COURSE OUTLINE

Toronto Metropolitan University (TMU)

MTH141, Linear Algebra Fall 2023

INSTRUCTORS:

• The course coordinator of this course is **K. Lan**; Website: https://math.ryerson.ca/∼klan/

Instructor	Office	Tel. ext.	Email	Office hours
K. Lan	ENG229	556962	klan@torontomu.ca	Wed. 2:00- 4:00pm
C. Wang	VIC 703	553811	cpwang@torontomu.ca	Mon. 13:00-14:30pm
N. Jung	VIC 703	553811	nara.jung@torontomu.ca	Wed. 4:10-5:00pm
M. Alqasas	VIC 703	553811	malqasas@torontomu.ca	Mon. 8:00-10:00am
S. Samiezadeh	VIC 703	553811	saeid.samiezadeh@torontomu.ca	Thur. 10:30-11:30am
A. Sayyidmousavi	VIC 703	553811	asayyidmousavi@torontomu.ca	Tues: 10:00-11:00am

• Office hours take place in the instructor's office. The instructors are available at these times and at other times by appointment for individual assistance and consultation.

Email Policy

Students are expected to monitor and retrieve messages and information issued to them on a frequent basis. All official or formal electronic communications from students must be sent from their official TMU Email account. Emails from other addresses may not be responded to. You would write down the course number and your section number in your emails.

Lecture time and locations

Instructor	Section	Lecture-Time and	Locations
K. Lan	1 – 6	Mon, 11:00-13:00pm, DSQ02	Wed, 12:00-14:00pm, DSQ02
C. Wang	7 – 12	Mon, 11:00-13:00pm, DSQ03	Wed, 12:00-14:00pm, DSQ03
Nara Jung	13 – 18	Mon 11:10-13:00pm, DSQ12	Wed 12:10-14:00pm, DSQ12
Majed Alqasas	19 – 24	Mon. 11-13:00pm, DSQ13	Wed 12-14:00pm, DSQ13
S. Samiezadeh	25 – 30	Mon. 11-13:00pm,LIB072	Wed 13-15:00pm, LIB072
A. Sayyidmousavi	31 – 32	Mon. 11:00-13:00pm, ENG106	Wed 12:00-14:00pm, EPH242

Lectures: Lectures will begin on Wednesday, September 6, 2023 and end Monday, December 4, 2023.

Fall Study Week: October 9-13, 2023. There will be lectures and labs during this week except Thanksgiving on Monday, October 9, 2023.

MATH Labs: Labs will begin from the second week (starting on the week of September 11, 2023 and ending on the week of November 27, 2023). There will be no labs during September 5-8, 2023.

TAs and Labs

Sec	Time and location	TA	Email
1	Tue,15:00-16:00pm,KHE119	Sima Naderi Mighan	sima.naderi@torontomu.ca
2	Thurs, 9:00-10:00am, SHE662	Chang Oh	c4oh@torontomu.ca
3	Fri,12:00-13:00pm, POD366	Hanieh Ashrafirad	hanieh.ashrafirad@torontomu.ca
4	Mon, 14:00-15:00pm,ENGLG12	Aliakbar Eslami Baladeh	aeslamibaladeh@torontomu.ca
5	Tue, 11:00-12:00pm, ENGLG02	Maryam Basiri	maryam.basiri@torontomu.ca
6	Tue, 12:00-13:00pm,ENGLG13	Madej Matthew	matthew.madej@torontomu.ca
7	Tue, 12:00-13:00pm,ENG106	Mariam Walaa	mariam.walaa@torontomu.ca
8	Tue, 15:00-16:00pm,ENGLG13	Gustavo Cicchini	gcicchinisantos@torontomu.ca
9	Mon, 13:00-14:00pm, VIC303	S. Dayasthasan	dayasthasan.sinnathu@torontomu.ca
10	Thurs, 16:00-17:00pm, ENGLG13	Serban Boghina	serban.boghina@torontomu.ca
11	Mon, 14:00-15:00pm,SHE554	Ali Nouhi	ali.nouhi@torontomu.ca
12	Tue, 12:00-13:00pm,ENGLG12	Maryam Basiri	maryam.basiri@torontomu.ca
13	Mon, 15:00-16:00pm,ENG102	S. Dayasthasan	dayasthasan.sinnathu@torontomu.ca
14	Tue, 17:00-18:00pm,ENGLG12	Gustavo Cicchini	gcicchinisantos@torontomu.ca
15	Tue, 10:00-11:00am,SHE554	Maryam Basiri	maryam.basiri@torontomu.ca
16	Tue, 13:00-14:00pm,TRS1075	Cuinn Chowdhury	cuinn.chowdhury@torontomu.ca
17	Thurs, 9:00-10:00am,ENGLG12	Maryam Basiri	maryam.basiri@torontomu.ca
18	Thurs, 14:00-15:00pm,POD366	Holden Pimentel	holden.pimentel@torontomu.ca
19	Thurs, 16:00-17:00pm,POD358	Maryam Basiri	maryam.basiri@torontomu.ca
20	Mon, 14:00-15:00pm,EPH441	Samaneh Yazdani Pour	samaneh.yazdanipour@torontomu.ca
21	Thurs, 16:00-17:00pm,VIC103	Sima Darbasi	sima.darbasi@torontomu.ca
22	Fri,12:00-13:00pm,SHE660	Xiwen Tian	xiwen.tian@outlook.com
23	Thurs, 17:00-18:00pm,SHE662	Phuc Ngo	phuc.ngo@torontomu.ca
24	Fri,13:00-14:00pm,ENGLG24	Phuc Ngo	phuc.ngo@torontomu.ca
25	Fri,12:00-13:00pm,ENGLG24	N. Atabakilachini	n.atabakilachini@torontomu.ca
26	Fri,12:00-13:00pm,ENGLG21	Phuc Ngo	phuc.ngo@torontomu.ca
27	Tue, 11:00-12:00pm,POD358	James Conley	j1conley@torontomu.ca
28	Tue, 11:00-12:00pm,EPH201	Jesse Lucier	jesse.lucier@torontomu.ca
29	Fri,8:00-9:00am, ENGLG12	Soheil Sahamifar	ssahamifar@torontomu.ca
30	Thurs,8:00-9:00am,ENGLG12	Saba Sabet	saba.sabet@torontomu.ca
31	Thurs, 16:00-17:00pm,EPH216	Phuc Ngo	phuc.ngo@torontomu.ca
32	Thurs, 14:00-1:00pm,KHE117	Phuc Ngo	phuc.ngo@torontomu.ca

Note that Section i=Section $i1$ (lecture)=Section $i2$(Lab), where $i = 1, 2$, for example, Section 1=Section 011 (lecture)=Section 012(Lab).

Calendar Course Description

Systems of linear equations and matrices. Determinants. Vector spaces. Inner product spaces. Eigenvalues and eigenvectors. (see https://www.torontomu.ca/calendar/2023-2024/courses/mathematics/MTH/141/)

Print text and eTEXT:

Linear Algebra by Kunquan Lan (fourth edition), Pearson, 2020.

Print text: ISBN: 9780138168407

You can buy the print text from TMU campus store.

Digital Option Only: Purchase access code 9780137889181 from TMU Campus Store. Redeem access code at http://www.pearsoncustom.com/can/ryerson_mth108.

Note: 9780137889181 is the ISBN for the access code. Students need to purchase 9780137889181 from the TMU Campus Store website. Once they make their purchase they will be emailed their access code which they can then redeem at the website: http://www.pearsoncustom.com/can/ryerson_mth108.

Note that you may need to retype the underscore _ in the above link if it doesn't work.

1. Go to https://campusstore.ryerson.ca/topic/accesscodes.

2. In the search box at the bottom of this above website page, click MTH141 (Fall 2023) and then click search, you will see [Pearson eText with eText Student Access Code for MTH108 Linear Algebra for [TORONTO METROPOLITAN UNIVERSITY]]. There are instructions on how to buy the access code on this page.

3. Once students make their purchase, they will be emailed their access codes.

4. Then students can go to the website: http://www.pearsoncustom.com/can/torontometro_math108 to redeem for the etext.

Course Objectives:

1. To gain a facility with the basic concepts and techniques of linear algebra.
2. To build a strong foundation in linear algebra as preparation for subsequent courses in mathematics, science and engineering.
3. To nurture abilities in analytic and creative thinking and problem-solving.

Syllabus: We shall study the following sections:

Chapter 1: Euclidean spaces, section 1.1-1.4

Chapter 2: Matrices, sections 2.1-2.5, 2.7, Skip 2.6

Chapter 3: Determinants, sections 3.1-3.4; Skip Theorem 3.3.7, Example 3.3.9 and exercise 4.

Chapter 4: Systems of linear equations, sections 4.1-4.6

Chapter 5: Linear transformations, sections 5.1-5.3

Chapter 6: Planes and lines in $\mathbb{R}^3$, sections 6.1-6.3

Chapter 7: Bases and dimensions, sections 7.1-7.4

Chapter 8: Eigenvalues and diagonalizability, sections 8.1-8.2

Chapter 9: Vector spaces, sections 9.1-9.2

Chapter 10: Complex numbers, sections 10.1-10.4

Topics and Temporary Course Schedule

Week	**Date**	**Activity**	**Sections**	**HW by 11:59pm**
1	Sept6	Lecture	1.1	HW1, Sept10
2	Sept11, 13	Lecture	1.2, 1.3	HW2, Sept17
3	Sept18, 20	Lecture	1.4, 2.1, 2.2, 2.3, 2.4	HW3, Sept24
4	Sept25, 27	Lecture	2.4, 2.5, 2.7, 3.1, 3.2, 3.3	HW4, Oct1
5	Oct2, 4	Lecture	3.4, 4.1, 4.2, 4.3	HW5, Oct8
6	Oct11	Lecture	4.4, 4.5	HW6, Oct15
7	Oct16, 18	Lecture	4.6, 5.1,5.2	HW7, Oct22
8	Oct23, 25	Lecture	5.3, 6.1,6.2	HW8, Oct29
9	Oct30, Nov1	Lecture	6.3, 7.1, 7.2	HW9, Nov5
10	Nov6, 8	Lecture	7.3, 7.4	HW10, Nov12
11	Nov13, 15	Lecture	8.1, 8.2	HW11, Nov19
12	Nov20, 22	Lecture	9.1, 9.2	HW12, Nov26
13	Nov27, 29	Lecture	10.1,10.2	HW13, Dec3
14	Dec 4	Lecture	10.3,10.4	No HW submission

Note that we will not cover all the sections in some chapters.

Homework and Quizzes:

Weekly homework questions corresponding to the material you have studied in the week will be posted to D2L by the instructor. You need to hand each homework to the corresponding homework submission fold in the **Assignment** in Assessment in D2L of the common course shell by 11:59pm, every Sunday, starting on September 10. Please note that the assignments will not be marked; however, they may be checked for completeness and correctness. Experience has shown that the only way to learn math is to do it. The amount you learn in this course and the grade you receive will be proportional to the amount of time you spend doing problems. Keep up with the homework. Each student should do at least 4 hours of independent study after 4 hour lectures each week.

• Each homework and quiz problem are from the material we studied in last week's lecture.

• You need to hand in each homework to the **Assignment** in Assessment in D2L by 11:59pm, every Sunday, starting on September 10, 2023 and ending at December 3, 2023

• Assistance with mathematical questions on the course or homework is available at the Math Lab.

• There will be a weekly 15 minutes quiz at each lab with problems analogous to the assigned homework problems or examples given in class. Each quiz must be submitted to your TA before the deadline assigned by your TA during the lab. You will get zero marks for the quiz if you submit your quiz late.

• Each quiz must be written in your own section. If you write it in another section, you will get zero marks for the quiz.

• Full solutions to each quiz will be given by your TA in the next Lab.

• Last lab ends in the week of November 27, 2023.

• **There will be no make-up quiz whatever reasons you provide.**

• You can hand in your missing homework to your TA after you submit suitable documents (see **Missed Class and/or Evaluations** below) to your department and get permission from your MTH141 instructor.

Evaluation:

- 10%: You must hand in the weekly assigned homework to the **Assignment** in Assessment in D2L by 11:59pm, every Sunday, starting September 10 in order to receive 10% of the final grade.
- Quizzes (12%): There will be a 15-minute quiz during every lab, starting in the week of Sept. 11, 2023.
- Midterm (36%): 1.5 hours; 11:10-12:40pm, Monday, October 16, 2023.
- Final Exam (42%): 2 hours, during the examination period: December, 2023.

Format:

The formats of the midterm and final exam are both multiple choice and full-answer problems.

Aids: You are **NOT** allowed to use any **AIDS** including calculators, formula sheets, scrap paper and cell phones during the weekly quiz, midterm test or final exam for this course.

NOTE:

• You must bring a TMU Photo ID to the weekly quiz, the midterm and the final exam.

• You must use the pencils to fill in the scantron sheets for the multiple choice questions.

Re-marking of Test If a test is submitted for re-marking, the whole test may be remarked.

Missed Class and/or Evaluations

1. Students are required to inform their instructors of any situation which arises during the semester which may have an adverse effect upon their academic performance, and must request any considerations and accommodations according to the relevant policies and well in advance. Failure to do so will jeopardize any academic appeals.

2. If a test is missed, then the corresponding percentage of the test will be transferred to the final exam or write a make-up test. If the final exam is missed, an INC grade may be given, in accordance to the policies given in https://www.torontomu.ca/senate/course-outline-policies/missed-tests-examinations-course-management-policy-166/.

3. If proper documentation is not received by the instructor within reasonable time (generally, that means within 3 working days), the mark for the missed evaluation will be zero.

Medical Certificates

If a student misses the deadline for submitting an assignment, or the date of an exam or other evaluation component because of illness, they must submit a TMU Student Medical Certificate AND an Academic Consideration form within 3 working days of the missed date. Both documents are available at (PDF) Student Medical Certificate Guidelines (https://www.torontomu.ca/senate/forms/medical.pdf). You must submit your forms to your own program department.

Religious Observance

If a student needs accommodation because of religious observance, they must submit a Request for Accommodation of Student Religious, Aboriginal and Spiritual Observance AND an Academic Consideration form within the first 2 weeks of the class or, for a final examination, within 2 weeks of the posting of the examination schedule. If the required absence occurs within the first 2 weeks of classes, or the dates are not known well in advance as they are linked to other conditions, these forms should be submitted with as much lead time as possible in advance of the required absence. Both documents are available at (PDF) Student Request for Accommodation of Student Religious, Aboriginal and Spiritual Observance (https://www.torontomu.ca/senate/forms/relobservforminstr.pdf). If you are a full-time or part-time degree student, then you must submit the forms to your own program department or school.

Students who need Academic Accommodation Support

Students who need academic accommodation support should register with Academic Accommodation Support (https://www.torontomu.ca/accommodations/). Before the first graded work is due, registered students should inform their instructors through an "Accommodation Form for Professors" that they are registered with Academic Accommodation Support and what accommodations are required.

Academic Integrity and Plagiarism

TMU's Academic Integrity Policy applies to all students at the University. The policy and its procedures are triggered in the event that there is a suspicion that a student has engaged in a form of academic misconduct. Forms of academic misconduct include plagiarism, cheating, supplying false information to the University, and other acts. The most common form of academic misconduct is plagiarism. Plagiarism is a serious academic offence and penalties can be severe. In any academic exercise, plagiarism occurs when one offers as one's own work the words, data, ideas, arguments, calculations, designs or productions of another without appropriate attribution or when one allows one's work to be copied. All academic work must be submitted using the citation style approved by the instructor. Students may refer to the TMU Library's list of Citations and Style Guides (https://library.torontomu.ca/guides/style/) for more information.

It is assumed that all examinations and work submitted for evaluation and course credit will be the product of individual effort, except in the case of group projects arranged for and approved by the course instructor. Submitting the same work to more than one course, without instructor approval, is also considered a form of plagiarism. Students are advised that suspicions of academic misconduct may be referred to the

Academic Integrity Office (AIO). Students who are found to have committed academic misconduct will have a Disciplinary Notation (DN) placed on their academic record (not on their transcript) and will be assigned one or more of the following penalties:

- A grade reduction for the work including a grade of zero for the work.
- An F in the course.
- More serious penalties up to and including expulsion from the University. For more detailed information on these issues, please refer to the full online text for the (PDF) Academic Integrity Policy (https://www.torontomu.ca/senate/policies/academic-integrity-policy-60/) and to the Academic Integrity website (https://www.torontomu.ca/academicintegrity/).

Important Resources Available at TMU

- The Library (https://library.torontomu.ca/) provides research workshops and individual assistance. Inquire at the Reference Desk on the second floor of the library, or go to Research Skills Workshops (https://library.torontomu.ca/info/workshops).
- Student Learning Support (https://www.torontomu.ca/student-life-and-learning/learning-support/) offers group-based and individual help with writing, math, study skills and transition support, and other issues.
- For more resources and information on significant dates, academic standings, exam schedules, etc., visit the Current Students website (https://www.torontomu.ca/current-students/).
- The Student Guide (https://www.torontomu.ca/studentguide/) summarizes the policies, fees, procedures and services you'll need to know as a TMU student.

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Homework for Linear Algebra Weekly homework questions corresponding to the material you have studied in the week will be posted to D2L by the instructor. You need to hand each homework to the corresponding homework submission fold in the **Assignment** in Assessment in D2L by 11:59pm, every Sunday, starting on September 10.

In the following table, the first column lists the sections we shall study; the second one lists the Definitions which you need to understand; the third column lists theoretical results including Theorems, corollaries and propositions. We do not teach the proofs of these theorems, corollaries and propositions in general, but you have to understand the theoretical results and know how to apply them. These can be learnt from the instructors in her/his lecturing and via studying the text-book and doing the homework. In the midterm and the final exam, there will be some thinking problems which you need to use the knowledge of these theoretical results. The fourth column lists examples you need to study by applying the definitions, theorems, corollaries or propositions. The last column lists the homework questions which you need to hand in. You can do all other exercise questions of each section. The full solution to each question can be found in the Appendix of the textbook.

Sec	Definition	Theorem	Example	Questions to be handed in
1.1	$1-7$	$1-2$	$1-8$	$3,5,6,7,10,12,13(2),15,17,18$
1.2	$1-5$	$1-8$	$1-9$	$1(ii),2(ii),3A,B,4(iii),6(5),7;8(iv),(v);$ $9(i),(iii);10(i);11,12$
1.3	1	$1-2$, Cor.1(2)	$1-3$	$1(3),(4);2;5(4),(6);6(b),(c)$
1.4	1	$1-3$	$1-6$	$1(1);3;4(2);5$
2.1	$1-4$	1	$1-10$	$7;10(3);11$
2.2	$1-2$	$1-3$	$1-10$	$1,7,11,12$
2.3	1	1	$1-7$	$1A_3;2,A_4,3,4,5$
2.4	1	1	$1-12$	$1,D,H,2,C,E,5C,6,A,F$
2.5	$1-2$	$1-5$	$1-3$	$1A,C$
2.7	1	$1,4-9$, Cor.1	$1-6$	$1;2;3B,C;4,5;6A;7D,E;$
3.1	1	$1-3$	$1-5$	$1;2A_1;3\|A\|;4$
3.2	$1-2$	$1-3$	$1-3$	$1A;2\|B\|;3;4\|D\|,\|F\|$
3.3		$1-3$, Cor.1	$1-7$	$1\|A\|;2\|A\|,\|F\|,3\|A\|$
3.4		$1-4$	$1-5$	$1A,C,E;2.2A,B;3(5),(6);4.$
4.1	$1-3$	1	$1-8$	$1(d);2(2);3;4(a);5.$
4.2		1	$1-5$	$1(i);2(a),(c),(e)$
4.3			$1-2$	$1a),e),h),2a),c),e)$
4.4		$1-2$, Cor.1	$1-4$	$1a),d);2,3,4a),d)$
4.5		$1-5$, Cor.1-3	$1-5$	$1c);2a),3a);4,5,6,7$
4.6		$1-2$	$1-6$	$1,2,5$
5.1	$1-3$	1, Prop.1	$1-6$	$1A3,2,3,4a),5,7,8,9b)$
5.2	$1-3$	$1-5$	$1-4$	$1a);2;3c);4c)$
5.3		$1-5,6(1)-(3)$	$1-6$	$1,2,3(2),4,6$
6.1	1	$1-2$	$1-2$	$1(4),2,3,4(1).$
6.2	$1-2$	$1,3$	$1,2,4$	$1,4$
6.3	$1-5$	$1-5$, Prop.1	$1-11$	$1(a),2(a),3(a),4,5,6(a),7,8(a),9-13,$ $14(a),15(a)$
7.1	1	$1-5$, Cor.1,2	$1-5$	$1-4$
7.2	1	$1-8$, Cor.1	$1-4$	$1-4$
7.3	1	$1-2$	$1-5$	$1-5$
7.4	1	$1-5$	$1-6$	$1-7$
8.1	$1-3$	$1,3,4,5$, Cor.1	$1-6$	$1(B),2(B),(D),3,4$
8.2	1	$1,2,6$, Cor.1	$1-5$	$1(B),2,3,4,8;5,6,7$
9.1	$1-3$	$1,3,4,5$, Cor.1	$1-6$	$1,2,4,7,8,12$
9.2	1	$1,2,6$, Cor.1	$1-5$	$1,2,3,4,5$
10.1	$1-5$	Prop.1,2	$1-9$	$1-9$
10.2	$1,2$	$1,2$	$1-3$	$1,2$
10.3		$1,3$, Cor.1	$1,5$	$1-4$
10.4		1, Cor.1	$1-3$	$1,2$