mostly	Very Good	Very Good	Very Good
A Great Deal	Excellent	Excellent	Excellent
Mostly	Very Good	Very Good	Very Good
Mostly	Very Good	Good	Good
A Great Deal	Excellent	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
A Great Deal	Good	Very Good	Very Good
A Great Deal	Good	Good	Good
A Great Deal	Very Good	Excellent	Excellent
Moderately	Excellent	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
Mostly	Very Good	Excellent	Excellent
Mostly	Very Good	Very Good	Very Good
A Great Deal	Excellent	Excellent	Excellent
Mostly	Excellent	Excellent	Excellent
Mostly	Very Good	Very Good	Very Good
Somewhat	Poor	Fair	Fair
A Great Deal	Excellent	Excellent	Excellent
A Great Deal	Good	Very Good	Very Good
A Great Deal	Excellent	Excellent	Excellent
A Great Deal	Very Good	Very Good	Very Good
Moderately	Excellent	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
Mostly	Very Good	Very Good	Very Good
Mostly	Excellent	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
Moderately	Good	Very Good	Very Good
Mostly	Very Good	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
Mostly	Excellent	Excellent	Excellent
A Great Deal	Good	Very Good	Very Good
Mostly	Excellent	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
Mostly	Excellent	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
Moderately	Very Good	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
Mostly	Excellent	Excellent	Excellent
A Great Deal	Good	Very Good	Very Good
Mostly	Excellent	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
Mostly	Excellent	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
Mostly	Excellent	Excellent	Excellent
A Great Deal	Excellent	Excellent	Excellent
Moderately	Very Good	Excellent	Excellent

What did this instructor do to facilitate my learning within this course?
Avleen Kaur, by far as been the best math professor I have had. She made sure you LEARNED the material and were just not taught to memorize stuff. She made every exam/quiz fair.
Her notes were very clear, detailed and provided good examples. Her expectations of us were fair and clearly laid out.
She was very good at explaining the material, and at the beginning of each class she would recall the material from the previous class to help me understand the new material better.
Instructor Avleen Kaur provided excellent lectures that provided detailed explanations and examples. She spent extra time answering questions before and after classes as well as on piazza and always answered emails regarding them. She was very friendly and approachable, she gave us lots of extra time to submit our papers after a test or quiz and she was very nice with her marking.
Instructor made great notes and was very available and helpful when answering questions.
Good tutorial questions and exams.
Did everything she could to make sure students understood the material. In-depth explanations, encouraged student emails, used piazza to answer specific questions from the course.
She did a great job of going over lots of examples with us to make sure we understood the material and what she was looking for on exams and mid terms. She also was always very friendly with us making sure to answer every detailed notes and lots of examples. Very generous marker.
Clear instruction.
Provided extra time outside the class for solving problems. Most helpful teacher in UofM.
She was very caring with her students by helping us with the topics that were difficult to understand. She also made the material easier to understand.
Provided good notes and recorded lectures.
Provided complete notes that covered the material well.
The Instructor provided a friendly atmosphere which made online learning a pleasant experience.
Provided complete notes that covered the material well.
Provide comprehensive notes and recorded lectures. The quizzes also helped a great deal.
She made sure we understood and every possible way of doing one math, learning from the very basic and go through all the problems we have.
The Piazza platform was extremely helpful and the instructor was approachable and easy to contact.
very good, she was excellent!
Went above and beyond to assure that students understood content, always willing to stay after and provide assistance when required.
She posted amazing notes/templates to fill in on my OneNote. But most importantly, this professor is the most accessible professor that I've ever had before. She was constantly available, whenever we would ask questions.
They did a good and thorough job teaching the subject. Explained it all really well.
Very clear notes, made every effort to be available to students and help as much as possible.
Miss Kaur was an incredibly competent and helpful teacher. She was prompt with emails, delivered lectures masterfully and (most importantly) showed a deep passion for all forms of mathematics.
Flexible office hours, lots of practice questions were available and her way of teaching was excellent.
Gave clear explanations on how to solve problems and was great at teaching difficult concepts. Also quite often asked if there were any questions during lectures which was very helpful.
She was a great teacher an gave us all material we needed to succeed. From textbook pages to past exams.
Really helpful fill-in-the-blank notes that made following in class much easier. Avleen had a passion for teaching and it showed. Her love of math and ensuring her students found success was evident. Extremely helpful when I thought that using piazza to answer questions was very helpful.
Lots of different options to study and helpful guide/studying.
Best Video Lectures / Explanations clear / great tutorial questions - great pace!
The final exam was really fair and the last test was fair as well, however the mid terms were both very difficult.
The questions given in the quizzes, term tests and final exam were usually similar to what I expected, based on the problems from the textbook which I did for practice. This stands out to me since this is not the case for some.
Understanding of the new learning experience and accommodating towards students. Using an iPad to teach the course was also very helpful as the notes could be seen clearly. The instructor did a really good job.
Provided all the lectures and lecture notes on time and she taught us in a way anyone could understand the course material.
Avleen went into immense detail and always went over the stuff that was most important the most. She was very helpful during office hours, and also stayed after class for an extra 10-15 minutes to answer student's questions. She also set up a Piazza group for us so we could post our questions and she would help us with solutions we couldn't figure out.
Good tutorial questions and exams
Excellent online learning experience, providing necessary information through email and uploading course material in a good timely manner.
Avleen Kaur came and stayed 10 minutes before and after class to answer questions and used piazza to answer any questions we had in a very short amount of time. She was clear and concise in class and shows very easily.
Her classes were very organized and easy to follow. Her step-by-step instructions on how to approach a variety of types of questions helped my immensely.
The Instructor did an amazing job at showing her understanding of the material and making it easy for students to understand. Her dedication was above and beyond any prof I have dealt with; she answered all questions with great help.
Great notes/lectures, explained things really well.
Helpful and provided all resources required.
Made quizzes applicable to the material and straightforward, was very understanding of technical issues. Very friendly and personable.
Showed down and spent more time on sections of the class that were hard to understand.
Avleen provided very clear lectures and accompanying notes. She was very organized in her communication and I rarely felt unsure about where to get information or find help.
Additionally, she was very approachable taking time out of her schedule to explain how I was having trouble keeping up with the course. She provided me with an organized understanding of what skills I would need to demonstrate on the final.
Used sufficient tools such as a digital writing pad and pencil which is optimal for online teaching as well as provide recorded lectures for students.
In a way you don't even have to read again after listening to her explanation.
She provided reasonable expectations and deadlines along with course material and tests that accurately reflected the material taught in class. She also highlighted material that was important for our future engineering career.

How might this instructor improve this course
She's doing amazing as is.
Especially with online, I would have liked more office hours at a specific time as he's seemed to move around a lot, making it confusing. I would have also liked more in class examples, as I believe you can never have too many.
nothing
Instructor Avleen Kaur does not need to improve the way she taught the course, it was delivered exactly as one would expect and facilitated learning. One might say occasionally 5min overtime on instructing occurred which Maybe split up the grades a bit more maybe with some assignments so the final is not as heavy.
There is nothing the instructor could improve on
More structured lectures
Watch the way she talks to the class. Sometimes during a test she would say over zoom "this is a very easy test" comments like these I think do not help and make some students feel bad if they are having a hard time. I personally don't like this.
She is best
Keep up the good work
Group the course notes by section, be more patient with the students.
Budget time better so we complete all the course material with some time to study before the exam
Budget time better so we complete all the course material with some time to study before the exam
Organize the course to give some time at the end for a questions and answers class.
Avoid comments during quizzes and exams such as "This is easy you should be done by now"
slow down a tiny bit, it was hard to follow/keep up at sometimes
Not sure.
I would consider trying to include more real world examples in the problems that we did. We worked very well learning the theory behind everything, but it was still very abstract in terms of applications. For example we had to calculate the area of a circle.
Classes ran late a lot
The only thing I would say is slow down slightly when going over examples in lecture.
idk lol
The lecture itself would move too fast to most students to write down notes and also be able to listen effectively. This caused a lot of students to either rely on the recordings to be able to learn and take notes or watch the lectures. It would be helpful for her to slow down to allow to students to take note of what she has written and to better explain her process.
Not quite sure
My only suggestion for improving the course is to be a little bit more mindful of the time. Often examples were started right at 9:19 Or 9:20 and the class would end up running overtime. I know we didn't have to run across campus but it was still a bit annoying.
Kinda came off condescending in the beginning but later on I just realized that she really dislikes cheaters.
I found the notes very hard to follow if you didn't print them off or use a tablet to take notes. I still use a pen and notebook and it was very hard to take clear we notes from the way she had the slides setup. Overall she's a good teacher. She is very good now, I have no idea what she has to improve.
Even though the examples given in the lectures were generally useful, I feel like having some harder examples in the lectures would be even better.
I don't see any improvements required as I feel like like the course was taught very well in these unfortunate times.
Avleen was one of the best profs I've ever had. I can't believe she isn't technically a professor. I have never had a good math prof until I took Math 2132 with Avleen. I have no suggestions for improvement because Avleen is perfect. Another thing that I really appreciated about her teaching style is that she is very good at communicating everything with her students.
More structured lectures
Less review during each class of more simpler course material from previous/current course(s) and replace with more challenging examples.
The class was amazing, only wish it was in person.
Sometimes a bit more encouragement would be nice to make us feel like all the effort we're putting in is being acknowledged. It wasn't bad but could be improved.
all in all the instructor did a great job, my only complaint was the fast pace of the course but I guess that is how the course is structured
went a bit to fast through some notes, but overall not a huge deal as we could go back and review the notes as needed.
Course was good
Marked assignments to further motivate learning.
Narrow the textbook questions down so that students have time for other course work as well.
Piazza could take a lot of time to keep up with. I'm sure the instructor put the most time in, but potentially some sort of question quality guide would be helpful to differentiate between 'what is the answer to this' and a more open ended question.
Have TAs to give more specific feed back when marking test results.
The instructor was perfect I was lucky to be in her class
I would like her to slow down the writing speed of the live lectures, as I was spending too much time copying down notes and not enough time listening to the material

COURSE INSTRUCTOR COMMENTS

WINTER 2016

AVLEEN KAUR

COURSE: MATH 1210 B05/07
INSTRUCTOR: S. Tsaturian

- No Comments.

MATH 1210 B05/07

1.
 - She is a good teacher
 - She asks questions personally to make sure we understand
2.
 - Always first in class
 - Has her notes ready all of the time
 - Uses the time allotted and beyond, after class
 - Looks like she has studied and been a TA previously
 - Helps and knows the materials
 - Has a good body language and is fluent in what she teaches
3.
 - All notes ready before tutorial
 - Sometimes over explained some things which I didn't find useful
 - Always had answers and explanations to questions
4.
 - Accent, but still easy to understand
5.
 - Has the concepts written on the board before class
 - She would benefit from receiving more time



COURSE: MATH 1210 B05
INSTRUCTOR: G.I. Moghaddam

- No Comments.

COURSE: MATH 2080 B01
INSTRUCTOR: R. Clouatre

- No Comments.

COURSE: MATH 2160 B02
INSTRUCTOR: M. Slevinsky

- No Comments.

MATH 1210 B05

1.
 - No Comments.

MATH 2080 B01

2.
 - Sometimes seemed to be rushing through material
 - Louder than the room and class size required
 - Assignments time sufficient for regular evaluation
3.
 - She can't finish the material on
4.
 - Often runs late but goes in depth into material
 - Overall, excellent
5.
 - She always comes in early to write needed theorems on board prior to the start of lab
 - Has several questions prepared so we use up entire lab time
 - Able to answer our questions clearly
 - Stays on topic for the whole lab. Asks us if we have questions
 - Provides email, many help center hours and stays after the lab often to ensure we get the help we need
 - Approachable
 - Overall, one of the best TA's I've ever had!
6.
 - She actually shows up 10-15 minutes early every week to write relevant theorems on whiteboard for reference
 - She also encouraged us to see her in her office if we needed additional help
7.
 - She is a very good TA
8.
 - Excellent TA

MATH 2160 B02

1.
 - She's very good!!! Very nice and willing to help us!
2.
 - The prof just talking rocket science and we can't understand

COURSE INSTRUCTOR COMMENTS

SUMMER 2017

AVLEEN KAUR

COURSE: MATH 1210 B01
INSTRUCTOR: J. Breen

- -Avleen is a great TA and really excellent to work with

MATH 1210 B01

1.
 - Quiz 4 sheets are missing
 - Do not like quizzes but tutorials worksheets were great
2.
 - Sometimes absent
 - Has an accent which is hard to understand
 - Overall, good teacher
 - I succeeded without the lab
3.
 - Great help!
4.
 - Always has answers to the questions given to her
 - Explains everything when student sis not capable
 - Efficiently works on the questions
 - Very friendly
5.
 - Spends lots of time explaining rather than letting us answer questions on our own
6.
 - Short on quizzes once
 - Helpful. Asks if class wants example on board

COURSE: MATH 2160 B02
INSTRUCTOR: M. Slevinsky

- Superb TA

MATH 2160 B02

1.
 - The quizzes were often used to introduce new material, thus making it difficult to do well on them and thus succeed in the course (not Avleen's fault, course's fault)
2.
 - Best TA ever!
 - She marks fairly, understands what she is teaching, is available outside of the class
 - She really helped me through to pass this course
3.
 - Explanations clearer than the prof himself
 - Examples are actually explained in the lab which helped
 - Helped me potentially pass this course!
4.
 - Nominate for TA of the year
5.
 - She prepared a lot and she is nice

AVLEEN KAUR

COURSE: MATH 1500 B01
INSTRUCTOR: R. Borgersen

- No Comments.

MATH 1500 B01

1.
 - Always has questions to go through
 - Always uses full hour or overtime
 - Knows the content
 - Avleen gave her email and was always approachable
 - She makes sure we understand
2.
 - The first time I took this course, my TA was awful and I got 40% on the midterm. This time my TA explained everything really well, always made sure everyone understood before continuing. I ended up getting 94% on the midterm this time around
3.
 - Very good!
4.
 - She is a very good TA. She explains stuff well and makes sure that the majority of the class understand what she is teach. Best TA!



COURSE INSTRUCTOR COMMENTS

SUMMER 2018

AVLEEN KAUR

COURSE: MATH 1210 B02
INSTRUCTOR: M. Davidson

- Avleen is an excellent TA. It is worth noting that the one very low score for 3 (use of lab time) was from a student who did not like the format I had laid out for the TAs to follow

MATH 1210 B02

1.
 - She showed up to every lab
 - She had materials prepared for the labs
 - She was always helping
 - There was no question she couldn't answer
 - She always asked if anyone needed help
 - Easy to understand her when she was explaining something
 - Overall, nice and was always helping students by explaining course material clearly
 - The lab answered questions about course subjects I struggled with
2.
 - She is always on time
 - Very helpful
 - Good use of time
 - She gives pointers and understands the material
 - She gives explanations in class (detailed)
 - She is very helpful!
3.
 - We just work on worksheet
 - Since we have class every day I think more quizzes would be good
4.
 - She gives helpful notes

From: Abby Koch kocha34@myumanitoba.ca 
Subject: Student Feedback on MATH 2132 - Avleen Kaur
Date: May 11, 2021 at 12:57 PM
To: Derek Krepski Derek.Krepski@umanitoba.ca, Shaun Lui Shaun.Lui@umanitoba.ca
Cc: AVLEEN KAUR Avleen.Kaur@umanitoba.ca

Hello Dr. Krepski and Dr. Lui,

I completed the MATH 2132 course over the Winter 2021 semester taught by Avleen Kaur. Whenever I have a particularly outstanding instructor, I like to leave comments on the course's SRI with my contact information to be used as a student reference towards the instructor's future promotion or tenure. As the course didn't have an SRI available, I asked Avleen who I could send my feedback to. Therefore, I am passing these comments on to the both of you!

- Firstly, it is evident that Avleen holds a strong understanding of high level mathematics as she presents complex material with ease and clarity. The notes that she created for the class were always thoughtfully laid out with an emphasis on key learning points.
- Another strength of Avleen's rests in her compassion towards students. As I am sure you both know, it can be especially difficult to develop a personal connection in a remote learning setting. Each lecture period, Avleen signed on early and stayed late (sometimes contributing over an hour of her time in addition to the lecture period) to answer student questions.
- Avleen's person philosophy that grades are not the only measure of student understanding changed my perspective on math courses. She helped me to gain a greater confidence in my technical abilities which I will take throughout my engineering career.

When the time comes for Avleen to apply for another instructor position or promotion, I am happy to provide these comments once again to support her. In addition to my thoughts, I have also attached class chat screenshots of Avleen's final MATH 2132 period held on April 16, 2021, where dozens of students shared similar sentiments on her instructional style.

Please do reach out if you have any questions on my comments.

All the best,
Abby Koch

Biosystems Engineering Undergraduate Student | University of Manitoba
Email: kocha34@myumanitoba.ca | Phone: 204-998-5703
LinkedIn: <https://www.linkedin.com/in/abby-koch-64a3a8169/>



Avleen Kaur -
Studen...21.pdf

 Chat

From James Neufeld to Everyone: 09:24 AM
Will convolutions be tested?

From Andrew Baker to Everyone: 09:24 AM
@Nikolaus we are converting the parts of the differential equation into a form where algebraic manipulation will not change the original equation but this form allows the equation to be solved as an algebra question

From James Neufeld to Everyone: 09:25 AM
So magic essentially okay cool thanks

From Gwen Greenhill to Everyone: 09:26 AM
Thank you for teaching us this term!

From James Neufeld to Everyone: 09:26 AM
Thanks Avleen!

From 103 - Mohammad At... to Everyone: 09:26 AM
Thank you for everything!

From Ethan H to Everyone: 09:26 AM
thanks for teaching us.

From Megan Starosilec to Everyone: 09:26 AM
Thank you Avleen!!

From Titus Waldner to Everyone: 09:26 AM

To: Everyone

Type message here...

 Chat

thanks for teaching us.

From Megan Starosilec to Everyone: 09:26 AM
Thank you Avleen!!

From Titus Waldner to Everyone: 09:26 AM
Thank you

From sydneypratt to Everyone: 09:26 AM
Thanks!!

From Darian Chakhmouradian to Everyone: 09:26 AM
Thank you

From Tran Dung to Everyone: 09:26 AM
thank

From Ethan Kolmel to Everyone: 09:26 AM
thanks a bunch avleen

From Mohamm... to Everyone: 09:26 AM
What time is the office hours?

From Nikolaus Reichert to Everyone: 09:26 AM
Thanks Avleen, This was a super fun course!

To: Everyone

Type message here...

 Chat

From Ethan Froese to Everyone:

Thank you!!

From Justin Powers to Everyone:

Thank you

From Me to Everyone:

Awesome term Avleen- you're amazing!

From josh ilyas to Everyone:

Thank you!!!

From Tobias Bergmann to Everyone:

Thank you!!

From Chiamaka Nwadi... to Everyone:

<3333

From Autumn Tyler to Everyone:

Thank you! Its been great

From Dillon Dietri... to Everyone:

Thanks!

From Massis Sarkes to Everyone:

To: Everyone ▾  File 

Type message here...

 Chat

I thanks!

From Karan Patel to Everyone:

Thank you! Avleen

From Zaid Khan to Everyone:

Thank you AVLEEN! This course has been amazing with you!!! Hope your dad and grandfather feel better

From Ethan Kolmel to Everyone:

prob woulda failed this class with another prof tbh

From James Neufeld to Everyone:

This is actually my last math class I'll ever need to take

From Tobias Bergmann to Everyone:

^ ^ ^

From Jack Gibson to Everyone:

Thank you!

From Andrew Baker to Everyone:

Couldn't have had a better professor for this course

From Ashley Albert to Everyone:

your the best! thank you so much

From Duncan Platts to Everyone:

To: Everyone ▾  File 

Type message here...

Chat

From [Darian Chakhmouradian](#) to Everyone:

Thank You!

From [Fabio Albaran](#) to Everyone:

09:27 AM

Thanks

From [Bryce Marino](#) to Everyone:

09:27 AM

Thank you!!

From [Darian Chakhmouradian](#) to Everyone:

09:27 AM

:)

From [Simon](#) to Everyone:

09:27 AM

Thank you!

From [Jake Martin](#) to Everyone:

09:27 AM

thank you avleen!

From [Anas Alam](#) to Everyone:

09:27 AM

thank youuu !!

From [Chiamaka Nwadi...](#) to Everyone:

09:27 AM

I'm getting emotional watching you get emotional

From [Mohamm...](#) to Everyone:

09:28 AM

Awww

To: Everyone

Type message here...

Chat

From [josh ilyas](#) to Everyone:

09:28 AM

you did great thank you

From [Andrew Baker](#) to Everyone:

09:28 AM

Sometimes its easier to have it explained by somebody whu is still a student

From [Autumn Tyler](#) to Everyone:

09:28 AM

Thanks again! See you on Tuesday for this exam

From [Ethan Kolmel](#) to Everyone:

09:28 AM

hope your family is well. See you at the exam!

From [Ethan H](#) to Everyone:

09:28 AM

Take care and consider teaching more classes.

From [josh ilyas](#) to Everyone:

09:28 AM

^^

From [Ethan Kolmel](#) to Everyone:

09:29 AM

teach math 3 :P

From [Nikolaus Reichert](#) to Everyone:

09:29 AM

ask to do 1010 lol

From [Ethan Kolmel](#) to Everyone:

09:31 AM

To: Everyone

Type message here...

Chat

From Andrew Baker to Everyone: 09:28 AM
Sometimes its easier to have it explained by somebody whu is still a student

From Autumn Tyler to Everyone: 09:28 AM
Thanks again! See you on Tuesday for this exam

From Ethan Kolmel to Everyone: 09:28 AM
hope your family is well. See you at the exam!

From Ethan H to Everyone: 09:28 AM
Take care and consider teaching more classes.

From josh ilyas to Everyone: 09:28 AM
^^

From Ethan Kolmel to Everyone: 09:29 AM
teach math 3 :P

From Niklaus Reichert to Everyone: 09:29 AM
ask to do 1010 lol

From Ethan Kolmel to Everyone: 09:31 AM
if you teach math 3 winter term next year then ill gladly take it

right that makes sense

To: Everyone

Type message here...



...

From: Amanda Rismani rismania@myumanitoba.ca
Subject: MATH 2132 Course Feedback
Date: April 16, 2021 at 5:35 PM
To: AVLEEN KAUR Avleen.Kaur@umanitoba.ca

Hello Avleen,

Thank you for this great semester.

I just wanted to give some feedback.

Your notes and explanations are amazing. Thank you for uploading them. Not too many professors do that, and it can be frustrating to find the one point needed to fix something or figure out on your own.

The extra resources on UMlearn are very much appreciated. Thank you for putting so much effort into this class.

One constructive criticism is the cheating speech each quiz. I would bet that those people never watched a single video, so your messages never reached them.

It's been great to learn from you and get motivated.

Best regards,
Amanda

From: Breanna Stratton strattob@myumanitoba.ca
Subject: Course
Date: April 28, 2021 at 12:08 PM
To: AVLEEN KAUR Avleen.Kaur@umanitoba.ca

Hello Avleen,

I couldn't find anywhere I could submit a course evaluation for Math 2132 with you, but I have a lot of positive things to say about it, so I figured I'd just send straight to you.

I think you are a wonderful teacher. Something you did that I especially appreciated was briefly reviewing topics from the previous prerequisites before explaining how they pertain to the course. That was very helpful in understanding and is surprising hard to come by in professors.

Also, the tools you used in class like highlighters and particularly that reddish glowing writing tool that you delete after using made following along easy. Whatever platform you used for the notes is definitely the best note writing platform I've seen used since courses went online; and you used it well.

Another something that made for a great course experience was your encouragement of the use of piazza and your explanations given on there. Although I didn't really ask any questions on piazza, I found what was posted to be super helpful and it encouraged me to try all the recommended exercises listed, not just the even numbers for which I had solutions for.

Anyways, I just thought you conducted this course excellently, regardless of it being your first course, and I wanted to let you know.

Thanks so much,
Breanna Stratton
789 1001

From: Harwinder Sharma sharmah3@myumanitoba.ca
Subject: Reviews/Evaluation
Date: April 16, 2021 at 8:21 PM
To: AVLEEN KAUR Avleen.Kaur@umanitoba.ca

Hello professor,

I am replying to your email from earlier regarding evaluations. I do not see one available for this class on UM learn. I was wondering where I can give my input, because nonetheless this was most definitely my favorite class.

I want to start off by saying that I have NEVER liked math courses offered at the uofm. Whether it be because how it was taught, the content, etc. I have never had a good math experience at the uofm, however, this term was different. You taught this course so well! And made it so easy to follow and understand, I never thought I would be saying that about a math course but here I am.

I want to say thank you so much for making this class easy and making it a breeze. If there is a way I can give you a rating as a professor, please let the class know because I'm sure the class agrees with me aswell. Everyone even in the groupchats outside of class say you were probably one of the best teacher they had and the best one to teach this course. You did amazing and I hope that you will teach math 3 aswell because your teaching style is one that ALL students can understand.

Thank you for the great semester! And I hope you nothing but the best and I hope your family that you will be going to visit in India gets well soon!

Sincerely,
Harwinder Sharma

From: Josh Cowell cowellj@myumanitoba.ca
Subject: Final Exam 2017 Solutions
Date: April 17, 2021 at 12:48 AM
To: AVLEEN KAUR Avleen.Kaur@umanitoba.ca

Hi Avleen,

I finished a few of the questions on the 2017 final, and I was looking for the solutions so I could check over my work. Is there an answer key posted anywhere, or should I just ask on piazza if I want to see a solution for a particular question?

Also, unrelated but since I saw that you were asking for feedback on the course in the format email, I thought I'd give some. Even though I've been sitting pretty well right on the middle of the curve, it's hard to pick out any of the questions on the tests as unfair. They've all been representative of the material we've covered throughout the course, and anything I've gotten wrong I can only fault myself for. My understanding of concepts presented in this course is, I think, more solid than in a lot of the other courses I've taken so far. The lectures and the notes were always clear, and the examples were useful and really helped me to understand the theory, which helped to keep the information stuck in my head. All in all, this class has been my favourite of the math courses I've taken so far. Even though it's been taught online, it's gotten me more interested in math than I thought I'd ever be, and for the first time I'm looking forward to taking all of these engineering math courses.

Thanks,
Josh Cowell

From: Makenna Coldwell coldwel1@myumanitoba.ca
Subject: Math 2132
Date: April 30, 2021 at 9:16 PM
To: AVLEEN KAUR Avleen.Kaur@umanitoba.ca

Hello Instructor Kaur,

My name is Makenna Coldwell and I was a student in your winter 2021 Math 2132 class. I just wanted to say that you were a fantastic instructor and that I believe you should definitely continue being a professor, and that I wish you the best in your career endeavors. I enjoyed your teaching style and being in your class very much even though for most of the semester I had to work a lot of overtime and night hours so I usually watched the recordings. You provided very clear examples and explanations and always answered questions online on piazza within such a short time frame! I enjoy mathematics so much and after taking this course with you as the instructor I am contemplating doing a minor in math while doing my biomedical engineering degree. It was nice hearing you mention mathematicians and theories occasionally in class since I spend so much of my personal time reading about them! I just finished my last final exam for this semester which is why I took so long getting to writing this email. I hope that you can see your family in India and that they are doing well too. Finally, I just wanted to inquire with you and ask if you are instructing any further math courses such as Math 3 or that if you are going to continue with Math 2 (so that I can recommend other students enrolling in your class) ? Thank you for reading this email, as a woman in STEM I think very highly of you and your accomplishments and hope to achieve as much as you have in the future.

-Makenna Coldwell

From: Yuyao Du duy1@myumanitoba.ca

Subject: Math 2132

Date: April 20, 2021 at 9:30 PM

To: AVLEEN KAUR Avleen.Kaur@umanitoba.ca

Hi, Avleen, I am yuyao and writing this email to thank you for being so kind and helpful during this semester. I believe you will come a wonderful and great professor in the short term. You put so much effort on this course during this tough time. Everyone loves you in the class. We Even have an slogan is called protect Avleen, giving the great feedback on the evaluation and rate my professor. I know the delay of the flight May make you feel anxious because you are so eager to see your grandma. Everything will be fine and getting better and better. As our math class,you build a great and healthy relationship between students. From academic aspect, Your teaching skills are great. As an instructorYou are a person who has warm heart. I am proud that I am the one of your first class. This is a amazing experience But I believe this wouldn't be your best class. You further is so bright. And go back to Indian And hope you have the best summer with your grandma.

Best wishes to you and your family.

Best

yuyao

获取 [Outlook for iOS](#)

From: **Zoe Dyck** dyckz1@myumanitoba.ca

Subject: MATH 2132

Date: April 16, 2021 at 2:38 PM

To: AVLEEN KAUR Avleen.Kaur@umanitoba.ca

Hi Avleen,

I would like to say a huge thank you for teaching this course. It was a privilege to learn from you, and I can't believe this was your first time ever teaching a class, because you exceeded all my expectations.

I haven't had many profs that take the amount of time that you did to really make sure we understood every single aspect of the material that we were learning. This showed me that you really truly care about your students, which is very important to me.

I wish I could have been taught by you in person, and I hope our paths cross again in the future.

I hope everything goes well with your family, and have a safe flight to India!

Thank you again,

Zoë Dyck



University of Manitoba
Faculty of Science
Department of Mathematics

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1 Course Details

Course Title & Number	MATH 2132 A01: Engineering Mathematical Analysis 2
Number of Credit Hours	3
Class Times & Days of Week	8:30 am-9:20 am Monday, Wednesday and Friday
Tutorial Time & Day of Week	11:30 am -12:45 pm Tuesday
Required Software	Zoom, details will be posted on UMLearn
Prerequisites	MATH 1210 or MATH 1211, MATH 1710

2 Instructor Contact Information

Instructor Name	Avleen Kaur
Preferred Form of Address	Avleen (she/her)
Online Office Hours	3:30 pm-4:30 pm Monday and Wednesday, or by appointment
Office Hours Zoom Meeting Details	https://zoom.us/j/97697345604?pwd=QzFSUG9TQUs0dT1BRDZJeE9iUU9DUT09 Zoom Meeting ID: 976 9734 5604 Passcode: 851155
Email	Avleen.Kaur@umanitoba.ca or kaura349@myumanitoba.ca All email communication must conform to the Communicating with Students university policy. You may include MATH 2132 in the subject for your emails. Your emails will get an answer within 24 hours during the weekdays and 48 hours over the weekend. If you have a question regarding problems from the textbook exercises, tutorials, lectures, etc., then you must post it on MATH 2132-Winter 2021 class on Piazza .

3 Description of the Course

This course will have live lectures and tutorials. All quizzes and midterm examinations will be held in the tutorials. The following topics will be discussed.

- **Infinite Series:** Infinite sequences and series of constants and functions, Power series, Alternating series.
- **Taylor and Maclaurin Series:** Taylor polynomial and remainder, Maclaurin and Taylor series of functions and their applications to limits, Approximations of functions by polynomials and evaluation of integrals, Binomial expansion.
- **Ordinary Differential Equations:** Separable first-order differential equations, Linear first-order differential equations and integrating factors, Simple second-order differential equations; Homogeneous and non-homogeneous linear differential equations of nth-order; Applications of linear differential equations.
- **Laplace Transforms:** Laplace transforms and their applications to linear differential equations; Unit pulse and Dirac-delta functions.

Note: Not all sections of the text or notes will be covered. Information about which sections/topics in the text are required material will be given in lectures.

4 Minimum Technological Requirements

The Faculty of Science has indicated that all students enrolled in this course must ensure they have access to the following:

1. a computing device where one can create and edit documents;
2. an internet connection capable of streaming videos and downloading software; and
3. access to a web-cam and microphone.

5 Course Goals

The course has five main goals:

1. determining whether sequences of constants and functions converge;
2. finding and applying Maclaurin and Taylor series for functions;
3. solving and applying separable, linear first-order, and simple second-order differential equations;
4. solving and applying homogeneous and non-homogeneous linear n th-order differential equations; and
5. using Laplace transforms to solve linear differential equations.

6 Intended Learning Outcomes

At the completion of the course, the student is expected to be able to:

1. use tests to determine whether sequences of constants and functions converge;
2. understand the concept of convergence of Maclaurin and Taylor series;
3. find the Maclaurin and Taylor series for a function;
4. approximate a function by its truncated Maclaurin or Taylor series and determine the error in doing so;
5. apply Maclaurin and Taylor series to the evaluation of limits and integrals;
6. solve separable, linear first-order, and simple second-order differential equations;
7. model various physical problems with first and second-order differential equations;

8. solve homogeneous and non-homogeneous linear nth-order differential equations using auxiliary equations and the method of undetermined coefficients;
9. model and solve vibration problems with second-order linear differential equations;
10. be able to calculate Laplace transforms and their inverses;
11. solve linear differential equations with Laplace transforms; and
12. use unit pulse and Dirac-delta functions in the context of differential equations.

7 Using Copyrighted Materials

Please respect copyright. We will use copyrighted content in this course. I have ensured that the content I use is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted works, including those created by me, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the Copyright Act applies or written permission has been confirmed. For more information, see the University's Copyright Office website at <http://umanitoba.ca/copyright/> or contact um_copyright@umanitoba.ca.

Posting/uploading course materials to note-sharing sites is prohibited:

https://umanitoba.ca/admin/vp_admin/ofp/copyright/media/Note_sharing_Web_sites.pdf

8 Recording Class Lectures

All class and tutorial lectures will be recorded and uploaded by the instructors on UMLearn. Course materials, presentations and lectures that form part of this course are copyrighted material. **No audio or video recording** of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission. Course materials (both paper and digital) are for the participant's private study and research.

9 Textbook, Readings, Materials

1. **Textbook:** Calculus for Engineers (fourth edition) by Donald Trim, (Prentice-Hall).
2. **Web-page:** <http://home.cc.umanitoba.ca/~dtrim/Courses/Math2132/math2132.html>, by Donald Trim is an excellent and mandatory source for study materials and past exams.
3. Notes on Alternating series on the web-page mentioned above.
4. Notes and solutions on mass-spring systems on the web-page mentioned above.
5. Notes and solutions on Laplace transforms on the web-page mentioned above.

10 Course Technology

1. **UMLearn:** All the material from the instructor and TA will be posted on UMLearn. For any help see <https://centre.cc.umanitoba.ca/technology/umlearn/>.
2. **Zoom:** All live lectures, tutorials, office hours and exams will be conducted on Zoom. For any help, see <https://support.zoom.us/hc/en-us>.
3. **Piazza:** We will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and the instructor. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. All registered students will be enrolled on MATH 2132-Winter 2021 course on Piazza or you can find our class sign-up link at: <https://piazza.com/umanitoba.ca/winter2021/math2132>.
For any help, see <https://support.piazza.com/support/home>. If you have any problems or feedback for the developers, email team@piazza.com.
4. **Crowdmark:** All quizzes and exams will be distributed by Crowdmark. Student will be required to submit their solutions to the quizzes and exams on Crowdmark as well. For any help, see <https://crowdmark.com/help/categories/support-for-students/>.

11 Class Communications

Please note that all communication between the instructor and you as a student must comply with the electronic communication with student policy—see http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html. You are required to obtain and use your U of M email account for all communication between yourself and the university.

Your emails to the instructor will get an answer within 24 hours during the weekdays and 48 hours over the weekend. If you have not receive a response in that time-frame, you are welcome to send your instructor a reminder email.

All questions regarding problems from textbook exercises, lectures, tutorials, etc., must be posted on **Piazza**. In case you send an email regarding it, it will be posted on Piazza as well and you will get the answer there. All registered students will be enrolled on **MATH 2132-Winter 2021 course on Piazza** or you can find our class sign-up link at: <https://piazza.com/umanitoba.ca/winter2021/math2132>.

For any help, see <https://support.piazza.com/support/home>. If you have any problems or feedback for the developers, email team@piazza.com.

12 Expectations: I Expect You To

- (i) Complete all requirements of the course, which include attending live lectures and tutorials regularly.
- (ii) Participate in class discussions on Piazza.

- (iii) Use university-level, mathematical writing, legible and with correct format. There are many worked examples in the notes and solution manual; these should guide you on how to write solutions to problems on tests.
- (iv) Be honest. Quiz and examination submissions must be your own work.

Remote Learning Etiquette in the Virtual Classroom:

- (i) Please make sure your microphone is muted and video is turned off when a lecture begins.
- (ii) If you would like to ask a question, please use the chat feature for short questions. For longer questions, use the raise hand feature or chat to indicate you have a question. The instructor will un-mute you.
- (iii) I will be in class for 10 minutes prior to and after the class time. I will treat you with respect and would appreciate the same courtesy in return. See Respectful Work and Learning Environment Policy.
- (iv) Please keep all course communications, including both public and private chats, professional and respectful.

Professional Conduct

We recognize that these are unusual circumstances and some adjustments need to be made when working virtually. At the same time, we do want to remind you that University policies, such as the Respectful Work and Learning Environment policy, still apply, as do basic expectations around how students will engage with each other and all members of the University. This means that when participating in classes, online meetings, etc., students are expected to behave professionally, and follow the same basic norms as they would in person, such as being properly clothed, not being impaired, and participating respectfully. Essentially, **if you wouldn't do it in an in-person class, don't do it in a virtual setting.**

Please familiarize yourself with the UM Respectful Work and Learning Environment (RWLE),
http://umanitoba.ca/admin/governance/media/Respectful_Work_and_Learning_Environment_RWLE_Policy_-_2016_09_01.pdf

Section 2.5(c) of the Student Non-Academic Misconduct and Concerning Behaviour Procedure describes types of inappropriate or disruptive behaviour https://umanitoba.ca/admin/governance/media/Student_Non-Academic_Misconduct_and_Concerning_Behaviour_Procedure_-_2018_09_01.pdf

13 Student Accessibility Services

If you are a student with a disability, please contact SAS for academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

Student Accessibility Services <http://umanitoba.ca/student-supports/accessibility>
520 University Centre
204 474 7423
student_accessibility@umanitoba.ca

14 Expectations: You Can Expect Me To

- (i) Make every effort to plan the course and each class so that learning will be maximized.
- (ii) Be open to suggestions (they can often lead to improvements in a course).
- (iii) Treat you as adult learners, with related respect.
- (iv) Answer all of your questions.
- (v) Be punctual.
- (vi) Be available to you during office hours.
- (vii) Provide you with resources and guidance for succeeding in this course.
- (viii) Respond to your emails in the promised time-frame.

15 Course Evaluation Methods

Three components contribute to the final grade in the course.

1. Three quizzes counting 20% of the final grade will be held in the tutorials. The worst of the three will count 5% and the other two will count 7.5% each.
2. Two midterms counting 40% of the final grade will be held in the tutorials. The better of the two will count 25% of the grade, and the lesser will count 15%.
3. A final examination counting 40% of the final grade.

There are no make-up quizzes and midterms. Students who miss their midterm or quiz for a medical or compassionate reason (supporting evidence is NOT needed) should contact me within 48 hours of the test.

Since tests and the final examination will be online, notes and books may be used. In other words, quizzes, tests and examination are open book. Calculators are permitted.

During the quiz/exam students **will not**:

- copy by manual or electronic means from any work produced by any other person or persons, present or past, including tutors or tutoring services;
- share questions or answers in whole or in part with anyone, including posting portions of the test/exam in publicly accessible locations;
- copy from any source including textbooks and websites, or
- consult external websites, online forums, search engines, etc. or any resource not appearing in the list of acceptable test materials above.

Due Date	Assessment Tool
Tues, Feb 02, 2021	Quiz 1
Tues, Feb 23, 2021	Midterm 1
Tues, March 09, 2021	Quiz 2
Tues, March 23, 2021	Midterm 2
Tues, April 06, 2021	Quiz 3
TBD	Final Exam

16 Grading

Fall 2020 / Winter 2021 Grading Accommodation: Students may choose to exclude from their UM GPA either: (a) up to one (1) grade received in Fall term, and up to one (1) grade received in Winter term; or (b) up to one (1) grade received in a spanned course which runs through both Fall and Winter terms. Students must decide whether to exercise this option at the end of the academic year (during the period May 1 to July 1, 2021). For more information, discuss with an academic advisor, or see <https://umanitoba.ca/coronavirus/students>.

The following can be used as a guide in changing numerical grades to letter grades. It is only a guide, however, as **fluctuations in grade lines may occur**.

Letter Grade	Percentage out of 100	Grade Point Range	Final Grade Point
A+	95-100	4.25-4.5	4.5
A	86-94	3.75-4.24	4.0
B+	80-85	3.25-3.74	3.5
B	72-79	2.75-3.24	3.0
C+	65-71	2.25-2.74	2.5
C	60-64	2.0-2.24	2.0
D	50-59	Less than 2.0	1.0
F	Less than 50		0

17 Voluntary Withdrawal & Authorized Withdrawal

Voluntary Withdrawal Deadline: MARCH 31, 2021.

Students have the opportunity to voluntarily withdraw (VW) from this class on or before the date above. By this date, students will have received some feedback, which includes *marks of Quiz 1, Quiz 2, Midterm 1 and Midterm 2*, to gauge their progress in the course. Students may contact their instructor to make an appointment to review their progress in more detail, or discuss the VW option with an academic advisor in their home Faculty. Students enrolled in the course after the VW deadline above will be assigned a final grade. Note that students may retake a course they have decided to VW in the next semester (if available).

See http://umanitoba.ca/u1/know_yourself/573.html.

Authorized Withdrawal

At times medical or compassionate circumstances arise in a student's life that prevent them from performing as they would in normal circumstances. If you are in this position, please con-

tact a Faculty academic advisor to discuss your options. Be prepared to provide documentation to support/explain your circumstances. http://www.umanitoba.ca/student/resource/student_advocacy/authorized-withdrawal/index.html

18 Academic Integrity

The Department of Mathematics, the Faculty of Science and the University of Manitoba all regard acts of academic dishonesty in quizzes, tests, examinations or assignments as serious offences and may assess a variety of penalties depending on the nature of the offence.

Acts of academic dishonesty include bringing unauthorized materials into a test or exam, copying from another student, plagiarism and examination personation. Students are advised to read the sections entitled *Academic Integrity* and *Final Examinations: 4. Personations* in the *General Academic Regulations* of the current Undergraduate Calendar.

Penalties for violation include being assigned a grade of zero on a test or assignment, being assigned a grade of "F" in a course, compulsory withdrawal from a course or program, suspension from a course/program/faculty, or even expulsion from the University. Further information about suggested minimum penalties assessed by the Faculty of Science can be found here: <https://sci.umanitoba.ca/statement-on-academic-dishonesty/>.

All students are advised to familiarize themselves with the **Student Discipline Bylaw**, which is printed in its entirety in the Student Guide; also [available online](#) or through the Office of the University Secretary.

19 Notice Regarding Collection, Use, and Disclosure of Personal Information by the University

Your personal information is being collected under the authority of The University of Manitoba Act. It will be used for the purposes of grading papers and providing feedback to students. Personal information will not be used or disclosed for other purposes, unless permitted by The Freedom of Information and Protection of Privacy Act (FIPPA). The University of Manitoba has taken steps to ensure that its agreements with Crowdmark, Inc. and WebAssign for services provided by the Crowdmark and WebAssign applications are in compliance with FIPPA. Please be aware that information held by Crowdmark Inc. and Webassign may be transmitted to and stored on servers outside of the University of Manitoba, or Canada. The University of Manitoba cannot and does not guarantee protection against the possible disclosure of your data including, without limitation, against possible secret disclosures of data to a foreign authority in accordance with the laws of another jurisdiction. If you have any questions about the collection of personal information, contact the Access and Privacy Office (tel. 204-474-9462), The University of Manitoba, 233 Elizabeth Dafoe Library, Winnipeg, Manitoba, Canada, R3T 2N2.

Chapter 1 INFINITE SEQUENCES AND SERIES

Section 1. Infinite Sequences

a) Infinite Sequences of Numbers

List of items

1
2
3
4
5

List of numbers

1
2
3
4
5

→ Compact notation

→ Formal notation

Another Example

Definition 1.1 (a) (Infinite Sequence)

If n is a positive integer, the sequence whose nth term is the number a_n can be written as:

$$a_1, a_2, a_3, a_4, \dots, a_n, a_{n+1}, \dots$$

Or more simply,

$$\{a_n\}_{n=1}^{\infty} \stackrel{\text{OR}}{=} \{a_n\}$$

The number a_n is also called the general term of the sequence.

~~Imp~~ **General term:** The general term is the n^{th} term, a_n .

Example 1.1

Find an explicit formula for the general term of the sequence.

$$1) \left\{ \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \dots \right\} \rightarrow$$

$$2) \left\{-\frac{2}{3}, \frac{3}{9}, -\frac{4}{27}, \frac{5}{81}, \dots\right\} \rightarrow$$

$$3) \left\{0, 1, \sqrt{2}, \sqrt{3}, \sqrt{4}, \dots\right\} \rightarrow$$

Example 1,2

Find the 1st, 2nd and 15th terms of the sequences with the given general term:

$$1) a_n = \frac{1}{2^{n-1}}$$

$$2) a_n = (-1)^n \sqrt{n^2 + 1}$$

$$3)a_n=\sin{(2n\pi)}$$

Recursively defined sequence

Example 1.3

Find the first four terms of the sequence defined recursively as follows:

$$C_1 = 2,$$
$$C_{n+1} = 3 + \sqrt{5 + c_n}, n \geq 1.$$

Recall MATH 1500

Functions

Example

Definition 1.1 (b) (Infinite Sequence)

A sequence a_n is a function, say $f(n) = a_n$, whose domain is the set of positive integers (natural numbers \mathbb{N}) and whose range is a subset of real numbers \mathbb{R} .

That is, $f : \mathbb{N} \rightarrow \mathbb{R}$.

b) Limits of a sequences

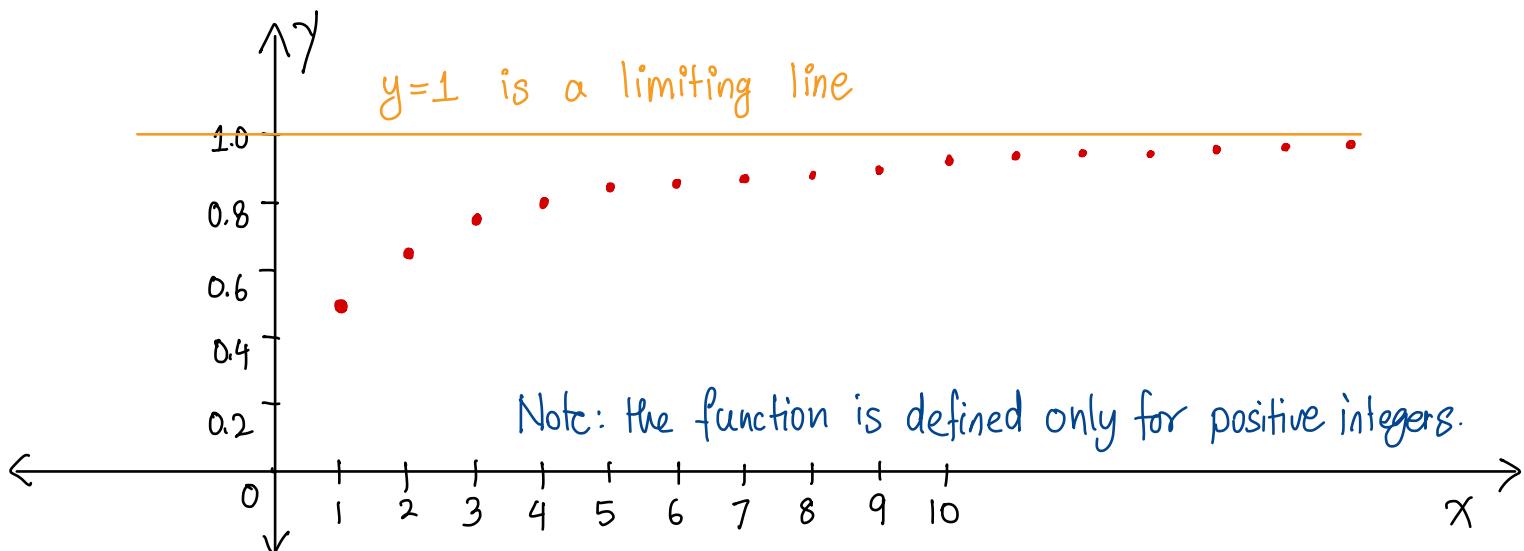
Consider the sequence $a_n = \frac{n}{n+1} = f(n)$ (say)

Because $a_1 =$

$$a_2 =$$

$$a_3 =$$

we can plot it in two dimensions.



In general, if the terms of the sequence approach the (finite) number L as n increases without bound, we say that the sequence **converges** to the limit L and write

$$L = \lim_{n \rightarrow \infty} a_n.$$

For instance, in our example we have

$$\lim_{n \rightarrow \infty} a_n = \lim_{n \rightarrow \infty} \frac{n}{n+1}$$

~~limit~~
If the limit L does not exist, we say that the sequence $\{a_n\}$ **diverges**.

Theorem 1.1 (Limit theorem for Sequences)

If $\lim_{n \rightarrow \infty} a_n = L$ and $\lim_{n \rightarrow \infty} b_n = M$, then

① $\lim_{n \rightarrow \infty} (ra_n + sb_n) = rL + sM$

② $\lim_{n \rightarrow \infty} (a_n b_n) = LM$

③ $\lim_{n \rightarrow \infty} \frac{a_n}{b_n} = \frac{L}{M}, M \neq 0$

④ $\lim_{n \rightarrow \infty} \sqrt[m]{a_n} = \sqrt[m]{L}$, provided $\sqrt[m]{a_n}$ is defined for all n and $\sqrt[m]{L}$ exists, where m is a positive integer.

Example 1.4

Find the limit of the following convergent sequences.

$$1) \left\{ \frac{100}{n} \right\}$$

$$2) \left\{ \frac{2n^2 + 5n - 7}{n^3} \right\}$$

$$3) \left\{ \frac{3n^4+n-1}{5n^4+2n+1} \right\}$$

Example 1.5

Show that the following sequences diverge.

$$1) \left\{ (-1)^n \right\}$$

$$2) \left\{ \frac{n^5 + n^3 + 2}{7n^4 + n^2 + 3} \right\}$$

Notation: If $\lim_{n \rightarrow \infty} a_n$ doesn't exist because the numbers a_n become arbitrarily large as $n \rightarrow \infty$, we write $\lim_{n \rightarrow \infty} a_n = \infty$.

Example 1.6

Determine the convergence or divergence of the sequence $\{\sqrt{n^2 + 3n} - n\}$.

**COMMON QUESTION: CAN WE USE L'HOPITALS RULE FOR
CALCULATING $\lim_{n \rightarrow \infty} a_n$?**

From MATH 1500 \Rightarrow If a function is differentiable at a point $x=c$ then it is continuous at $x=c$.

Ans. Not yet, as $a_n = f(n)$ (say), is discontinuous.
So we can't differentiate anything 😞

BUT, there is a way around it! 😊

Theorem 1.2 (How to use L'hopital's rule)

Given the sequence $\{a_n\}$, let f be a continuous function such that $f(n) = a_n$ for $n = 1, 2, 3, \dots$

A) (for convergence)

If the $\lim_{x \rightarrow \infty} f(x)$ exists and $\lim_{x \rightarrow \infty} f(x) = L$, then the sequence $\{a_n\}$ converges and $\lim_{n \rightarrow \infty} a_n = L$

B) (for divergence to infinity)

If $\lim_{x \rightarrow \infty} f(x) = \infty$ (or $-\infty$), then $\lim_{n \rightarrow \infty} a_n = \infty$ (or $-\infty$).

Example 1.7

Given that the sequence $\left\{ \frac{n^2}{1 - e^n} \right\}$ converges,
evaluate $\lim_{n \rightarrow \infty} \frac{n^2}{1 - e^n}$.

Theorem 1,3

Let $a_n = r^n$, where r is a fixed number. Then

- If $|r| < 1$, then $\lim_{n \rightarrow \infty} r^n = 0$.
- If $|r| > 1$, then $\lim_{n \rightarrow \infty} |r^n| = \infty$.

Example 1.8

Determine whether the sequence converges or diverges.

$$1) \left\{ \left(-\frac{2}{3} \right)^n \right\}$$

$$2) \left\{ (1.01)^{n+10} \right\}$$

V_oImp

SUGGESTED EXERCISES

Exercise 10.1

Problems 1-28

Optional: Read pages 588-590

Something to think:

Must sequences be only of real numbers?